Contents of this Chapter...

DURAPULSE Parameter Summary ........................................... 4–2
Parameters available only in later firmware versions of DURAPULSE AC drives ... 4–2

Detailed Parameter Listings .................................................. 4–15
Motor Parameters ................................................................ 4–15
Ramp Parameters ................................................................ 4–18
Volts/Hertz Parameters ....................................................... 4–24
Digital Parameters ................................................................. 4–29
Setting Explanations for Multi-Function Input Parameters (P3.02–P3.10) ... 4–31
Setting Explanations for Multi-Function Output Parameters (P3.11–P3.14) ... 4–37

Analog Parameters ................................................................. 4–40
Analog Input Parameter Examples ........................................ 4–46
Presets Parameters ............................................................... 4–55
Protection Parameters ........................................................... 4–57
PID Parameters .................................................................. 4–66
Display Parameters ............................................................... 4–72
Communications Parameters ................................................ 4–73
Encoder Feedback Parameters ............................................... 4–78
Chapter 4: AC Drive Parameters

**DURAPULSE Parameter Summary**

Parameters available only in later firmware versions of DURAPULSE AC drives

Some parameters and settings are available only in later firmware versions of DURAPULSE AC drives. Check parameter P9.39 to determine the firmware version of your DURAPULSE drive.

Parameters and settings available only with firmware v1.02 and higher:
- P6.30
- P9.39

Parameters and settings available only with firmware v1.04 and higher:
- P3.02–P3.10 settings 19, 20
- P3.11–P3.14 setting 16
- P3.31
- P4.13
- P4.14
- P4.15
- P7.27 settings 02, 03
- P7.28

Parameters and settings available only with firmware v1.05 and higher:
- P2.09
- P2.10 settings 04, 05
- P4.13 default = 06
- P6.37

<table>
<thead>
<tr>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Range</strong></td>
</tr>
<tr>
<td><strong>Default Setting</strong></td>
</tr>
<tr>
<td><strong>User Setting</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parameter *</th>
<th>Description</th>
<th>Range*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Motor Parameters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P0.00</td>
<td>Motor Nameplate Voltage</td>
<td>230V class: 200/208/220/230/240</td>
</tr>
<tr>
<td></td>
<td></td>
<td>460V class: 380/400/415/440/460/480</td>
</tr>
<tr>
<td>P0.01</td>
<td>Motor Nameplate Amps</td>
<td>Drive Rated Amps x 0.4 to 1.0</td>
</tr>
<tr>
<td>P0.02</td>
<td>Motor Base Frequency</td>
<td>50/60/400</td>
</tr>
<tr>
<td>P0.03</td>
<td>Motor Base RPM</td>
<td>375 to 24,000 rpm</td>
</tr>
<tr>
<td>P0.04</td>
<td>Motor Maximum RPM</td>
<td>P0.03 to 24,000 rpm</td>
</tr>
<tr>
<td>P0.05</td>
<td>Motor Auto Tune</td>
<td>00 Disable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 Enable P0.06 only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02 Enable P0.06 and P0.07</td>
</tr>
<tr>
<td>P0.06</td>
<td>Motor Line to Line Resistance R1</td>
<td>00 to 65535 mΩ</td>
</tr>
<tr>
<td>P0.07</td>
<td>Motor No-Load Current</td>
<td>Drive Rated Amps x 0.0 to 0.9 (Amps)</td>
</tr>
</tbody>
</table>

* Some parameters and settings are available only in later firmware versions of DURAPULSE drives. Refer to the beginning of this “DURAPULSE Parameter Summary” section for more information.
<table>
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<tr>
<th>Parameter *</th>
<th>Description</th>
<th>Range*</th>
<th>Default Setting</th>
<th>User Setting</th>
</tr>
</thead>
</table>
| **P1.00**   | Stop Methods                       | 00: Ramp to Stop  
               01: Coast to Stop | 00        |              |
| P1.01       | Acceleration Time 1                | 0.1 to 600.0s  (must be > 1s to be effective) | 10.0      |              |
| P1.02       | Deceleration Time 1                | 0.1 to 600.0s  (must be > 1s to be effective) | 30.0      |              |
| P1.03       | Accel S-curve                      | 0 to 7 | 00             |              |
| P1.04       | Decel S-curve                      | 0 to 7 | 00             |              |
| P1.05       | Acceleration Time 2                | 0.1 to 600.0s  (must be > 1s to be effective) | 10.0      |              |
| P1.06       | Deceleration Time 2                | 0.1 to 600.0s  (must be > 1s to be effective) | 30.0      |              |
| P1.07       | Select method to use               | 00: RMP2 from DI terminal  
               01: Transition Frequencies P1.08 & P1.09 | 00        |              |
| P1.08       | Accel 1 to Accel 2 frequency transition | 0.0 to 400.0 Hz | 0.0       |              |
| P1.09       | Decel 2 to Decel 1 frequency transition | 0.0 to 400.0 Hz | 0.0       |              |
| P1.10       | Skip Frequency 1                   | 0.0 to 400.0 Hz | 0.0       |              |
| P1.11       | Skip Frequency 2                   | 0.0 to 400.0 Hz | 0.0       |              |
| P1.12       | Skip Frequency 3                   | 0.0 to 400.0 Hz | 0.0       |              |
| P1.13       | Skip Frequency 4                   | 0.0 to 400.0 Hz | 0.0       |              |
| P1.14       | Skip Frequency 5                   | 0.0 to 400.0 Hz | 0.0       |              |
| P1.17       | Skip Frequency Band                | 0.0 to 20.0 Hz | 0.0       |              |
| P1.18       | DC Injection Current Level         | 00 to 100 % | 00           |              |
| P1.20       | DC Injection during Start-up       | 0.0 to 5.0 sec | 0.0       |              |
| P1.21       | DC Injection during Stopping       | 0.0 to 25.0 sec | 0.0       |              |
| P1.22       | Start-point for DC Injection       | 0.0 to 60.0 Hz | 0.0       |              |

* Some parameters and settings are available only in later firmware versions of DURAPULSE drives. Refer to the beginning of this “DURAPULSE Parameter Summary” section for more information.

◆ Parameter can be set during RUN Mode.
### Parameter Summary (continued)

| Parameter  
<table>
<thead>
<tr>
<th>*</th>
<th>Description</th>
<th>Range*</th>
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<th>User Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Volts/Hertz Parameters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| P2.00 | Volts/Hertz Settings | 00: General Purpose  
01: High Starting Torque  
02: Fans and Pumps  
03: Custom | | 00 |
| P2.01 | Slip Compensation | 0.0 to 10.0 | 0.0 (V/Hz mode)  
1.0 (Vector mode) | |
| P2.02 | Auto-torque Boost | 00 to 10 | 00 | |
| P2.03 | Torque Compensation  
Time Constant | 00 to 10 sec | 0.05 | |
| P2.04 | Mid-point Frequency | 0.1 to 400 Hz | 0.5 | |
| P2.05 | Mid-point Voltage | 230V class: 0.1 to 240V  
460V class: 0.1 to 480V | 5.0  
10.0 | |
| P2.06 | Min. Output Frequency | 0.1 to 20.0 Hz | 0.5 | |
| P2.07 | Min. Output Voltage | 230V class: 0.1 to 50V  
460V class: 0.1 to 100V | 5.0  
10.0 | |
| P2.08 | PWM Carrier Frequency | 01 to 15 kHz  
01 to 15 kHz  
01 to 09 kHz  
01 to 06 kHz | 1-5hp = 15  
7.5–25hp = 9  
30–60hp = 6  
75–100hp = 6 | |
| P2.09 | Slip Compensation  
Time Constant | 0.05 to 10.00 sec | 0.10 | |
| P2.10 | Control Mode | 00: V/Hz without encoder feedback  
01: V/Hz with encoder feedback  
02: Sensorless Vector without encoder feedback  
03: Sensorless Vector with encoder feedback  
04: V/Hz with encoder feedback & high-speed regulation  
05: Sensorless Vector with encoder feedback & high-speed regulation | | 00 |

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◆ Parameter can be set during RUN Mode.
<table>
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<tr>
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<th>Description</th>
<th>Range*</th>
<th>Default Setting</th>
<th>User Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>P3.00</td>
<td>Source of Operation Command</td>
<td>00: Operation determined by digital keypad</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Operation determined by external control terminals; keypad STOP is enabled</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: Operation determined by external control terminals; keypad STOP is disabled</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>03: Operation determined by RS-485 interface; keypad STOP is enabled</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>04: Operation determined by RS-485 interface; keypad STOP is disabled</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.01</td>
<td>Multi-function Input Terminals (DI1 - DI2)</td>
<td>00: DI1 - FWD / STOP, DI2 - REV / STOP</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: DI1 - RUN / STOP, DI2 - REV / FWD</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: DI1 - RUN momentary (N.O.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DI2 - REV / FWD</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>DI3 - STOP momentary (N.C.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.02</td>
<td>Multi-function Input DI3</td>
<td>00: External Fault (N.O.)</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: External Fault (N.C.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.03</td>
<td>Multi-function Input DI4</td>
<td>02: External Reset</td>
<td>03</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>03: Multi-Speed Bit 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>04: Multi-Speed Bit 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.04</td>
<td>Multi-function Input DI5</td>
<td>05: Multi-Speed Bit 3</td>
<td>04</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>06: Multi-Speed Bit 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.05</td>
<td>Multi-function Input DI6</td>
<td>07: Manual Keyboard Control</td>
<td>05</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>08: Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>09: Jog</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.06</td>
<td>Multi-function Input DI7</td>
<td>10: External Base Block (N.O.)</td>
<td>06</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>11: External Base Block (N.C.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.07</td>
<td>Multi-function Input DI8</td>
<td>12: Second Accel/Decel Time</td>
<td>09</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13: Speed Hold</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>14: Increase Speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.08</td>
<td>Multi-function Input DI9</td>
<td>15: Decrease Speed</td>
<td>02</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>16: Reset Speed to Zero</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.09</td>
<td>Multi-function Input DI10</td>
<td>17: PID Disable (N.O.)</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>18: PID Disable (N.C.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3.10</td>
<td>Multi-function Input DI11</td>
<td>19: 1st/2nd Source Select (N.O.)</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20: 1st/2nd Source Select (N.C.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>99: Input Disable</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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### Chapter 4: AC Drive Parameters

#### Parameter Summary (continued)

<table>
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<tr>
<th>Parameter</th>
<th>Description</th>
<th>Range*</th>
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<th>User Setting</th>
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</thead>
<tbody>
<tr>
<td><strong>Digital Parameters (continued)</strong></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
| P3.11 Multi-Function Output Terminal 1 (Relay Output) | 00: AC Drive Running  
01: AC Drive Fault  
02: At Speed  
03: Zero Speed  
04: Above Desired Frequency (P3.16)  
05: Below Desired Frequency (P3.16)  
06: At Maximum Speed (P0.04)  
07: Over Torque detected (P6.08)  
08: Above Desired Current (P3.17)  
09: Below Desired Current (P3.17)  
10: PID Deviation Alarm  
11: Heatsink Overheat Warning (OH1)  
12: Soft Braking Signal | 00 | | |
| P3.12 Multi-Function Output Terminal 2 (DO1) | 00: AC Drive Running  
01: AC Drive Fault  
02: At Speed  
03: Zero Speed  
04: Above Desired Frequency (P3.16)  
05: Below Desired Frequency (P3.16)  
06: At Maximum Speed (P0.04)  
07: Over Torque detected (P6.08)  
08: Above Desired Current (P3.17)  
09: Below Desired Current (P3.17)  
10: PID Deviation Alarm  
11: Heatsink Overheat Warning (OH1)  
12: Soft Braking Signal | 01 | | |
| P3.13 Multi-Function Output Terminal 3 (DO2) | 00: AC Drive Running  
01: AC Drive Fault  
02: At Speed  
03: Zero Speed  
04: Above Desired Frequency (P3.16)  
05: Below Desired Frequency (P3.16)  
06: At Maximum Speed (P0.04)  
07: Over Torque detected (P6.08)  
08: Above Desired Current (P3.17)  
09: Below Desired Current (P3.17)  
10: PID Deviation Alarm  
11: Heatsink Overheat Warning (OH1)  
12: Soft Braking Signal | 02 | | |
| P3.14 Multi-Function Output Terminal 4 (DO3) | 00: AC Drive Running  
01: AC Drive Fault  
02: At Speed  
03: Zero Speed  
04: Above Desired Frequency (P3.16)  
05: Below Desired Frequency (P3.16)  
06: At Maximum Speed (P0.04)  
07: Over Torque detected (P6.08)  
08: Above Desired Current (P3.17)  
09: Below Desired Current (P3.17)  
10: PID Deviation Alarm  
11: Heatsink Overheat Warning (OH1)  
12: Soft Braking Signal | 03 | | |
| P3.16 Desired Frequency | 0.0 to 400.0 Hz | 0.0 | | | |
| P3.17 Desired Current | 0.0 to <Drive Rated Amps> | 0.0 | | | |
| P3.18 PID Deviation Level | 1.0 to 50.0 % | 10.0 | | | |
| P3.19 PID Deviation Time | 0.1 to 300.0 sec | 5.0 | | | |
| P3.20 Desired Frequency 2 | 0.0 to 400.0 Hz | 0.0 | | | |
| P3.30 Frequency Output (FO) Scaling Factor | 1 to 20 | 1 | | | |
| P3.31 2nd Source of Operation Command | 00: Operation determined by digital keypad  
01: Operation determined by external control terminals; keypad STOP is enabled  
02: Operation determined by external control terminals; keypad STOP is disabled  
03: Operation determined by RS-485 interface; keypad STOP is enabled  
04: Operation determined by RS-485 interface; keypad STOP is disabled | 0 | | | |

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◆ Parameter can be set during RUN Mode.
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<th>User Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P4.00</strong></td>
<td>Source of Frequency Command</td>
<td>01: Frequency determined by digital keypad up/down</td>
<td></td>
<td>01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: Frequency determined by 0 to +10V input on AI1 terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>03: Frequency determined by 4 to 20 mA input on AI2 terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>04: Frequency determined by 0 to 20 mA input on AI2 terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>05: Frequency determined by RS-485 communication interface</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>06: Frequency determined by -10V to +10V input on (AI3) terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P4.01</strong></td>
<td>Analog Input Offset Polarity</td>
<td>00: No Offset</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Positive Offset</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: Negative Offset</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P4.02</strong></td>
<td>Analog Input Offset</td>
<td>0.0 to 100.0%</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td><strong>P4.03</strong></td>
<td>Analog Input Gain</td>
<td>0.0 to 300.0%</td>
<td></td>
<td>100.0</td>
</tr>
<tr>
<td><strong>P4.04</strong></td>
<td>Analog Input Reverse Motion Enable</td>
<td>00: Forward Motion Only</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Reverse Motion Enable</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P4.05</strong></td>
<td>Loss of AI2 Signal (4-20 mA)</td>
<td>00: Decelerate to 0Hz</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Stop immediately and display error code “External Fault”</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: Continue operation by the last frequency command</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P4.11</strong></td>
<td>Analog Output Signal</td>
<td>00: Frequency Hz</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Current A</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: PV</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P4.12</strong></td>
<td>Analog Output Gain</td>
<td>00 to 200%</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td><strong>P4.13</strong></td>
<td>2nd Source of Frequency Command</td>
<td>same settings as for P4.00</td>
<td></td>
<td>06</td>
</tr>
<tr>
<td><strong>P4.14</strong></td>
<td>2nd Analog Input Offset Polarity</td>
<td>same settings as for P4.01</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td><strong>P4.15</strong></td>
<td>2nd Analog Input Offset</td>
<td>0.0 to 100.0%</td>
<td>0.0 (float)</td>
<td></td>
</tr>
<tr>
<td><strong>P4.16</strong></td>
<td>2nd Analog Input Gain</td>
<td>0.0 to 300.0%</td>
<td>100.0 (float)</td>
<td></td>
</tr>
<tr>
<td><strong>P4.17</strong></td>
<td>Trim Frequency Reference</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0 (float)</td>
<td></td>
</tr>
<tr>
<td><strong>P4.18</strong></td>
<td>Trim Mode Select</td>
<td>00: Disable Trim function</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: 1st source frequency + 2nd source freq</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: 1st source frequency - 2nd source freq</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>03: Speed Command + Trim Frequency Reference (P4.17)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>04: Speed Command - Trim Frequency Reference (P4.17)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Parameter *</th>
<th>Description</th>
<th>Range*</th>
<th>Default Setting</th>
<th>User Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>P5.00</td>
<td>Jog Speed</td>
<td>0.0 to 400.0 Hz</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>P5.01</td>
<td>Multi-Speed 1</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
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<tr>
<td>P5.02</td>
<td>Multi-Speed 2</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
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</tr>
<tr>
<td>P5.03</td>
<td>Multi-Speed 3</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
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</tr>
<tr>
<td>P5.04</td>
<td>Multi-Speed 4</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
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<td>P5.05</td>
<td>Multi-Speed 5</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
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<tr>
<td>P5.06</td>
<td>Multi-Speed 6</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
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<tr>
<td>P5.07</td>
<td>Multi-Speed 7</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>P5.08</td>
<td>Multi-Speed 8</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>P5.09</td>
<td>Multi-Speed 9</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>P5.10</td>
<td>Multi-Speed 10</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>P5.11</td>
<td>Multi-Speed 11</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>P5.12</td>
<td>Multi-Speed 12</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>P5.13</td>
<td>Multi-Speed 13</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>P5.14</td>
<td>Multi-Speed 14</td>
<td>0.0 to 400.0 Hz</td>
<td>0.0</td>
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</tr>
<tr>
<td>P5.15</td>
<td>Multi-Speed 15</td>
<td>0.0 to 400.0 Hz</td>
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### Parameter Summary (continued)

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<th>Description</th>
<th>Range*</th>
<th>Default Setting</th>
<th>User Setting</th>
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<tr>
<td><strong>P6.00</strong></td>
<td>Electronic Thermal Overload Relay</td>
<td>00: Inverter/Vector Duty Motors 01: Fan Cooled Standard Motors 02: Inactive</td>
<td>00</td>
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</tr>
<tr>
<td><strong>P6.01</strong></td>
<td>Auto Restart after Fault</td>
<td>00 to 10</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td><strong>P6.02</strong></td>
<td>Momentary Power Loss</td>
<td>00: Stop operation after momentary power loss 01: Continue operation after momentary power loss, speed search from Speed Reference 02: Continue operation after momentary power loss, speed search from Minimum Speed</td>
<td>00</td>
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</tr>
<tr>
<td><strong>P6.03</strong></td>
<td>Reverse Operation Inhibit</td>
<td>00: Enable Reverse Operation 01: Disable Reverse Operation</td>
<td>00</td>
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</tr>
<tr>
<td><strong>P6.04</strong></td>
<td>Auto Voltage Regulation</td>
<td>00: AVR enabled 01: AVR disabled 02: AVR disabled during decel 03: AVR disabled during stop</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td><strong>P6.05</strong></td>
<td>Over-Voltage Stall Prevention</td>
<td>00: Enable Over-voltage Stall Prevention 01: Disable Over-voltage Stall Prevention</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td><strong>P6.06</strong></td>
<td>Auto Adjustable Accel/Decel</td>
<td>00: Linear Accel/Decel 01: Auto Accel, Linear Decel 02: Linear Accel, Auto Decel 03: Auto Accel/Decel 04: Auto Accel/Decel Stall Prevention (limited by P1.01, P1.02, P1.05 and P1.06)</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td><strong>P6.07</strong></td>
<td>Over-Torque Detection Mode</td>
<td>00: Disabled 01: Enabled during constant speed operation 02: Enabled during acceleration</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td><strong>P6.08</strong></td>
<td>Over-Torque Detection Level</td>
<td>30 to 200%</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td><strong>P6.09</strong></td>
<td>Over-Torque Detection Time</td>
<td>0.1 to 10.0</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td><strong>P6.10</strong></td>
<td>Over-Current Stall Prevention during Acceleration</td>
<td>20 to 200% 00: Disable</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td><strong>P6.11</strong></td>
<td>Over-Current Stall Prevention during Operation</td>
<td>20 to 200%</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td><strong>P6.12</strong></td>
<td>Maximum Allowable Power Loss Time</td>
<td>0.3 to 5.0 sec</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td><strong>P6.13</strong></td>
<td>Base-Block Time for Speed Search</td>
<td>0.3 to 5.0 sec</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td><strong>P6.14</strong></td>
<td>Maximum Speed Search Current Level</td>
<td>30 to 200%</td>
<td>150</td>
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</tr>
</tbody>
</table>

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<th>Description</th>
<th>Range*</th>
<th>Default Setting</th>
<th>User Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>P6.15</td>
<td>Upper Bound of Output Frequency</td>
<td>0.1 to 400 Hz</td>
<td>400</td>
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</tr>
<tr>
<td>P6.16</td>
<td>Lower Bound of Output Frequency</td>
<td>0.0 to 400 Hz</td>
<td>0.0</td>
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<tr>
<td>P6.17</td>
<td>Over-Voltage Stall Prevention Level</td>
<td>230V series - 330.0V to 450.0V 460V series - 600.0V to 900.0V</td>
<td>390.0 780.0</td>
<td></td>
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<tr>
<td>P6.18</td>
<td>Braking Voltage Level</td>
<td>230V series - 370.0V to 450.0V 460V series - 740.0V to 900.0V</td>
<td>380.0 760.0</td>
<td></td>
</tr>
<tr>
<td>P6.30</td>
<td>Line Start Lockout</td>
<td>00: Enable Line Start Lockout 01: Disable Line Start Lockout</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>P6.31</td>
<td>Present Fault Record</td>
<td>00: No Fault occurred 01: O ver-current (oc) 02: O ver-voltage (ov) 03: O ver-temperature</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>P6.32</td>
<td>Second Most Recent Fault Record</td>
<td>04: O verload (oL) 05: Thermal O verload (oL1) 06: O ver-Torque (oL2) 07: External Fault (EF)</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>P6.33</td>
<td>Third Most Recent Fault Record</td>
<td>08: CPU failure 1 (CF1) 09: CPU failure 2 (CF2) 10: CPU failure 3 (CF3) 11: Hardware Protection Failure (HPF)</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>P6.34</td>
<td>Fourth Most Recent Fault Record</td>
<td>12: O ver-current during accel (O CA) 13: O ver-current during decel (O Cd) 14: O ver-current during steady state (O Cn) 15:Ground fault or fuse failure (GFF)</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>P6.35</td>
<td>Fifth Most Recent Fault Record</td>
<td>17: Input power 3-phase loss 19: Auto Ramp Fault 20: Parameters Locked</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>P6.36</td>
<td>Sixth Most Recent Fault Record</td>
<td>21: PID Feedback loss (FbE) 22: Encoder Feedback Loss 23: O utput Shorted (O CC) 24: Momentary Power Loss</td>
<td>00</td>
<td></td>
</tr>
</tbody>
</table>

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### Parameter Summary (continued)

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<th>Description</th>
<th>Range*</th>
<th>Default Setting</th>
<th>User Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PID Parameters</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>P7.00</td>
<td>Input Terminal for PID Feedback</td>
<td>00: Inhibit PID operation 01: Forward-acting (heating loop) PID feedback, PV from AI1 (0 to +10V) 02: Forward-acting (heating loop) PID feedback, PV from AI2 (4 to 20 mA) 03: Reverse-acting (cooling loop) PID feedback, PV from AI1 (0 to +10V) 04: Reverse-acting (cooling loop) PID feedback, PV from AI2 (4 to 20 mA)</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td>P7.01</td>
<td>PV 100% Value</td>
<td>0.0 to 999</td>
<td></td>
<td>100.0</td>
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<tr>
<td>P7.02</td>
<td>PID Setpoint Source</td>
<td>00: Keypad 01: Serial Communications 02: AI1 (0 to +10V) 03: AI2 (4 to 20mA)</td>
<td></td>
<td>02</td>
</tr>
<tr>
<td>P7.03</td>
<td>PID Feedback Gain</td>
<td>00 to 300.0%</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>P7.04</td>
<td>PID Setpoint Offset Polarity</td>
<td>00: No Offset 01: Positive Offset 02: Negative Offset</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td>P7.05</td>
<td>PID Setpoint Offset</td>
<td>0.0 to 100.0%</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>P7.06</td>
<td>PID Setpoint Gain</td>
<td>0.0 to 300.0%</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>P7.07</td>
<td>Keypad PID Setpoint</td>
<td>0.0 to 999</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>P7.10</td>
<td>PID Multi-setpoint 1</td>
<td>0.0 to 999</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>P7.11</td>
<td>PID Multi-setpoint 2</td>
<td>0.0 to 999</td>
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</tr>
<tr>
<td>P7.12</td>
<td>PID Multi-setpoint 3</td>
<td>0.0 to 999</td>
<td></td>
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<tr>
<td>P7.13</td>
<td>PID Multi-setpoint 4</td>
<td>0.0 to 999</td>
<td></td>
<td>0.0</td>
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<tr>
<td>P7.14</td>
<td>PID Multi-setpoint 5</td>
<td>0.0 to 999</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>P7.15</td>
<td>PID Multi-setpoint 6</td>
<td>0.0 to 999</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>P7.16</td>
<td>PID Multi-setpoint 7</td>
<td>0.0 to 999</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>P7.17</td>
<td>Proportional Control</td>
<td>0.0 to 10.0</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>P7.18</td>
<td>Integral Control</td>
<td>0.00 to 100.0 sec</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>P7.19</td>
<td>Derivative Control</td>
<td>0.00 to 1.00 sec</td>
<td></td>
<td>0.00</td>
</tr>
<tr>
<td>P7.20</td>
<td>Upper Bound for Integral Control</td>
<td>00 to 100%</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>P7.21</td>
<td>Derivative Filter Time Constant</td>
<td>0.0 to 2.5 sec</td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td>P7.22</td>
<td>PID Output Frequency Limit</td>
<td>00 to 110%</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>P7.23</td>
<td>Feedback Signal Detection Time</td>
<td>0.0 to 3600 sec.</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>P7.24</td>
<td>PID Feedback Loss</td>
<td>00: Warn and AC Drive Stop 01: Warn and continue operation 02: Warn and continue at last frequency 03: Warn and continue at Preset Speed (P7.28)</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td>P7.25</td>
<td>PID Feedback Loss Preset Speed</td>
<td>0.0 to 400.0 Hz</td>
<td></td>
<td>0.0</td>
</tr>
</tbody>
</table>

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### Chapter 4: AC Drive Parameters

**Parameter Summary (continued)**

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<th>Parameter *</th>
<th>Description</th>
<th>Range*</th>
<th>Default Setting</th>
<th>User Setting</th>
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<tbody>
<tr>
<td><strong>Display Parameters</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>◆ P8.00</td>
<td>User Defined Display Function</td>
<td>00: Output Frequency (Hz) 01: Motor Speed (rpm) 02: Scaled Frequency 03: Output Current (A) 04: Motor Load (%) 05: Output Voltage (V) 06: DC Bus Voltage (V) 07: PID Setpoint 08: PID Feedback (PV) 09: Frequency Setpoint</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td>◆ P8.01</td>
<td>Frequency Scale Factor</td>
<td>0.01 to 160.0</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>◆ P8.02</td>
<td>Backlight Timer</td>
<td>00: Timer Enable (1 min light off) 01: Timer Disable</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td><strong>Communications Parameters</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P9.00</td>
<td>Communication Address</td>
<td>01 to 254</td>
<td></td>
<td>01</td>
</tr>
<tr>
<td>P9.01</td>
<td>Transmission Speed</td>
<td>00: 4800 baud 01: 9600 baud 02: 19200 baud 03: 38400 baud</td>
<td></td>
<td>01</td>
</tr>
<tr>
<td>P9.02</td>
<td>Communication Protocol</td>
<td>00: MODBUS ASCII mode 7 data bits, no parity, 2 stop bits 01: MODBUS ASCII mode 7 data bits, even parity, 1 stop bit 02: MODBUS ASCII mode 7 data bits, odd parity, 1 stop bit 03: MODBUS RTU mode 8 data bits, no parity, 2 stop bits 04: MODBUS RTU mode 8 data bits, even parity, 1 stop bit 05: MODBUS RTU mode 8 data bits, odd parity, 1 stop bit</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td>P9.03</td>
<td>Transmission Fault Treatment</td>
<td>00: Display fault and continue operating 01: Display fault and RAMP to stop 02: Display fault and COAST to stop 03: No fault displayed and continue operating</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td>P9.04</td>
<td>Time Out Detection</td>
<td>00: Disable 01: Enable</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td>P9.05</td>
<td>Time Out Duration</td>
<td>0.1 to 60.0 seconds</td>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>◆ P9.07</td>
<td>Parameter Lock</td>
<td>00: All parameters can be set and read 01: All parameters are read-only</td>
<td></td>
<td>00</td>
</tr>
<tr>
<td>◆ P9.08</td>
<td>Restore to Default</td>
<td>99: Restores all parameters to factory defaults</td>
<td></td>
<td>00</td>
</tr>
</tbody>
</table>

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<tbody>
<tr>
<td><strong>P9.11</strong></td>
<td>Block Transfer Parameter 1</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.12</strong></td>
<td>Block Transfer Parameter 2</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.13</strong></td>
<td>Block Transfer Parameter 3</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.14</strong></td>
<td>Block Transfer Parameter 4</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
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<tr>
<td><strong>P9.15</strong></td>
<td>Block Transfer Parameter 5</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.16</strong></td>
<td>Block Transfer Parameter 6</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.17</strong></td>
<td>Block Transfer Parameter 7</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.18</strong></td>
<td>Block Transfer Parameter 8</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.19</strong></td>
<td>Block Transfer Parameter 9</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.20</strong></td>
<td>Block Transfer Parameter 10</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.21</strong></td>
<td>Block Transfer Parameter 11</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.22</strong></td>
<td>Block Transfer Parameter 12</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.23</strong></td>
<td>Block Transfer Parameter 13</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.24</strong></td>
<td>Block Transfer Parameter 14</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
<td></td>
</tr>
<tr>
<td><strong>P9.25</strong></td>
<td>Block Transfer Parameter 15</td>
<td>P0.00 to P8.02, P9.99</td>
<td>P9.99</td>
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</tr>
<tr>
<td><strong>P9.26</strong></td>
<td>Serial Comm Speed Reference</td>
<td>0.0 to 400.0 Hz</td>
<td>60.0</td>
<td></td>
</tr>
<tr>
<td><strong>P9.27</strong></td>
<td>Serial Comm RUN Command</td>
<td>00: Stop</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td><strong>P9.28</strong></td>
<td>Serial Comm Direction Command</td>
<td>00: Forward</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Reverse</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P9.29</strong></td>
<td>Serial Comm External Fault</td>
<td>00: No fault</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: External fault</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P9.30</strong></td>
<td>Serial Comm Fault Reset</td>
<td>00: No action</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Fault Reset</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P9.31</strong></td>
<td>Serial Comm JOG Command</td>
<td>00: Stop</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Jog</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P9.39</strong></td>
<td>Firmware Version</td>
<td>#.##</td>
<td>#.##</td>
<td></td>
</tr>
<tr>
<td><strong>P9.40</strong></td>
<td>Parameter Copy</td>
<td>00: Disable Copy Keypad Function</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Enable Copy Keypad Function</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>P9.41</strong></td>
<td>GS Series Number</td>
<td>01: G S 1</td>
<td>#</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: G S 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>03: G S 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>04: G S 4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Some parameters and settings are available only in later firmware versions of DURAPULSE drives. Refer to the beginning of this “DURAPULSE Parameter Summary” section for more information.

◆ Parameter can be set during RUN Mode.
### Encoder Feedback Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Range*</th>
<th>Default Setting</th>
<th>User Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>P10.00</td>
<td>Encoder Pulses per Revolution</td>
<td>01 to 20000</td>
<td>1024</td>
<td></td>
</tr>
<tr>
<td>P10.01</td>
<td>Encoder Type Input</td>
<td>00: Disable</td>
<td>00</td>
<td>00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Single Phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: Quadrature, FWD - CCW</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>03: Quadrature, FWD - CW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P10.02</td>
<td>Proportional Control</td>
<td>0.0 to 10.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>P10.03</td>
<td>Integral Control</td>
<td>0.00 to 100.00 sec</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>P10.04</td>
<td>Encoder Control Output Limit</td>
<td>0.0 to 20.0%</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>P10.05</td>
<td>Encoder Loss Detection</td>
<td>00</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: Warn and continue operation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: Warn and RAMP to stop</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: Warn and COAST to stop</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Some parameters and settings are available only in later firmware versions of DURAPULSE drives. Refer to the beginning of this “DURAPULSE Parameter Summary” section for more information.

◆ Parameter can be set during RUN Mode.
Detailed Parameter Listings

<table>
<thead>
<tr>
<th>Parameter Number</th>
<th>Parameter Name</th>
<th>Parameter Setting Range</th>
<th>Parameter Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>P0.00</strong></td>
<td>Motor Nameplate Voltage</td>
<td>Default Setting: 230V class - 240; 460V class - 480</td>
<td>This parameter determines the Maximum Output Voltage of the AC 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. The setting value must be equal to or greater than the Mid-Point Voltage (P2.05).</td>
</tr>
<tr>
<td><strong>P0.01</strong></td>
<td>Motor Nameplate Amps</td>
<td>Default Setting: Drive Rating (A)</td>
<td>Range: Drive Rated Amps x 0.4 to Drive Rated Amps x 1.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This parameter sets the output current to the motor, and is used by the drive to set the motor overload protection. Set this parameter value to the full load current listed on the motor nameplate. (Also refer to P6.00 to set overload current type.)</td>
</tr>
<tr>
<td><strong>P0.02</strong></td>
<td>Motor Base Frequency</td>
<td>Default Setting 60</td>
<td>Range: 50/60/400</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This parameter should be set to the base frequency of the motor as indicated on the motor nameplate. Motor Base Frequency determines the volts per hertz ratio.</td>
</tr>
</tbody>
</table>

If the ◆ symbol is found next to the parameter name, the parameter can be edited when the AC drive is in RUN Mode.

Motor Parameters

**P0.00** Motor Nameplate Voltage Default Setting: 230V class - 240; 460V class - 480

460V series: 380/400/415/440/460/480

This parameter determines the Maximum Output Voltage of the AC 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. The setting value must be equal to or greater than the Mid-Point Voltage (P2.05).
Chapter 4: AC Drive Parameters

Motor Base RPM

Default Setting: 1750

Range: 375 to 24,000 RPM

This value should be set according to rated Base RPM of the motor as indicated on the motor nameplate.

Motor Maximum RPM

Default Setting: P0.03

Range: P0.03 to 24,000 rpm

This value should be set according to the desired maximum speed of the motor. This value should not exceed the motor’s maximum rated speed.

Warning: The Motor Maximum RPM 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 parameter, along with P0.02 and P0.03, determines the Maximum Output Frequency of the AC Drive. The Maximum Output Frequency can be calculated as follows:

\[
\text{Max. Output Frequency} = \left( \frac{\text{Maximum Speed (P 0.04)}}{\text{Base Speed (P 0.03)}} \right) \times \text{Base Frequency (P 0.02)}
\]

If an output limit based on Maximum Output Frequency is desired, use the following equation to determine the corresponding value for Motor Maximum RPM:

\[
\text{Motor Maximum RPM} = \left( \frac{\text{Max. Output Frequency}}{\text{Motor Base Frequency (P 0.02)}} \right) \times \text{Motor Base RPM (P 0.03)}
\]

Motor Auto Tune

Default Setting: 00

Settings: 00 Disable
- 01 Enable P0.06 only (R1)
- 02 Enable P0.06 and P0.07 (R1 + No-load Test)

Auto-tuning is required only for Sensorless Vector Control Modes (P2.10 = 02, 03, 05).

Do NOT set auto-tuning without a motor connected. Also, do NOT set auto-tuning with any mechanical load connected to the motor output shaft.

The unit will auto detect when you press the RUN key after this parameter is set to 01 or 02. When set to 01, the unit will auto detect only the motor R1 line to line resistance value (P0.06); manually enter the motor no-load current in P0.07. When set to 02, the values of both P0.06 and P0.07 will be filled in automatically.

Refer to the “Auto-Tune Procedure” subsection of chapter 3 for step-by-step auto-tuning instructions.
**P0.06 Motor Line-to-Line Resistance R1**

Default: 00

Range: 00 to 65535 milliohm

The motor auto detection feature will set this parameter. The user may also set this parameter without using P0.05. Some motor manufacturers list this value on the motor nameplate.

**P0.07 Motor No-Load Current**

Default: Drive Rated Amps x 0.4

Range: Drive Rated Amps x 0.0 to 0.9 (Amps)

The rated current of the AC drive is regarded as 100%. The setting of the motor no-load current will affect the slip compensation. The setting value must be less than the Motor Rated Current (P0.01).
Ramp Parameters

**P1.00 Stop Methods**

<table>
<thead>
<tr>
<th>Stop Method</th>
<th>Default Setting: 00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range: 00 Ramp to Stop</td>
<td></td>
</tr>
<tr>
<td>01 Coast to stop</td>
<td></td>
</tr>
</tbody>
</table>

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

- **Ramp**: The AC drive decelerates the motor to Minimum Output Frequency (P2.06) and then stops according to the deceleration time set in P1.02 or P1.06.
- **Coast**: The AC drive stops output instantly upon command, and the motor free runs until it comes to a complete stop.

The drive application or system requirements will determine which stop method is needed.

**P1.01 Acceleration Time 1**

<table>
<thead>
<tr>
<th>Default Setting: 10 sec</th>
</tr>
</thead>
</table>

Range: 0.1 to 600 sec

This parameter is used to determine the time required for the AC drive to ramp from 0 to its Maximum Motor RPM (P0.04). The rate is linear unless S-Curve is “Enabled” (P1.03 > 0).

**P1.02 Deceleration Time 1**

<table>
<thead>
<tr>
<th>Default Setting: 30 sec</th>
</tr>
</thead>
</table>

Range: 0.1 to 600 sec

This parameter is used to determine the time required for the AC drive to decelerate from the Maximum Motor RPM (P0.04) down to 0Hz. The rate is linear unless S-Curve is “Enabled” (P1.04 > 0).
**P1.03 Accel S-Curve**  
*Default Setting: 00*

**Range:** 00 to 07  
This parameter is used whenever the motor and load need to be accelerated more smoothly. The Accel S-Curve may be set from 0 to 7 to select the desired acceleration S Curve.

<table>
<thead>
<tr>
<th>S-curve characteristics</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-curve characteristics</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td></td>
</tr>
</tbody>
</table>

- **P 1.03 = 00**  
  "Accel S curve Disabled"

- **P 1.04 = 00**  
  "Decel S curve Disabled"

S-curves can only be seen when the motor is loaded. Static testing will result in no noticeable change on tuning software (i.e. GSoft).

Accel / Decel times 1 and 2 are applied to S-curve calculations.
Chapter 4: AC Drive Parameters

**P1.04 Decel S-Curve**

Default Setting: 00

Range: 00 to 07

This parameter is used whenever the motor and load need to be decelerated more smoothly. The Decel S-Curve may be set from 00 to 07 to select the desired deceleration S-Curve.

From the diagram shown below, the original setting accel/decel time will be for reference when the function of the S-curve is enabled. The actual accel/decel time will be determined based on the S-curve selected (1 to 7).

![Diagram of Decel S-Curve]

S curve is disabled in (1), (2)

P1.03 sets S curve for (3)

P1.04 sets S curve for (4)

---

**P1.05 Acceleration Time 2**

Default Setting: 10.0

Range: 0.1 to 600 sec

The Second Acceleration Time determines the time for the AC drive to accelerate from 0 RPM to Maximum Motor RPM (P0.04). Acceleration Time 2 (P1.05) can be selected using a multi-function input terminal or frequency transition (P1.07).

---

**P1.06 Deceleration Time 2**

Default Setting: 30 sec

Range: 0.1 to 600 sec

The Second Deceleration Time determines the time for the AC drive to decelerate from Maximum Motor RPM (P0.04) to 0 RPM. Deceleration Time 2 (P1.06) can be selected using a multi-function input terminal or frequency transition (P1.07).
Select Method for 2nd Accel/Decel

Default Setting: 00

Range: 00: Second Accel/Decel from terminal
01: Frequency Transitions P1.08 & P1.09

The second set of acceleration and deceleration times P1.05 and P1.06 can be selected either with a multi-function input terminal programmed to Second Accel/Decel, or by the values of the transition frequencies P1.08 and P1.09.

Second Accel/Decel Times selected with Multi-Function Input Terminal

Accel 1 to Accel 2 Frequency Transition

Default Setting: 0.0

Range: 0.0 to 400.0 Hz

This parameter sets the frequency at which the AC drive changes acceleration rate from Acceleration Time 1 (P1.01) to Acceleration Time 2 (P1.05).

Second Accel/Decel Times selected with Frequency Transition

Decel 2 to Decel 1 Frequency Transition

Default Setting: 0.0

Range: 0.0 to 400.0 Hz

This parameter sets the frequency at which the AC drive changes deceleration rate from Deceleration Time 2 (P1.06) to Deceleration Time 1 (P1.02).
### Chapter 4: AC Drive Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1.10</td>
<td><strong>Skip Frequency 1</strong> Default Setting: 0.0 Range: 0.0 to 400.0Hz</td>
</tr>
<tr>
<td>P1.11</td>
<td><strong>Skip Frequency 2</strong> Default Setting: 0.0 Range: 0.0 to 400.0Hz</td>
</tr>
<tr>
<td>P1.12</td>
<td><strong>Skip Frequency 3</strong> Default Setting: 0.0 Range: 0.0 to 400.0 Hz</td>
</tr>
<tr>
<td></td>
<td>• P1.10, P1.11, and P1.12 determine the location of the frequency bands that will be skipped during AC drive operation.</td>
</tr>
<tr>
<td>P1.13</td>
<td><strong>Skip Frequency 4</strong> Default Setting: 0.0 Range: 0.0 to 400.0 Hz</td>
</tr>
<tr>
<td>P1.14</td>
<td><strong>Skip Frequency 5</strong> Default Setting: 0.0 Range: 0.0 to 400.0 Hz</td>
</tr>
<tr>
<td>P1.17</td>
<td><strong>Skip Frequency Band</strong> Default Setting: 0.0 Range: 0.0 to 20.0 Hz</td>
</tr>
<tr>
<td></td>
<td>This parameter determines the frequency band for a given Skip Frequency (P1.10, P1.11, or P1.12). Half of the Skip Frequency Band is above the Skip Frequency and the other half is below. Programming this parameter to 0.0 disables all skip frequencies.</td>
</tr>
</tbody>
</table>

![Diagram](attachment:image.png)

**Output frequency**

- Skip Frequency 1: P1.10
- Skip Frequency 2: P1.11
- Skip Frequency 3: P1.12
- Skip Frequency Set Point
- Skip Frequency Band: P1.17
**P1.18 DC Injection Current Level**  
Default Setting: 00  
Range: 00 to 100%  
This parameter determines the amount of DC Braking Current applied to the motor during start-up and stopping. When setting DC Braking Current, please note that 100% is equal to the rated current of the drive. It is recommended to start with a low DC Braking Current Level and then increase until proper holding torque has been attained.

**P1.20 DC Injection during Start-up**  
Default Setting: 0.0  
Range: 0.0 to 5.0 sec  
This parameter determines the duration of time that the DC Braking Current will be applied to the motor during the AC drive start-up. DC Braking will be applied for the time set in this parameter until the Minimum Frequency is reached during acceleration.

**P1.21 DC Injection during Stopping**  
Default Setting: 0.0  
Range: 0.0 to 25.0 sec  
This parameter determines the duration of time that the DC braking voltage will be applied to the motor during stopping. If stopping with DC Braking is desired, then P1.00 must be set to Ramp to Stop (00).

**P1.22 Start-point for DC Injection**  
Default Setting: 0.0  
Range: 0.0 to 60.0 Hz  
This parameter determines the frequency when DC Braking will begin during deceleration.
**Volts/ Hertz Parameters**

### P2.00 Volts/ Hertz Settings

**Default Setting:** 0.0

**Settings:**
- 00 General Purpose (constant torque)
- 01 High Starting Torque
- 02 Fans and Pumps (variable torque)
- 03 Custom

P2.04 through P2.07 are only used when the Volts/Hertz parameter (P2.00) is set to 03.

#### 00: General Purpose

<table>
<thead>
<tr>
<th>Volts</th>
<th>P0.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/20</td>
<td>60/400 Hz Base Frequency</td>
</tr>
<tr>
<td>1.5</td>
<td>50 Hz Base Frequency</td>
</tr>
</tbody>
</table>

#### 01: High Starting Torque

<table>
<thead>
<tr>
<th>Volts</th>
<th>P0.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>18/36</td>
<td>60/400 Hz Base Frequency</td>
</tr>
<tr>
<td>23/46</td>
<td>50 Hz Base Frequency</td>
</tr>
</tbody>
</table>

#### 02: Fans and Pumps

<table>
<thead>
<tr>
<th>Volts</th>
<th>P0.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/20</td>
<td>60/400 Hz Base Frequency</td>
</tr>
<tr>
<td>30</td>
<td>50 Hz Base Frequency</td>
</tr>
</tbody>
</table>

### 03: Custom

A custom curve can be applied for nonstandard motors.

Example:

These settings keep the V/Hz ratio at 380/300 for a motor rated 380V, 18000 rpm, 300 Hz:

- P0.00 = 460V or 400V
- P0.02 = 400 Hz
- P2.00 = 03
- P2.04 = 300 Hz
- P2.05 = 380V
- P2.06 = 1.5 Hz
- P2.07 = 20V
- P6.15 = 300 Hz
### P2.01 Slip Compensation

**Default Setting:** V/Hz mode: 0.0 / Vector mode: 1.0  
**Range:** 0.0 to 10.0

This parameter can be used to partially compensate for the slip inherent in asynchronous three phase AC induction motors. An increase in load on the motor will result in an increase in slip within the motor. When this parameter is set above zero, the drive automatically increases the output frequency as the load increases. The higher the parameter setting, the more aggressively the drive increases the output frequency. The drive compares the actual output current to the values of P0.01 (Motor Nameplate Amps) and P0.07 (Motor No-Load Current) in order to determine the required output frequency increase.

The proper setting for P2.01 is determined by trial and error. Correct settings of P0.01, P0.07, and P2.09 (if applicable) are important for proper operation of this slip compensation feature.

### P2.02 Auto-torque Boost

**Default Setting:** 00  
**Range:** 00 to 10

This parameter functions similarly to the High Starting Torque setting of the V/Hz Settings parameter (P2.00 = 01), except that this parameter (P2.02) uses less current. The High Starting Torque setting of P2.00 boosts starting torque by increasing current at every start beyond what is required to move the load. However, P2.02 Auto-torque Boost increases the current only as required to move the load. The proper setting for P2.02 is determined by trial and error.

- This parameter only applies in V/Hz mode.

### P2.03 Torque Compensation Time Constant

**Default Setting:** 0.05  
**Range:** 00 to 10 sec

This parameter is essentially a low-pass filter which affects how Auto-Torque Boost (P2.02) is applied. When this parameter is set to zero, Auto-Torque Boost is applied instantaneously. When this parameter is set greater than zero, Auto-Torque Boost is applied gradually over the time period set by this parameter.
Chapter 4: AC Drive Parameters

**P2.04 Mid-point Frequency**  
Default Setting: 1.5  
Range: 0.1 to 400 Hz  
This parameter sets the Mid-Point Frequency of V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point frequency can be determined.

This parameter must be greater than or equal to the Minimum Output Frequency (P2.06) and less than or equal to the Maximum Voltage Frequency (P0.02). This parameter is used only when the Volts/Hertz Settings parameter (P2.00) is set to 03, custom.

**P2.05 Mid-point Voltage**  
Default Setting: 230V class: 10.0 / 460V class: 20.0  
Range: 230V class: 0.1 to 240V  
460V class: 0.1 to 480V  
This parameter sets the Mid-Point Voltage of any V/F curve. With this setting, the V/F ratio between Minimum Frequency and Mid-Point Frequency can be determined.

This parameter must be greater than or equal to the Minimum Output Voltage (P2.07) and less than or equal to the Maximum Output Voltage (P0.00). This parameter is used only when the Volts/Hertz Settings parameter (P2.00) is set to 03, custom.

**P2.06 Minimum Output Frequency**  
Default Setting: 1.5  
Range: 0.1 to 20.0 Hz  
This parameter sets the Minimum Output Frequency of the AC drive.

This parameter must be less than or equal to the Mid-Point Frequency (P2.04). This parameter is used only when the Volts/Hertz Settings parameter (P2.00) is set to 03, custom.

**P2.07 Minimum Output Voltage**  
Default Setting: 230V class: 10.0 / 460V class: 20.0  
Range: 230V class: 0.1 to 50V  
460V class: 0.1 to 100V  
This parameter sets the Minimum Output Voltage of the AC drive.

This parameter must be equal to or less than Mid-Point Voltage (P2.05). This parameter is used only when the Volts/Hertz Settings parameter (P2.00) is set to 03, custom.

P2.04 through P2.07 are used only when the Volts/Hertz parameter (P2.00) is set to 03. If trying to set when P2.00 is not 03, “ERR” will result.
**PWM Carrier Frequency**

Default Settings: 15/09/06/06

Range:
- 1 to 5 hp; 01 to 15 kHz
- 7.5 to 25 hp; 01 to 15 kHz
- 30 to 60 hp; 01 to 09 kHz
- 75 to 100 hp, 01 to 06 kHz

This parameter sets the carrier frequency of PWM (Pulse-Width Modulated) output.

- In the table below, we see that the carrier frequency of PWM output has a significant influence on the electromagnetic noise, leakage current and heat dissipation of the AC drive, and the acoustic noise to the motor.

<table>
<thead>
<tr>
<th>Carrier Frequency</th>
<th>Acoustic Noise</th>
<th>Electromagnetic Noise, Leakage Current</th>
<th>Heat Dissipation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1kHz</td>
<td>significant</td>
<td>minimal</td>
<td>minimal</td>
</tr>
<tr>
<td>15kHz</td>
<td>minimal</td>
<td>moderate</td>
<td>moderate</td>
</tr>
</tbody>
</table>

**Slip Compensation Time Constant**

Default Setting: 0.10

Range: 0.05 to 10.00 sec

This parameter is usually applied to heavy-load applications in which the motor speed is changed frequently. It acts as a damper for P2.01, Slip Compensation, which changes the output frequency to compensate for motor slip due to heavy loads. Frequent speed changes can cause system vibration, and P2.09 can be adjusted while monitoring drive/motor operation to reduce that vibration.

Increasing P2.09 slows the Slip Compensation response (loosens speed regulation).

Decreasing P2.09 speeds the Slip Compensation response (tightens speed regulation).

- This parameter is enabled only in the “high-speed regulation” control modes; (P2.10 = 04 or 05).
- This parameter is available only with AC drive firmware v1.05 or higher. Refer to P9.39 to determine the drive’s firmware version.
Control Mode

Default: 00

Range:

00: V/Hz without encoder feedback
01: V/Hz with encoder feedback
02: Sensorless Vector without encoder feedback
03: Sensorless Vector with encoder feedback
04: V/Hz with encoder feedback and high-speed regulation
05: Sensorless Vector with encoder feedback and high-speed regulation

This parameter determines the control method of the AC drive.

The V/Hz modes (00, 01, & 04) are the basic control modes.

The Sensorless Vector modes (02, 03, & 05) allow improved torque performance at very low speeds and improved speed regulation. These modes require Auto-Tuning per P0.05 in order to match the characteristics of the particular motor being used.

The encoder feedback settings (01, 03, 04, & 05) require the installation of an optional GS3-FB feedback card in order for the drive to read the encoder signal from the motor. (Refer to Appendix A of this manual for more information regarding the GS3-FB.)

The high-speed regulation settings (04 & 05) enable two other parameters which can be used to reduce system vibration:
Slip Compensation Time Constant (P2.09) and Hunting Gain (P6.37).
Digital Parameters

**P3.00** Source of Operation Command  
Default Setting: 00

Settings:

- **00**: Operation Determined by Digital Keypad
- **01**: Operation determined by external control terminals. Keypad STOP is enabled.
- **02**: Operation determined by external control terminals. Keypad STOP is disabled.
- **03**: Operation determined by communication interface. Keypad STOP is enabled.
- **04**: Operation determined by communication interface. Keypad STOP is disabled.

This parameter sets the input source for the AC drive operation commands. Refer to P3.01 to P3.10 for more details.

**P3.01** Multi-Function Input Terminals (DI1-DI2)  
Default Setting: 00

Settings:

- **00**: DI1 - FWD/STOP  
  DI2 - REV/STOP
- **01**: DI1 - RUN/STOP  
  DI2 - REV/FWD
- **02**: DI1 - RUN (used with momentary N.O. contact)  
  DI2 - REV/FWD  
  DI3 - STOP (used with momentary N.C. contact)

Multi-function Input Terminals DI1 and DI2 do not have separate parameter designations. DI1 and DI2 must be used in conjunction with each other to operate two and three wire control.
### Chapter 4: AC Drive Parameters

#### P3.02 Multi-Function Input (DI3)
- Default Setting: 00
- **External Fault (N.O.)**

#### P3.03 Multi-Function Input (DI4)
- Default Setting: 03
- **External Fault (N.C.)**

#### P3.04 Multi-Function Input (DI5)
- Default Setting: 04
- External Reset

#### P3.05 Multi-Function Input (DI6)
- Default Setting: 05
- Multi-Speed Bit 1 / PID Setpoint Bit 1

#### P3.06 Multi-Function Input (DI7)
- Default Setting: 06
- Multi-Speed Bit 2 / PID Setpoint Bit 2

#### P3.07 Multi-Function Input (DI8)
- Default Setting: 09
- Multi-Speed Bit 3 / PID Setpoint Bit 3

#### P3.08 Multi-Function Input (DI9)
- Default Setting: 02
- Multi-Speed Bit 4

#### P3.09 Multi-Function Input (DI10)
- Default Setting: 12
- Manual Keypad Control

#### P3.10 Multi-Function Input (DI11)
- Default Setting: 10
- Reserved

**Settings for P3.02 to P3.10:**

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td><strong>External Fault (N.O.)</strong></td>
</tr>
<tr>
<td>01</td>
<td><strong>External Fault (N.C.)</strong></td>
</tr>
<tr>
<td>02</td>
<td>External Reset</td>
</tr>
<tr>
<td>03</td>
<td>Multi-Speed Bit 1 / PID Setpoint Bit 1</td>
</tr>
<tr>
<td>04</td>
<td>Multi-Speed Bit 2 / PID Setpoint Bit 2</td>
</tr>
<tr>
<td>05</td>
<td>Multi-Speed Bit 3 / PID Setpoint Bit 3</td>
</tr>
<tr>
<td>06</td>
<td>Multi-Speed Bit 4</td>
</tr>
<tr>
<td>07</td>
<td>Manual Keypad Control</td>
</tr>
<tr>
<td>08</td>
<td>Reserved</td>
</tr>
<tr>
<td>09</td>
<td>Jog</td>
</tr>
<tr>
<td>10</td>
<td>External Base Block (N.O.)</td>
</tr>
<tr>
<td>11</td>
<td>External Base Block (N.C.)</td>
</tr>
<tr>
<td>12</td>
<td>Second Accel/Decel Time</td>
</tr>
<tr>
<td>13</td>
<td>Speed Hold (P4.00 must be set to 01.)</td>
</tr>
<tr>
<td>14</td>
<td>***Increase Speed (P4.00 must be set to 01.)</td>
</tr>
<tr>
<td>15</td>
<td>***Decrease Speed (P4.00 must be set to 01.)</td>
</tr>
<tr>
<td>16</td>
<td>Reset Speed to Zero (P4.00 must be set to 01.)</td>
</tr>
<tr>
<td>17</td>
<td>PID Disable (N.O.)</td>
</tr>
<tr>
<td>18</td>
<td>PID Disable (N.C.)</td>
</tr>
<tr>
<td>*19</td>
<td>1st/2nd Source Select (N.O.)</td>
</tr>
<tr>
<td>*20</td>
<td>1st/2nd Source Select (N.C.)</td>
</tr>
<tr>
<td>99</td>
<td>Input Disable</td>
</tr>
</tbody>
</table>

* Parameter setting available only with firmware v1.04 or higher (refer to P9.39)

** Use either setting 00 or 01, but not both. Use interposing relays if more contacts are needed.

*** Accel / Decel times must be more than one second in order for Increase (14) and Decrease (15) Speed settings to work efficiently.
Setting Explanations for Parameters P3.02 through P3.10

Settings 00 and 01: External Fault (N.O. & N.C.)

When an External Fault input signal is received, the AC drive output will turn off, the drive will display the words “External Fault” on the LED Display, and the motor will Coast to Stop. To resume normal operation, the external fault must be cleared, and the drive must be reset. (The drive can be reset from the STOP/RESET key on the keypad, or from a contact wired to a digital input set for function 02, External Reset.)

- Use either setting 00 or 01, but not both. Use interposing relays if more contacts are needed.

Setting 00
External Fault (N.O.)
P3.02-P3.10

External Fault (N.O.): Drive receives external fault signal when N.O. contact closes

00: External Fault (N.O.)
DI3-11
DCM

Setting 01
External Fault (N.C.)
P3.02-P3.10

External Fault (N.C.): Drive receives external fault signal when N.C. contact opens

01: External Fault (N.C.)
DI3-11
DCM

Setting 02: External Reset

An External Reset has the same function as the STOP/RESET key on the digital keypad. Use an External Reset to reset the drive after a fault.
Chapter 4: AC Drive Parameters

Settings 03, 04, and 05: PID Setpoint Bits 1, 2, 3
Settings 03, 04, 05 and 06: Multi-Speed Bits 1, 2, 3 and 4

The four Multi-Speed Bits are used to select the multi-speed settings defined by parameters P5.01 to P5.15. The first three of these bits can also be used to select a PID setpoint, if PID is enabled (P7.00 ≠ 0.)

<table>
<thead>
<tr>
<th>Multi-Speed / PID SP</th>
<th>Speed Selection</th>
<th>PID SP Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 4    Bit 3    Bit 2    Bit 1</td>
<td>P4.00</td>
<td>P7.02</td>
</tr>
<tr>
<td>OFF      OFF      OFF      OFF</td>
<td>ON P5.01: Spd 1</td>
<td>P7.11: SP 1</td>
</tr>
<tr>
<td>OFF      OFF      OFF      ON</td>
<td>ON P5.02: Spd 2</td>
<td>P7.12: SP 2</td>
</tr>
<tr>
<td>OFF      OFF      ON       OFF</td>
<td>ON P5.03: Spd 3</td>
<td>P7.13: SP 3</td>
</tr>
<tr>
<td>OFF      ON       OFF      OFF</td>
<td>ON P5.04: Spd 4</td>
<td>P7.14: SP 4</td>
</tr>
<tr>
<td>OFF      ON       ON       ON</td>
<td>ON P5.05: Spd 5</td>
<td>P7.15: SP 5</td>
</tr>
<tr>
<td>OFF      ON       ON       OFF</td>
<td>ON P5.06: Spd 6</td>
<td>P7.16: SP 6</td>
</tr>
<tr>
<td>OFF      ON       ON       ON</td>
<td>ON P5.07: Spd 7</td>
<td>P7.17: SP 7</td>
</tr>
<tr>
<td>ON       OFF      OFF      OFF</td>
<td>ON P5.08: Spd 8</td>
<td>-</td>
</tr>
<tr>
<td>ON       OFF      OFF      ON</td>
<td>ON P5.09: Spd 9</td>
<td>-</td>
</tr>
<tr>
<td>ON       OFF      ON       OFF</td>
<td>ON P5.10: Spd 10</td>
<td>-</td>
</tr>
<tr>
<td>ON       OFF      ON       ON</td>
<td>ON P5.11: Spd 11</td>
<td>-</td>
</tr>
<tr>
<td>ON       ON       OFF      OFF</td>
<td>ON P5.12: Spd 12</td>
<td>-</td>
</tr>
<tr>
<td>ON       ON       OFF      ON</td>
<td>ON P5.13: Spd 13</td>
<td>-</td>
</tr>
<tr>
<td>ON       ON       ON       OFF</td>
<td>ON P5.14: Spd 14</td>
<td>-</td>
</tr>
<tr>
<td>ON       ON       ON       ON</td>
<td>ON P5.15: Spd 15</td>
<td>-</td>
</tr>
</tbody>
</table>

In order to use the Multi-Speed settings, P5.01 - P5.15 must be set.
In order to use the Multi-PID SPs, P7.11 - P7.17 must be set, and P7.00 ≠ 0.

When all Multi-Speed inputs are off, the AC drive reverts back to the Command Frequency (P4.00). When all PID Multi-Setpoint inputs are off, the AC drive reverts back to the PID Setpoint Source (P7.02).

Setting 07
This setting is used to temporarily switch to the keypad RUN and STOP buttons as the source of the operation command for run and stop functions. It does NOT change the source of the frequency command for the speed reference. Useful for troubleshooting.

Setting 09: Jog Command
This setting configures a Multi-function Input Terminal to run the motor at a preset speed only while the Jog Input is activated. Set the Jog Speed in P5.00. The Jog function can be used in combination with a FWD/REV signal (P3.01 = 01 or 02) to Jog in forward or reverse directions.

The drive must be stopped to initiate this command. The Jog Command cannot be used simultaneously with an active FWD/STOP, REV/STOP, or RUN/STOP command.
Settings 10 and 11: External Base Block (N.O.) and External Base Block (N.C.)

Value 10 is for a normally open (N.O.) input, and value 11 is for a normally closed (N.C.) input.

When an External Base Block is activated, the LCD display reads “EXT.BASE-BLOCK,” the AC drive stops all output, and the motor will free run. When the External Base Block is deactivated, the AC drive will start the speed search function and synchronize with the motor speed. The AC drive will then accelerate to the Master Frequency.

Setting 12: Second Accel/Decel Time

Multi-function Input Terminals DI3~DI11 can be set to select between Accel/Decel times 1 and 2. Parameters P1.01 and P1.02 set Accel 1 and Decel 1 times. Parameters P1.05 and P1.06 set Accel 2 and Decel 2 times.
Setting 13: Speed Hold

When the Speed Hold command is received, the drive acceleration or deceleration is stopped and the drive maintains a constant speed.

Settings 14 and 15: Increase and Decrease Speed

(Electronic Motor Operated Potentiometer)

Settings 14 and 15 allow the Multi-function terminals to be used to increase or decrease speed. As long as the DI terminal is activated, the speed reference will continuously increase or decrease using the acceleration and deceleration ramp settings.

- Increase Speed rate of change = P0.04(Hz) / P1.01(s)
- Decrease Speed rate of change = P0.04(Hz) / P1.02(s)

Example:
For P0.04 = 60Hz; P1.01 = P1.02 = 10s; rate of change = 60Hz/10s = 6Hz/s

- In order to use these settings, P4.00 must be set to 01.
- Accel / Decel times must be more than one second to work efficiently.
Setting 16: Reset Speed to Zero
This setting allows a Multi-function input terminal to reset the drive output frequency to zero.

Settings 17 and 18: PID Disable (N.O.) and (N.C.)
Settings 17 and 18 set the Multi-function terminals to disable PID operation.

Settings 19* and 20*: 1st/2nd Source Select (N.O.) and (N.C.)
The AC drive runs from the (1st) Source of Operation Command (P3.00) and the (1st) Source of Frequency Command (P4.00) if the 1st/2nd Source Select signal is inactive.
The AC drive runs from the 2nd Source of Operation Command (P3.31) and the 2nd Source of Frequency Command (P4.13) if the 1st/2nd Source Select signal is active.

- Among other uses, these two settings allow the drive operation to be switched back and forth between local and remote control.

* Parameter settings 19 and 20 are available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.

Setting 19
1st/2nd Source Select (N.O.)
P3.02-P3.10

1st/2nd Source Select (N.O.):
Drive selects the 2nd command source when N.O. contact closes

Setting 20
1st/2nd Source Select (N.C.)
P3.02-P3.10

1st/2nd Source Select (N.C.):
Drive selects the 2nd command source when N.C. contact opens

Setting 99: Multi-Function Input Disable
Setting a Multi-Function Input to 99 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 99 to make sure they have no effect on drive operation.

Any unused terminals should be programmed to 99 to make sure they have no effect on drive operation.
Chapter 4: AC Drive Parameters

**P3.11** Multi-Function Output Terminal 1 (Relay Output) Default Setting: 00

**P3.12** Multi-Function Output Terminal 2 (DO1) Default Setting: 01

**P3.13** Multi-Function Output Terminal 3 (DO2) Default Setting: 02

**P3.14** Multi-Function Output Terminal 4 (DO3) Default Setting: 03

Settings for P3.11 - P3.14:

- 00 AC Drive Running
- 01 AC Drive Fault
- 02 At Speed
- 03 Zero Speed
- 04 Above Desired Frequency (P3.16)
- 05 Below Desired Frequency (P3.16)
- 06 At Maximum Speed (P0.02)
- 07 Over Torque Detected
- 08 Above Desired Current (P3.17)
- 09 Below Desired Current (P3.17)
- 10 PID Deviation Alarm (P3.18 and P3.19)
- 11 Heatsink Overheat Warning (OH)
- 12 Soft Braking Signal
- 13 Above Desired Frequency 2 (P3.20)
- 14 Below Desired Frequency 2 (P3.20)
- 15 Encoder Loss
- 16 PID Feedback Loss Warning

* - Parameter setting available only with firmware v1.04 or higher (refer to P9.39)
Setting Explanations for Parameters P3.11 through P3.14

Setting 00: AC Drive Running — The terminal will be activated when there is an output from the drive.

Setting 01: AC Drive Fault — The terminal will be activated when one of the faults listed under parameters P6.31 through P6.36 occurs.

Setting 02: At Speed — The terminal will be activated when the AC drive attains the Command Frequency (P4.00).

Setting 03: Zero Speed — The output will be activated when Command Frequency (P4.00) is lower than the Minimum Output Frequency (P2.06).

Setting 04: Above Desired Frequency — The output will be activated when the AC drive is above the Desired Frequency (P3.16).

Setting 05: Below Desired Frequency — The output will be activated when the AC drive is below the Desired Frequency (P3.16).

Setting 06: At Maximum Speed — The output will be activated when the AC drive reaches Motor Maximum RPM (P0.04).

Setting 07: Over Torque Detected — The output will be activated when the AC drive reaches the Over-torque Detection Level (P6.08) and exceeds this level for a time greater than the Over-torque Detection Time (P6.09).

Setting 08: Above Desired Current — The output will be activated when the AC drive is above the Desired Current (P3.17).

Setting 09: Below Desired Current — The output will be activated when the AC drive is below the Desired Current (P3.17).

Setting 10: PID Deviation Alarm — The output will be activated when the AC drive exceeds the PID Deviation Level (P3.18) for longer than the PID Deviation Time (P3.19).

Setting 11: Heatsink Overheat Warning (OH) — The output will be activated when the heatsink overheats. The function will be activated as follows:
   Temperature range: 1 ~ 15HP, >90°C (194°F) ON; <90°C (194°F) OFF
   Above 15HP: >80°C (176°F) ON; <80°C (176°F) OFF

Setting 12: Soft Braking Signal — If DC Bus voltage is greater than the braking voltage level set in parameter P6.18 (Braking Voltage level), then any output configured for function 12 will change state.

Setting 13: Above Desired Frequency 2 — The output will be activated when the AC drive is above the Desired Frequency (P3.20).

Setting 14: Below Desired Frequency — The output will be activated when the AC drive is below the Desired Frequency (P3.20).

Setting 15: Encoder Loss — The output will be activated when the AC drive experiences loss of the encoder signal.

Setting *16: PID Feedback Loss Warning — The output will be activated when the AC drive experiences loss of a 4 to 20 mA PID Feedback signal.

* - Parameter setting available only with firmware v1.04 or higher (refer to P9.39)
### P3.16 Desired Frequency

**Default Setting:** 0.0

**Range:** 0.0 to 400.0 Hz

- If a multi-function output terminal is set to function as Desired Frequency Attained (P3.11 or P3.12 = 04 or 05), then the output will be activated when the programmed frequency is attained.

![Desired Frequency Diagram](image-url)

### P3.17 Desired Current

**Default Setting:** 0.0

**Range:** 0.0 to <Drive Rated Amps>

### P3.18 PID Deviation Level

**Default Setting:** 10.0

**Range:** 1.0 to 50.0%

- If a multi-function output terminal is set to PID Deviation Alarm (RO, DO1-DO3 setting = 10), then the output will be activated when the amount of deviation between the SP (set point) and PV (process variable) in the PID loop constantly exceeds the threshold set by this parameter for the period of time set by P3.19. This is defined in percentage of PV Value (see P7.01).

- This parameter is used in conjunction with P3.19, PID Deviation Time.

### P3.19 PID Deviation Time

**Default Setting:** 5.0

**Range:** 0.1 to 300.0 sec

- If a multi-function output terminal is set to PID Deviation Alarm (RO, DO1-DO3 setting = 10), then the output will be activated when the amount of deviation between the SP (set point) and PV (process variable) in the PID loop constantly exceeds the threshold set by P3.18 for the period of time set by this parameter.

- This parameter is used in conjunction with P3.18, PID Deviation Level.

### P3.20 Desired Frequency 2

**Default Setting:** 0.0

**Range:** 0.0 to 400.0 Hz
**P3.30 Frequency Output (FO) Scaling Factor**  
Default Setting: 1

Range: 1 to 20

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 is equal to the AC drive output frequency multiplied by P3.30. (Pulse per second = actual output frequency x P3.30).

**Example 1:** When drive frequency is 60.0 Hz and P3.30 = 10;  
60.0 Hz x 10 = 600.0 Hz;  
Frequency of FO's outputted square wave is 600.0 Hz

**Example 2:** When drive output frequency = 400.0 Hz and P3.30 = 20  
400.0Hz x 20 = 8kHz;  
FO's output frequency is 8kHz.

FO is an open collector circuit. Square wave is generated, for example, by sending +24V through a 4.7 kΩ resistor as shown in the diagram below.

![Diagram of FO-DCM circuit]

**P3.31 2nd Source of Operation Command**  
Default Setting: 00

Settings:

- 00 Operation Determined by Digital Keypad
- 01 Operation determined by external control terminals. Keypad STOP is enabled.
- 02 Operation determined by external control terminals. Keypad STOP is disabled.
- 03 Operation determined by RS-485 communication interface. Keypad STOP is enabled.
- 04 Operation determined by RS-485 communication interface. Keypad STOP is disabled.

This parameter sets the second input source for the AC drive operation command.

- Select the 1st or 2nd sources with a Digital Input and the appropriate parameter settings for P3.02 through P3.10.
- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.
Chapter 4: AC Drive Parameters

Analog Parameters

**P4.00**  
**Source of Frequency Command**  
Default Setting: 01

<table>
<thead>
<tr>
<th>Settings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Frequency determined by digital keypad up/down.</td>
</tr>
<tr>
<td>02*</td>
<td>Frequency determined by 0 to +10V input (including remote potentiometer) on AI1 terminal.</td>
</tr>
<tr>
<td>03</td>
<td>Frequency determined by 4 to 20 mA input on AI2 terminal.</td>
</tr>
<tr>
<td>04</td>
<td>Frequency determined by 0 to 20 mA input on AI2 terminal.</td>
</tr>
<tr>
<td>05</td>
<td>Frequency determined by RS-485 communication interface.</td>
</tr>
<tr>
<td>06</td>
<td>Frequency determined by -10V to +10V input on AI3 terminal.</td>
</tr>
</tbody>
</table>

This parameter sets the input source for the AC drive frequency command.

* In order to set P4.00 = 02, you must first change the value of P4.13 to some value other than two (02) in order to avoid the “Error: Duplicate Function” error message. (P4.13 default value is 02)

**P4.01**  
**Analog Input Offset Polarity**  
Default Setting: 00

<table>
<thead>
<tr>
<th>Settings</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Offset disabled</td>
</tr>
<tr>
<td>01</td>
<td>Positive Offset</td>
</tr>
<tr>
<td>02</td>
<td>Negative Offset</td>
</tr>
</tbody>
</table>

This parameter sets the analog input bias frequency to be positive or negative.

- The Analog Input Offset calculation will also define the Analog Input Offset Polarity. Refer to the note following P4.02.
- P4.01 to P4.04 are used when the source of frequency command is an analog input signal (0 to +10V, -10 to +10V, 0 to 20 mA, or 4 to 20 mA).

**P4.02**  
**Analog Input Offset**  
Default Setting: 0.0

Range: 0.0 to 100%

This parameter provides a frequency offset for an analog input.

- Use the equation below to determine the Analog Input Offset. For this equation, you will need to know the necessary Minimum Frequency References and Maximum Output Frequency needed for your application.

\[
\text{Analog Offset } \% = \left( \frac{\text{Min. Frequency Reference}}{\text{Maximum Output Frequency}} \right) \times 100
\]

The result of the Analog Input Offset calculation will also define the Analog Input Offset Polarity (P4.01). A positive answer means you should have a positive offset. A negative answer means you should have a negative offset.

- P4.01 to P4.04 are used when the source of frequency command is an analog input signal (0 to +10V, -10 to +10V, 0 to 20 mA, or 4 to 20 mA).
**P4.03  Analog Input Gain**

<table>
<thead>
<tr>
<th>Default Setting: 100.0</th>
</tr>
</thead>
</table>

Range: 0.0 to 300.0%

This parameter sets the ratio of analog input vs frequency output.

- Use the equation below to calculate the Analog Input Gain. For this equation, you will need to know the minimum and maximum set-point frequencies needed for your application.

\[
\text{Analog Gain \%} = \left( \frac{\text{Max. Frequency Reference} - \text{Min. Frequency Reference}}{\text{Maximum Output Frequency}} \right) \times 100
\]

- P4.01 to P4.04 are used when the source of frequency command is an analog input signal (0 to +10V, -10 to +10V, 0 to 20 mA, or 4 to 20 mA).

**P4.04  Analog Input Reverse Motion Enable**

<table>
<thead>
<tr>
<th>Default Setting: 00</th>
</tr>
</thead>
</table>

Range: 00 Forward Motion Only  
01 Reverse Motion Enable

- P4.01 to P4.04 are used when the source of frequency command is an analog input signal (0 to +10V, -10 to +10V, 0 to 20 mA, or 4 to 20 mA).

**P4.05  Loss of AI2 Signal (4-20mA)**

<table>
<thead>
<tr>
<th>Default Setting: 00</th>
</tr>
</thead>
</table>

Range: 00 - Decelerate to 0Hz  
01 - Stop immediately and display “EF”.  
02 - Continue operation by the last frequency command

This parameter determines the operation of the drive when the ACI frequency command is lost.

**P4.11  Analog Output Signal**

<table>
<thead>
<tr>
<th>Default Setting: 00</th>
</tr>
</thead>
</table>

Range: 00 - Frequency Hz  
01 - Current A  
02 - PV

This parameter configures the 0-10V AO output to indicate either output Frequency, output Current, or the PID Process Variable.
Chapter 4: AC Drive Parameters

**P4.12**  Analog Output Gain  Default Setting: 100

Range: 00 to 200%

This parameter sets the voltage range of the analog output signal on output terminal AO.

- When P4.11 is set to 00, the analog output voltage is directly proportional to the output frequency of the AC drive. With the factory setting of 100%, the Maximum Output Frequency of the AC drive corresponds to +10VDC analog voltage output. (The actual voltage is about +10VDC, and can be adjusted by P4.12)

- When P4.11 is set to 01, the analog output voltage is directly proportional to the output current of the AC drive. With the factory setting of 100%, the 2.5 times rated current of the AC drive corresponds to +10 VDC analog voltage output. (The actual voltage is about +10 VDC, and can be adjusted by P4.12).

Note: Any type of voltmeter can be used. If the meter reads full scale at a voltage less than 10 volts, then P4.12 should be set by the following formula:

\[ P4.12 = \left( \frac{\text{meter full scale voltage}}{10} \right) \times 100\% \]

For Example: When using the meter with full scale of 5 Volts, adjust P4.12 to 50%.

**P4.13**  2nd Source of Frequency Command  Default Setting: 06

Settings:

- 01* Frequency determined by digital keypad up/down.
- 02 Frequency determined by 0 to +10V input on AI1 terminal.
- 03 Frequency determined by 4 to 20 mA input on AI2 terminal.
- 04 Frequency determined by 0 to 20 mA input on AI2 terminal.
- 05 Frequency determined by RS-485 communication interface.
- 06 Frequency determined by -10V ~ +10V input on AI3 terminal.

This parameter sets the second input source for the AC drive frequency command.

- Select the 1st or 2nd sources with a Digital Input and the appropriate parameter settings for P3.02 through P3.10.

- This parameter is available only with AC drive firmware v1.04 or higher. Default setting = 02 for firmware v1.04. Default setting = 06 for firmware v1.05 and higher. Refer to P9.39 to determine the drive's firmware version.

* In order to set P4.13 = 01, you must first change the value of P4.00 to some value other than one (01) in order to avoid the “Error: Duplicate Function” error message. (P4.00 default value is 01)
**P4.14  2nd Analog Input Offset Polarity**  
Default Setting: 00

Settings:

00  Offset disabled  
01  Positive Offset  
02  Negative Offset

This parameter sets the analog input 2nd bias frequency to be positive or negative.

- Select the 1st or 2nd sources with a Digital Input and the appropriate parameter settings for P3.02 through P3.10.
- The 2nd Analog Input Offset calculation will also define the 2nd Analog Input Offset Polarity. Refer to the note following P4.15.
- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive’s firmware version.

**P4.15  2nd Analog Input Offset**  
Default Setting: 0.0

Range: 0.0 to 100%

This parameter provides a frequency offset for a second analog input.

- Select the 1st or 2nd sources with a Digital Input and the appropriate parameter settings for P3.02 through P3.10.
- Use the equation below to determine the Analog Input Offset. For this equation, you will need to know the necessary Minimum Frequency References and Maximum Output Frequency needed for your application.

\[
\text{Analog Offset } \% = \left( \frac{\text{Min. Frequency Reference}}{\text{Maximum Output Frequency}} \right) \times 100
\]

The result of the 2nd Analog Input Offset calculation will also define the Analog 2nd Input Offset Polarity (P4.14). A positive answer means you should have a positive offset. A negative answer means you should have a negative offset.

- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive’s firmware version.
Chapter 4: AC Drive Parameters

P4.16  2nd Analog Input Gain

Default Setting: 100.0

Range: 0.0 to 300.0%

This parameter sets the ratio of the second analog input vs frequency output.

- Select the 1st or 2nd sources with a Digital Input and the appropriate parameter settings for P3.02 through P3.10.

- Use the equation below to calculate the Analog Input Gain. For this equation, you will need to know the minimum and maximum set-point frequencies needed for your application.

\[
\text{Analog Gain} \% = \left( \frac{\text{Max. Frequency Reference} - \text{Min. Frequency Reference}}{\text{Maximum Output Frequency}} \right) \times 100
\]

- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.

P4.17  Trim Reference Frequency

Default Setting: 00

Range: 0.0 to 400.0 Hz

This parameter determines a set frequency to add to or subtract from the selected Frequency Command (P4.00 or P4.13) to produce a modified actual frequency command. The setting of P4.18 determines whether P4.17 adds to or subtracts from the Frequency Command.

- This parameter is active only if P4.18 is set to 03 or 04.

- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.

<table>
<thead>
<tr>
<th>Source of Frequency Command</th>
<th>Trim Mode Select P4.18 Setting</th>
<th>Actual Frequency Command</th>
</tr>
</thead>
<tbody>
<tr>
<td>P4.00</td>
<td>03</td>
<td>P4.00 + P4.17</td>
</tr>
<tr>
<td></td>
<td>04</td>
<td>P4.00 - P4.17</td>
</tr>
<tr>
<td>P4.13</td>
<td>03</td>
<td>P4.13 + P4.17</td>
</tr>
<tr>
<td></td>
<td>04</td>
<td>P4.13 - P4.17</td>
</tr>
</tbody>
</table>
P4.18  ◆ Trim Mode Select  

Default Setting: 00

Settings:

00  Disable Trim Function
01  1st Frequency Command (P4.00) + 2nd Frequency Command (P4.13)
02  1st Frequency Command (P4.00) - 2nd Frequency Command (P4.13)
03  Frequency Command (P4.00 or P4.13) + Trim Ref Frequency (P4.17)
04  Frequency Command (P4.00 or P4.13) - Trim Ref Frequency (P4.17)

This parameter determines how the Frequency Command is modified by the Trim Frequency to produce the modified actual frequency command.

- For parameter settings 03 and 04, the Trim Frequency modifies whichever primary Frequency Command is selected as active by the digital input controlled by P3.02–P3.10 settings 19 or 20.
- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive’s firmware version.

P4.18 - Settings 01 & 02

P4.18 - Settings 03 & 04

NOTE: P4.00 & P4.13 values shown also include any effects of P4.01–P4.04 and P4.14–P4.16. These seven additional parameters affect frequency commands only from the analog inputs. They do not affect keypad or RS-485 frequency commands.
Chapter 4: AC Drive Parameters

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 Maximum Output Frequency, Analog Input Offset, Analog Input Gain, and the Mid-point Frequency.

A) **Maximum Output Frequency** = 
\[
\text{(P0.04 Maximum Speed / P0.03 Base Speed) x P0.02 Base Frequency}
\]

The Maximum Output Frequency is not a parameter setting, but is needed in order to calculate the Analog Gain. The default Maximum Output Frequency for the DURAPULSE drive is 60Hz. If parameters P0.02, P0.03, or P0.04 are changed, then the Maximum Output Frequency will change.

B) **Analog Offset %** = 
\[
\text{(Minimum Frequency Reference / Maximum Output Frequency) x 100}
\]

C) **Analog Gain %** = 
\[
\text{((Max Freq Reference - Min Freq Reference) / Max Output Frequency) x 100}
\]

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

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.
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

Calculations

A) Max Output Frequency = (1750 rpm / 1750 rpm) x 60 Hz = 60 Hz

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

C) Analog Gain % = ((60 Hz - 0Hz) / 60 Hz) x 100 = 100%

D) Mid-point Frequency = ((60 Hz – 0Hz) / 2) + 0Hz = 30 Hz

Parameter Settings

P4.01: 00 (default) – Offset disabled
P4.02: 00 (default) – 0% Analog Input Offset
P4.03: 100 (default) – 100% Analog Input Gain
P4.04: 00 (default) – Forward Motion Only

Results

<table>
<thead>
<tr>
<th>Voltage (V)</th>
<th>Maximum Output Frequency (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0V</td>
<td>0Hz</td>
</tr>
<tr>
<td>-10V</td>
<td>0Hz</td>
</tr>
<tr>
<td>5V</td>
<td>30Hz</td>
</tr>
<tr>
<td>10V</td>
<td>60Hz</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current (mA)</th>
<th>Maximum Output Frequency (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0mA</td>
<td>0Hz</td>
</tr>
<tr>
<td>4mA</td>
<td>0Hz</td>
</tr>
<tr>
<td>10mA</td>
<td>30Hz</td>
</tr>
<tr>
<td>20mA</td>
<td>60Hz</td>
</tr>
</tbody>
</table>
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, Motor Maximum RPM. (Motors produce reduced output torque when running above their base speed.)

WARNING: The Motor Maximum RPM 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 P4.01 through P4.04 can remain defaulted, as determined by the analog input calculations shown below. The increased Maximum Output Frequency can be obtained regardless of whether the Source of Frequency Command 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 = 70 Hz
- Motor Maximum RPM = 2042 rpm

Calculations

A) Max Output Frequency = (2042 rpm / 1750 rpm) x 60 Hz = 70 Hz
B) Analog Offset % = (0Hz / 70 Hz) x 100 = 0%
C) Analog Gain % = ((70 Hz - 0Hz) / 70 Hz) x 100 = 100%
D) Mid-point Frequency = ((70 Hz - 0Hz) / 2) + 0Hz = 35 Hz

Parameter Settings

P0.04: 2042 – Motor Maximum RPM
P4.01: 00 (default) – Offset disabled
P4.02: 00 (default) – 0% Analog Input Offset
P4.03: 100 (default) – 100% Analog Input Gain
P4.04: 00 (default) – Forward Motion Only

Results

Max. Output Frequency 70Hz
Motor Base Frequency 60Hz
Mid-Point Frequency 35Hz

WARNING: The Motor Maximum RPM 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.
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 (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 60 Hz.

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

Calculations

A) **Max Output Frequency** = (1750 rpm / 1750 rpm) x 60 Hz = 60 Hz

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

C) **Analog Gain %** = ((60 Hz - 10 Hz) / 60 Hz) x 100 = 83.3%

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

Parameter Settings

- P4.01: 01 – Positive Input Offset Polarity
- P4.02: 16.7 – 16.7% Analog Input Offset
- P4.03: 83.3 – 83.3% Analog Input Gain
- P4.04: 00 (default) – Forward Motion Only

Results

<table>
<thead>
<tr>
<th>Analog Signal</th>
<th>Maximum Output Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0V</td>
<td>60 Hz</td>
</tr>
<tr>
<td>5V</td>
<td>35 Hz</td>
</tr>
<tr>
<td>10V</td>
<td>10 Hz</td>
</tr>
<tr>
<td>-10V</td>
<td>0Hz</td>
</tr>
<tr>
<td>0mA</td>
<td>10mA</td>
</tr>
<tr>
<td>10mA</td>
<td>20mA</td>
</tr>
<tr>
<td>4mA</td>
<td>12mA</td>
</tr>
<tr>
<td>10mA</td>
<td>20mA</td>
</tr>
</tbody>
</table>
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 0 Hz when the potentiometer is positioned at mid-point of its scale. Parameter P4.04 must be set to enable reverse motion.

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

Calculations

A) Max Output Frequency = (1750 rpm / 1750 rpm) x 60 Hz = 60 Hz
B) Analog Offset % = (-60 Hz / 60 Hz) x 100 = -100%
C) Analog Gain % = ((60 Hz – (-60 Hz)) / 60 Hz) x 100 = 200%
D) Mid-point Frequency = ((60 Hz – (-60 Hz)) / 2) + (-60 Hz) = 0 Hz

Parameter Settings

P4.01: 02 – Negative Input Offset Polarity
P4.02: 100 – 100% Analog Input Offset
P4.03: 200 – 200% Analog Input Gain
P4.04: 01 – Reverse Motion Enable

Results

The negative (-) value for the Analog Offset % shows that a negative offset is needed for P4.01.

- Maximum Output Frequency
- Forward
- Reverse

DURAPULSE AC Drive User Manual
1st Ed. Rev. D 05/2013
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 = -15 Hz (reverse)
- Maximum Frequency Reference = 60 Hz

Calculations

A) Max Output Frequency = $(1750 \text{ rpm} / 1750 \text{ rpm}) \times 60 \text{ Hz} = 60 \text{ Hz}$

B) Analog Offset % = $(-15 \text{ Hz} / 60 \text{ Hz}) \times 100 = -25\%$

C) Analog Gain % = $((60 \text{ Hz} - 15 \text{ Hz}) / 60 \text{ Hz}) \times 100 = 125\%$

D) Mid-point Frequency = $((60 \text{ Hz} - (-15 \text{ Hz})) / 2) + (-15 \text{ Hz}) = 22.5 \text{ Hz}$

Parameter Settings

- P4.01: 02 – Negative Input Offset Polarity
- P4.02: 25 – 25% Analog Input Offset
- P4.03: 125 – 125% Analog Input Gain
- P4.04: 01 – Reverse Motion Enable

Results

![Graph showing Maximum Output Frequency](image)
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 Frequency Command. The Maximum Output Frequency 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

Calculations

A) Max Output Frequency = (1750 rpm / 1750 rpm) x 60 Hz = 60 Hz
B) Analog Offset % = (0Hz / 50 Hz) x 100 = 0%
C) Analog Gain % = ((50 Hz - 0Hz) / 60 Hz) x 100 = 83.3%
D) Mid-point Frequency = ((50 Hz - 0Hz) / 2) + 0Hz = 25 Hz

Parameter Settings

P4.01: 00 (default) - Offset disabled
P4.02: 00 (default) - 0% Analog Input Offset
P4.03: 71.4 – 71.4% Analog Input Gain
P4.04: 00 (default) - Forward Motion Only

Results

Max. Output Frequency 60Hz
Max. Frequency Reference 50Hz
25Hz
0Hz

0V 5V 10V
-10V 0V 10V
0mA 10mA 20mA
4mA 12mA 20mA
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 11.5 Hz. When the analog signal is at its maximum value, the set-point frequency will be 39.6 Hz.

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

Calculations

A) **Max Output Frequency** = (1750 rpm / 1750 rpm) x 60 Hz = 60 Hz
B) **Analog Offset %** = (11.5 Hz / 60 Hz) x 100 = 19.2%
C) **Analog Gain %** = (39.6 - 11.5) / 60) x 100 = 46.8%
D) **Mid-point Frequency** = ((39.6 - 11.5) / 2) + 11.5 = 25.6 Hz

Parameter Settings

P4.01: 01 - Positive Analog Input Offset Polarity
P4.02: 19.2 - 19.2% Analog Input Offset
P4.03: 46.8 - 46.8% Analog Input Gain
P4.04: 00 (default ) - Forward Motion Only

Results
**Example 8: Trim Mode**

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

- Minimum Frequency Reference = 0 Hz
- Maximum Frequency Reference = 45 Hz
- Output Frequency = Frequency Command - Trim Reference Frequency

**Calculations**

A) **Max Output Frequency** = (1750 rpm / 1750 rpm) x 60 Hz = 60 Hz

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

C) **Analog Gain %** = ((60 Hz - 0 Hz) / 60 Hz) x 100 = 100%

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

- **Actual Output Frequency** \(P_{4.18}=04\) = Freq Command - Trim Ref Freq

**Parameter Settings**

P4.01: 00 (default) - Offset disabled
P4.02: 00 (default) - 0% Analog Input Offset
P4.03: 100 (default) - 100% Analog Input Gain
P4.04: 00 (default) - Forward Motion Only
P4.17: 15 - Trim Reference Frequency = 15 Hz
P4.18: 04 - Output Frequency = Frequency Command - Trim Reference Frequency

**Results**

The drive will not reverse direction unless the Frequency Command is from an analog input, and reverse motion is enabled in P4.04.
Presets Parameters

**Jog Speed**

**P5.00**

Default Setting: 6.0

Range: 0.0 to 400.0 Hz

This parameter sets the speed for the Jog Command.

- The Jog Command is selected by a Multi-Function Input Terminal (P3.02 to P3.10) set to the Jog Command function (09).
- Acceleration and deceleration times apply to the Jog Speed

The Jog function can be used in conjunction with the direction signal (FWD/REV; P3.01 = 01 or 02) to Jog in forward and reverse directions.

The drive must be stopped to initiate this command. The Jog command cannot be used simultaneously with an active FWD/STOP, REV/STOP, or RUN/STOP command.
Chapter 4: AC Drive Parameters

**P5.01**  ◆ Multi-Speed 1  Default Setting: 0.0

**P5.02**  ◆ Multi-Speed 2  Default Setting: 0.0

**P5.03**  ◆ Multi-Speed 3  Default Setting: 0.0

**P5.04**  ◆ Multi-Speed 4  Default Setting: 0.0

**P5.05**  ◆ Multi-Speed 5  Default Setting: 0.0

**P5.06**  ◆ Multi-Speed 6  Default Setting: 0.0

**P5.07**  ◆ Multi-Speed 7  Default Setting: 0.0

**P5.08**  ◆ Multi-Speed 8  Default Setting: 0.0

**P5.09**  ◆ Multi-Speed 9  Default Setting: 0.0

**P5.10**  ◆ Multi-Speed 10  Default Setting: 0.0

**P5.11**  ◆ Multi-Speed 11  Default Setting: 0.0

**P5.12**  ◆ Multi-Speed 12  Default Setting: 0.0

**P5.13**  ◆ Multi-Speed 13  Default Setting: 0.0

**P5.14**  ◆ Multi-Speed 14  Default Setting: 0.0

**P5.15**  ◆ Multi-Speed 15  Default Setting: 0.0

Range for P5.01–P5.15: 0.0 to 400.0 Hz

The Multi-Function Input Terminals (refer to P3.02 to P3.10) are used to select one of the AC drive preset Multi-speeds. The speeds (frequencies) are determined by the settings of P5.01 to P5.15.

When all multi-speed inputs are off, the AC drive reverts back to the Command Frequency (P4.00).

<table>
<thead>
<tr>
<th>Multi-Speed Bits</th>
<th>Speed Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 4</td>
<td>Bit 3</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
</tr>
<tr>
<td>OFF</td>
<td>OFF</td>
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<tr>
<td>OFF</td>
<td>ON</td>
</tr>
<tr>
<td>OFF</td>
<td>ON</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Multi-Speed Bits</th>
<th>Speed Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit 4</td>
<td>Bit 3</td>
</tr>
<tr>
<td>ON</td>
<td>OFF</td>
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<tr>
<td>ON</td>
<td>OFF</td>
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<td>ON</td>
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<tr>
<td>ON</td>
<td>ON</td>
</tr>
</tbody>
</table>
Protection Parameters

**P6.00 Electronic Thermal Overload Relay**  
Default Setting: 00

**Settings:**

00  Constant Torque  (Recommended for inverter/vector duty motors)

Use this setting when using the drives 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.

01  Variable Torque  (Recommended for fan-cooled standard motors)

Use this setting when using the drives 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:

\[ I_{\text{output}}(\%) = \left[ f_{\text{output}}(\text{Hz}) \times 1.2 \, \%/\text{Hz} \right] + 40\% \]

**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.

\[ I_{\text{output}}(\%) = \left[ (25\,\text{Hz}) \times 1.2 \, \%/\text{Hz} \right] + 40\% = 70\% \]

02  Inactive

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).
Chapter 4: AC Drive Parameters

**P6.01 Auto Restart after Fault**

Default Setting: 00

Range: 00 to 10

After fault occurs (allowable faults: over-current OC, over-voltage OV), the AC drive can be reset/restarted automatically up to 10 times. Setting this parameter to 0 will disable the reset/restart operation after any fault has occurred. When enabled, the AC drive will restart with speed search, which starts at the previous Frequency. To set the fault recovery time after a fault, please see (P6.13) base-block time for speed search.

**P6.02 Momentary Power Loss**

Default Setting: 00

Settings:

- **00**: Stop operation after momentary power loss.
- **01**: Continue operation after momentary power loss; speed search from Speed Reference.
- **02**: Continue operation after momentary power loss; speed search from Minimum Speed.

This parameter will only work if the Source of Operation (P3.00) is set to something other than 00 (Operation determined by digital keypad).

**P6.03 Reverse Operation Inhibit**

Default Setting: 00

Settings:

- **00**: Enable Reverse Operation
- **01**: Disable Reverse Operation

This parameter determines whether the AC Motor Drive can operate in the reverse direction.
**P6.04 Auto Voltage Regulation**  
Default Setting: 00

Settings:
- 00: AVR enabled
- 01: AVR disabled
- 02: AVR disabled during decel
- 03: AVR disabled during stop

- AVR function automatically regulates the AC drive output voltage to the Maximum Output Voltage (P0.00). For instance, if P0.00 is set at 200 VAC and the input voltage is at 200V to 264VAC, then the Maximum Output Voltage will automatically be regulated to 200 VAC.
- Without AVR function, the Maximum Output Voltage may vary between 180V to 264VAC, due to the input voltage varying between 180V to 264VAC.
- Selecting program value 2 enables the AVR function and also disables the AVR function during deceleration. This offers a quicker deceleration.

**P6.05 Over-Voltage Stall Prevention**  
Default Setting: 00

Range: 00 Enable Over-voltage Stall Prevention  
01 Disable Over-voltage Stall Prevention

During deceleration, the AC drive DC bus voltage may exceed its Maximum Allowable Value due to motor regeneration. When this function is enabled, the AC drive will stop decelerating, and maintain a constant output frequency. The drive will resume deceleration when the voltage drops below the factory-preset value.

With moderate inertial loads, over-voltage during deceleration will not occur. For applications with high inertia loads, the AC 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 01 (disable) when using a dynamic braking resistor.**
Chapter 4: AC Drive Parameters

**P6.06 Auto Adjustable Accel/Decel**

Default Setting: 00

Settings:

00  Linear Accel/Decel
01  Auto Accel, Linear Decel
02  Linear Accel, Auto Decel
03  Auto Accel/Decel
04  Auto Accel/Decel Stall Prevention

If the auto accel/decel is selected, the AC drive will accel/decel in the fastest and smoothest means possible by automatically adjusting the time of accel/decel.

This parameter provides five modes to choose:

- **00** Linear Acceleration and deceleration (operation by P1.01, P1.02 or P1.05, P1.06 acceleration/deceleration time).
- **01** Automatic acceleration, linear deceleration (Operation by automatic acceleration time, P1.02 or P1.06 deceleration time).
- **02** Linear acceleration and automatic deceleration (Operation by automatic acceleration time, P1.01 or P1.05 acceleration time).
- **03** Automatic acceleration, deceleration (Operation by AC drive auto adjustable control).
- **04** Auto acceleration, deceleration. The auto accel/decel will not be quicker than the settings for acceleration (P1.01 or P1.05) or deceleration (P1.02 or P1.06). The operation is specific to preventing a stall.

**P6.07 Over-Torque Detection Mode**

Default Setting: 00

Settings:

00  Disabled
01  Enabled during constant speed operation
02  Enabled during acceleration

**P6.08 Over-Torque Detection Level**

Default Setting: 150

Range: 30 to 200%

- A setting of 100% is proportional to the Rated Output Current of the drive.
- This parameter sets the Over-Torque Detection level in 1% increments. (The AC drive rated current is equal to 100%).

**P6.09 Over-Torque Detection Time**

Default Setting: 0.1

Range: 0.1 to 10.0

This parameter sets the Over-Torque Detection Time in units of 0.1 seconds.
**P6.10 Over-current Stall Prevention during Acceleration**

Default Setting: 150

Range: 20 to 200%

A setting of 100% is equal to the Rated Output Current of the drive.

Under certain conditions, the AC drive output current may increase abruptly, and exceed the value specified by P6.10. This is commonly caused by rapid acceleration or excessive load on the motor. When this function is enabled, the AC drive will stop accelerating and maintain a constant output frequency. The AC drive will only resume acceleration when the current drops below the maximum value.

**P6.11 Over-current Stall Prevention during Operation**

Default Setting: 150

Range: 20 to 200%

During steady-state operation with motor load rapidly increasing, the AC drive output current may exceed the limit specified in P6.11. When this occurs, the output frequency will decrease to maintain a constant motor speed. The drive will accelerate to the steady-state output frequency only when the output current drops below the level specified by P6.11.
Chapter 4: AC Drive Parameters

**P6.12 Maximum Allowable Power Loss Time**

Default Setting: 2.0

Range: 0.3 to 5.0 sec

During a power loss, if the power loss time is less than the time defined by this parameter, the AC drive will resume operation. If the Maximum Allowable Power Loss Time is exceeded, the AC drive output is turned off.

**P6.13 Base-Block Time for Speed Search**

Default Setting: 0.5

Range: 0.3 to 5.0 sec

- When a momentary power loss is detected, the AC drive turns off for a specified time interval determined by P6.13 before resuming operation. This time interval is called Base-Block. This parameter should be set to a value where the residual output voltage due to regeneration is nearly zero, before the drive resumes operation.
- This parameter also determines the searching time when performing external Base-Block and Fault Reset (P6.01).

**P6.14 Maximum Speed Search Current Level**

Default Setting: 150

Range: 30 to 200%

Following a power failure, the AC drive will start its speed search operation only if the output current is greater than the value determined by P6.14. When the output current is less than that of P6.14, the AC drive output frequency is at a "speed synchronization point". The drive will start to accelerate or decelerate back to the operating frequency at which it was running prior to the power failure.

---

Input Power

Output Frequency

Output Voltage

Speed Search starts with the previous Frequency

Baseblock Time

P 6.13

Max. Allowable Power Loss Time

P 6.12

Speed Search starts with Minimum Output Frequency

Baseblock Time

P 6.13

Max. Allowable Power Loss Time

P 6.12

speed synchronization detection

P 6.02 = 01

P 6.02 = 02

DURAPULSE AC Drive User Manual

1st Ed. Rev. D 05/2013
**P6.15 Upper Bound of Output Frequency**  
Default Setting: 400  
Range: 0.1 to 400 Hz  
- The Upper/Lower Bound of Output Frequency is to prevent operation error and machine damage.  
- This parameter must be equal to or greater than the Lower Bound of Output Frequency (P6.16).  
- If the Upper Bound of Output Frequency is 50 Hz and the Maximum Output Frequency is 60 Hz, then any Command Frequency above 50 Hz will generate a 50 Hz output from the drive.  
- The Output Frequency is also limited by the Motor Maximum RPM (P0.04).  

**P6.16 Lower Bound of Output Frequency**  
Default Setting: 0.0  
Range: 0.0 to 400 Hz  
- The Upper/Lower Bound of Output Frequency is to prevent operation error and machine damage.  
- This parameter must be equal to or less than the Upper Bound of Output Frequency (P6.15).  
- If the Lower Bound of Output Frequency is 10 Hz, and the Minimum Output Frequency (P2.06) is set at 1.0 Hz, then any Command Frequency between 1-10 Hz will generate a 10 Hz output from the drive.  
- The Upper/Lower Bound of Output Frequency is to prevent operation error and machine damage.

If the reference frequency is less than 0.5 Hz, then this parameter setting is disabled.
### Over-Voltage Stall Prevention Level

| Default: 230V series = 390.0V |
| Default: 460V series = 780.0V |

Range: 230V Series - 330.0V to 450.0V  
460V Series - 600.0V to 900.0V

When drive is running, if the DC bus voltage exceeds Over-Voltage Stall level (P6.17), the AC drive will start over-voltage stall prevention.

### Braking Voltage Level

| Default: 230V series = 380.0V |
| Default: 460V series = 760.0V |

Range: 230V Series - 370.0V to 450.0V  
460V Series - 740.0V to 900.0V

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.

### Line Start Lockout

Default Setting: 00

Settings:

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Enable Line Start Lockout</td>
</tr>
<tr>
<td>01</td>
<td>Disable Line Start Lockout</td>
</tr>
</tbody>
</table>

When this parameter is enabled, the AC 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.

When this parameter is disabled, the AC Drive will start the motor when powered up with a RUN command already applied.

- This parameter is available only with AC drive firmware v1.02 or higher.  
  Refer to P9.39 to determine the drive's firmware version.
### P6.31 Present Fault Record
Default Setting: 00

### P6.32 Second Most Recent Fault Record
Default Setting: 00

### P6.33 Third Most Recent Fault Record
Default Setting: 00

### P6.34 Fourth Most Recent Fault Record
Default Setting: 00

### P6.35 Fifth Most Recent Fault Record
Default Setting: 00

### P6.36 Sixth Most Recent Fault Record
Default Setting: 00

Settings for P6.31 - P6.36:

- **00**: No Fault occurred
- **01**: Over-current (oc)
- **02**: Over-voltage (ov)
- **03**: Over-temperature (oH)
- **04**: Overload (oL)
- **05**: Thermal Overload (oL1)
- **06**: Over-Torque (oL2)
- **07**: External Fault (EF)
- **08**: CPU failure 1 (CF1)
- **09**: CPU failure 2 (CF2)
- **10**: CPU failure 3 (CF3)
- **11**: Hardware Protection Failure (HPF)
- **12**: Over-current during accel (OCA)
- **13**: Over-current during decel (OCd)
- **14**: Over-current during steady state (OCn)
- **15**: Ground fault or fuse failure (GFF)
- **17**: Input Power 3 phase loss
- **19**: Auto Ramp Fault
- **20**: Parameters Locked
- **21**: PID Feedback Loss
- **22**: Encoder Feedback Loss
- **23**: Output Shorted(OCC)
- **24**: Momentary Power Loss

### P6.37 Hunting Gain
Default Setting: 0

Range: 0 to 1000

This parameter can help control frequency oscillation of motors (if needed). If system vibration is encountered due to drive frequency hunting, reduce the vibration by adjusting this parameter while monitoring drive/motor operation.

- This parameter is enabled only in the “high-speed regulation” control modes; (P2.10 = 04 or 05).
- This parameter is available only with AC drive firmware v1.05 or higher. Refer to P9.39 to determine the drive’s firmware version.


**PID Parameters**

**P7.00** Input Terminal for PID Feedback  
Default Setting: 00

- **00** Inhibit PID operation.
- **01** Forward-acting (heating loop) PID feedback, PV from AI1 (0 to +10V)
- **02** Forward-acting (heating loop) PID feedback, PV from AI2 (4 to 20 mA)
- **03** Reverse-acting (cooling loop) PID feedback, PV from AI1 (0 to +10V)
- **04** Reverse-acting (cooling loop) PID feedback, PV from AI2 (4 to 20 mA)

**Basic PID Loop Diagram:**

```
+-------------------+       +-------------------+       +-------------------+
|  Setpoint         |       |  Integral gain    |       |  Output Freq.     |
|                   |       | limit P 7.23      |       |  Limit P 7.25     |
|                   |       |                   |       |  Digital filter   |
|                   |       |                   |       |  Freq. Command    |
| Setpoint P 7.10-P7.17 → P 7.20 → I P 7.21 → D P 7.22 → + → PID Feedback Signal x PID Feedback Gain (P 7.03) |
|                                               +-------------------+       +-------------------+       +-------------------+|
|                                               |       |                   |       |                   |
|                                               |       |                   |       |                   |
| +-------------------+       +-------------------+       +-------------------+ |
|  P 7.04 Positive Offset  P 7.05 Negative Offset + P 7.06 PID Setpoint Gain |
|                                               |       |                   |
|                                               |       |                   |
|                                               |       |                   |
| +-------------------+       +-------------------+       +-------------------+ |
|  100%              |       |  PID Setpoint x PID Setpoint Gain (P 7.06) + PID Setpoint Offset (P 7.05) |
|                                               |       |                   |
|                                               |       |                   |
| +-------------------+       +-------------------+       +-------------------+ |
|  P 7.04 thru P7.06 are used only when P7.02 = 2 or 3 (PID Setpoint Source is AI1 or AI2). |
```
**PV 100% Value**

Default Setting: 100.0

Range: 0.0 to 999

This parameter should be set to the value corresponding to the 100% value of the process variable (PV). The setting for P7.01 cannot be less than any setting for P7.10 to P7.17.

The setting for PV 100% value (P7.01) cannot be set less than any value set for P7.10 to P7.17. If you are unable to reduce P7.01 to the desired value, check parameters P7.10 to P7.17, and reduce these values accordingly.

**PID Setpoint Source**

Default Setting: 02

Settings:

- 00 Keypad
- 01 Serial Communications*
- 02 AI1 (0 to 10V)
- 03 AI2 (4 to 20mA)

The user may change the display to PID setpoint by changing P8.00 to 07 on the keypad.

* Serial communication PID setpoint uses P7.10 memory address:
  - Hexadecimal - 070A
  - MODBUS Decimal - 41803
  - Octal - V3412

**PID Feedback Gain**

Default: 100

Range: 00 to 300.0%

**PID Setpoint Offset Polarity**

Default: 00

Settings:

- 00 No Offset
- 01 Positive Offset
- 02 Negative Offset

This parameter functions similarly to P4.01, Analog Input Offset Polarity.

- This parameter only affects analog inputs AI1 and AI2. It does not affect AI3.

**PID Setpoint Offset**

Default: 0.0

Range: 0.0 to 100.0%

This parameter functions similarly to P4.02, Analog Input Offset.

- This parameter only affects analog inputs AI1 and AI2. It does not affect AI3.

**PID Setpoint Gain**

Default: 100

Range: 0.0 to 300.0%

This parameter functions similarly to P4.03, Analog Input Gain.

- This parameter only affects analog inputs AI1 and AI2. It does not affect AI3.
Chapter 4: AC Drive Parameters

**P7.10  Keypad PID Setpoint**  Default Setting: 0.0

Range: 0.0 to 999

This parameter is used for serial communication PID setpoints.

Serial communication PID setpoint uses P7.10 memory address:
Hexadecimal - 070A, MODBUS Decimal - 41803, Octal - V3412.

The setting for P7.10 cannot exceed the setting for P7.01.

**P7.11  PID Multi-setpoint 1**  Default Setting: 0.0

**P7.12  PID Multi-setpoint 2**  Default Setting: 0.0

**P7.13  PID Multi-setpoint 3**  Default Setting: 0.0

**P7.14  PID Multi-setpoint 4**  Default Setting: 0.0

**P7.15  PID Multi-setpoint 5**  Default Setting: 0.0

**P7.16  PID Multi-setpoint 6**  Default Setting: 0.0

**P7.17  PID Multi-setpoint 7**  Default Setting: 0.0

Range for P7.11-P7.17: 0.0 to 999  Default Setting: 0.0

The Multi-Function Input Terminals DI3 to DI11 (P3.02 to P3.10) are used to select one of the PID Multi-Setpoints. The SPs are determined by P7.11 to P7.17.

1) In order to use the Multi-PID SPs, P7.11 - P7.17 must be set, and P7.00 ≠ 0.
2) The settings for P7.11 through P7.17 cannot exceed the setting for P7.01.
3) When all PID Multi-Setpoint inputs are off, the AC drive reverts to the PID Setpoint Source (P7.02).
The first parameter of PID control is Proportional Control (P). For a given process, if the Proportional Value is set too low, the control action will be too sluggish. If the Proportional value is set too high, the control action will be unstable (erratic). Set the Integral Control (I) and Derivative Control (D) to zero (0). Begin tuning the process with a low Proportional Value, and increase the Proportional value until the system goes unstable (erratic). When instability is reached, reduce the Proportional Value slightly until the system becomes stable (smaller values reduce system Gain). Stability can be tested by moving between two wide-spread setpoint values.

With 10% deviation and P=1, then PX 10% = Control Output. For example, if the speed of a motor is dragged down 10% due to a load increase, a corrective speed signal increase of 10% is generated. In a perfect world, this increase in speed command should bring the motor speed back to normal.

Using only the Proportional Control, the corrective action may not increase fast enough or the setpoint may never be reached because of system losses. The Integral Control is used to generate additional corrective action.

When tuning, begin with a large Integral value and reduce the value until the system goes unstable (erratic). When instability is reached, increase the Integral value slightly until the system becomes stable and the desired setpoint value is reached.

If the control output is too sluggish after the Proportional Control (P) and Integral Control (I) values are set, Derivative Control (D) may be required. Begin with a high Derivative value and reduce the value to the point of system instability. Then increase the Derivative value until the control output regains stability. Stability can be tested by moving between two wide-spread setpoint values.
Chapter 4: AC Drive Parameters

### P7.23 Upper Bound for Integral Control
Default Setting: 100

Range: 00 to 100%

- This parameter defines an upper boundary or limit for the integral gain (I) and therefore limits the Master Frequency. Use the formula below to calculate the integral upper limit.

- The formula is: Integral upper limit = (Maximum Output Frequency) x P7.23. This parameter can limit the Maximum Output Frequency.

\[
\text{Max. Output Frequency} = \left( \frac{\text{Maximum Speed (P 0.04)}}{\text{Base Speed (P 0.03)}} \right) \times \text{Base Frequency (P 0.02)}
\]

### P7.24 Derivative Filter Time Constant
Default Setting: 0.0

Range: 0.0 to 2.5 sec

To avoid amplification of measured noise in the controller output, a derivative digital filter is inserted. This filter helps smooth oscillations. Larger values for P7.24 provide more smoothing.

### P7.25 PID Output Frequency Limit
Default Setting: 100

Range: 00 to 110%

This parameter defines the percentage of output frequency limit during the PID control. The formula is Output Frequency Limit = (Maximum Output Frequency) x P7.25. This parameter will limit the Maximum Output Frequency.

\[
\text{Max. Output Frequency} = \left( \frac{\text{Maximum Speed (P 0.04)}}{\text{Base Speed (P 0.03)}} \right) \times \text{Base Frequency (P 0.02)}
\]

### P7.26 Feedback Signal Loss Detection Time
Default Setting: 60

Range: 0.0 to 3600 sec

This parameter defines how long the PID Feedback signal is lost before an error is generated. Setting this parameter to 0.0 disables the PID Feedback loss timer. When the feedback signal is lost, the PID Feedback loss timer starts timing. When the timer value is greater than the setting value of P7.26, the PID Feedback Loss warning will activate as set in P7.27. The display shows "PID FBACK LOSS", meaning a feedback abnormality is detected. When the signal is corrected, the warning message "PID FBACK LOSS" will automatically be corrected if a PV signal is still present. If no signal is present, then the screen must be manually reset.
**P7.27 PID Feedback Loss Operation**

Default Setting: 00

Settings:

- **00** Warn and AC Drive Stop
- **01** Warn and Continue Operation
- **02** Warn and Continue at Last Frequency
- **03** Warn and Continue Preset Speed set in P7.28

* - Parameter setting available only with firmware v1.04 or higher (refer to P9.39)

This parameter sets the operation of the drive when there is a loss of the PID feedback signal.

**P7.28 PID Feedback Loss Preset Speed**

Default Setting: 0.0

Range: 0 to 400.0 Hz

This parameter sets the speed of operation of the drive when there is a loss of the PID feedback signal, and P7.27 is set to 03.

- This parameter is available only with AC drive firmware v1.04 or higher. Refer to P9.39 to determine the drive's firmware version.
### Display Parameters

**P8.00  User Defined Display Function**

Settings:

- 00  Output Frequency (Hz)
- 01  Motor Speed (rpm)
- 02  Scaled Frequency
- 03  Output Current (A)
- 04  Motor Load (%)
- 05  Output Voltage (V)
- 06  DC Bus Voltage (V)
- 07  PID Setpoint
- 08  PID Feedback (PV)
- 09  Frequency Setpoint

**P8.01  Frequency Scale Factor**

Default Setting: 1.0

Range: 0.01 to 160.0

This parameter can be used to multiply the display unit by a scaling factor so that the display will represent some other user desired unit. For example, the user may want to scale the drive display to represent ft/min for a motor that is driving a conveyor.

The coefficient $K$ determines the multiplying factor for the user-defined unit.

- The display value is calculated as follows:

  $\text{Display value} = \text{output frequency} \times K$

- The display window is only capable of showing four digits, but P8.01 can be used to create larger numbers. The display window uses decimal points to signify numbers up to five digits as explained below:

<table>
<thead>
<tr>
<th>DISPLAY</th>
<th>NUMBER REPRESENTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>9999</td>
<td>The absence of a decimal point indicates a four digit integer.</td>
</tr>
<tr>
<td>999.9</td>
<td>A single decimal point between the middle and the right-most numbers is a true decimal point; it separates ones and tenths as in “300.5 (three hundred and one-half).”</td>
</tr>
<tr>
<td>9999.</td>
<td>A single decimal point after the right-most number is not a true decimal point; instead it indicates that a zero follows the right-most numbers. For example, the number 12340 would be displayed as “1234.”.</td>
</tr>
</tbody>
</table>

**P8.02  Backlight Timer**

Default Setting: 00

Settings:

- 00  Timer Enable (1 min light off)
- 01  Timer Disable

This parameter is used to enable or disable the backlight timer.
Communications Parameters

**P9.00  Communication Address**  
Default Setting: 01  
Range: 01 to 254  
If the AC drive is controlled by serial communication, the communication address must be set via this parameter.

**P9.01  Transmission Speed**  
Default Setting: 01  
Settings:
- 00: 4800 baud data transmission speed  
- 01: 9600 baud data transmission speed  
- 02: 19200 baud data transmission speed  
- 03: 38400 baud data transmission speed  
This parameter is used to set the transmission speed between the computer and AC drive. Users can set parameters and control the operation of the AC drive via the RS-485 serial interface of a personal computer.

**P9.02  Communication Protocol**  
Default Setting: 00  
Settings:
- 00: MODBUS ASCII mode <7 data bits, no parity, 2 stop bits>  
- 01: MODBUS ASCII mode <7 data bits, even parity, 1 stop bit>  
- 02: MODBUS ASCII mode <7 data bits, odd parity, 1 stop bit>  
- 03: MODBUS RTU mode <8 data bits, no parity, 2 stop bits>  
- 04: MODBUS RTU mode <8 data bits, even parity, 1 stop bit>  
- 05: MODBUS RTU mode <8 data bits, odd parity, 1 stop bit>  
Each DURAPULSE AC drive has a pre-assigned communication address specified by P9.00. The master computer or PLC then controls each AC drive according to its communication address. DURAPULSE drives can be set up to communicate on Modbus networks using one of the following modes: ASCII (American Standard Code for Information Interchange), or RTU (Remote Terminal Unit). Users can select the desired mode along with the serial port communications protocol using the settings above.
### Chapter 4: AC Drive Parameters

#### P9.03 Transmission Fault Treatment

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Display fault and continue operating</td>
</tr>
<tr>
<td>01</td>
<td>Display fault and RAMP to stop</td>
</tr>
<tr>
<td>02</td>
<td>Display fault and COAST to stop</td>
</tr>
<tr>
<td>03</td>
<td>No fault displayed and continue operating</td>
</tr>
</tbody>
</table>

This parameter is used to detect an error and take appropriate action.

#### P9.04 Time Out Detection

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Disable</td>
</tr>
<tr>
<td>01</td>
<td>Enable</td>
</tr>
</tbody>
</table>

When this parameter is set to 01, 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.

#### P9.05 Time Out Duration

Default Setting: 0.5

Range: 0.1 to 60.0 seconds

#### P9.07 Parameter Lock

<table>
<thead>
<tr>
<th>Setting</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>All parameters can be set and read</td>
</tr>
<tr>
<td>01</td>
<td>All parameters are read-only</td>
</tr>
</tbody>
</table>

#### P9.08 Restore to Default

Default Setting: 00

Settings: 0 or 99

- Setting 99 restores all parameters to factory defaults.

---

DURAPULSE AC Drive User Manual

1st Ed. Rev. D          05/2013
### Block Transfer Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Default Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>P9.11</td>
<td>P9.99</td>
</tr>
<tr>
<td>P9.12</td>
<td>P9.99</td>
</tr>
<tr>
<td>P9.15</td>
<td>P9.99</td>
</tr>
<tr>
<td>P9.16</td>
<td>P9.99</td>
</tr>
<tr>
<td>P9.17</td>
<td>P9.99</td>
</tr>
<tr>
<td>P9.18</td>
<td>P9.99</td>
</tr>
<tr>
<td>P9.19</td>
<td>P9.99</td>
</tr>
<tr>
<td>P9.20</td>
<td>P9.99</td>
</tr>
<tr>
<td>P9.21</td>
<td>P9.99</td>
</tr>
<tr>
<td>P9.22</td>
<td>P9.99</td>
</tr>
<tr>
<td>P9.23</td>
<td>P9.99</td>
</tr>
</tbody>
</table>

**Range for Block Transfer Parameters (P9.11-P9.25):** P0.00 to P8.02, P9.99

The sequential block transfer parameters (P9.11 through P9.25) allow you to "group" various miscellaneous non-sequential parameters, so that only one PLC programming write instruction is required to update those parameters, instead of three separate write instructions.

- **Example:**
  Writing directly to three non-sequential parameters P1.00, P1.02, and P1.04 requires three separate write instructions from the PLC. However, those drive parameters can be updated with only one PLC write instruction to the sequential transfer blocks P9.11 through P9.13; if P9.11 is set to P1.00, P9.12 is set to P1.02, and P9.13 is set to P1.04.

- Setting P9.99 (default) disables the Block Transfer Parameter.
**Chapter 4: AC Drive Parameters**

**P9.26**

**Serial Comm Speed Reference**

- Default Setting: 60.0
- Range: 0.0 to 400.0 Hz [16-bit binary (HEX) format]
- This parameter is used to set the Frequency Command when the AC drive is controlled by communication interface.

In order for this parameter to function, the Source of Frequency Command (P4.00) must be set to 05.

**P9.27**

**Serial Comm RUN Command**

- Default Setting: 00
- Settings:
  - 00 Stop
  - 01 Run
  - Do not write both RUN (P9.27) & JOG (P9.31) Commands in the same write instruction. Use separate write instructions from the master computer or PLC.

In order for this parameter to function, the Source of Operation Command (P3.00) must be set to 03 or 04.

**P9.28**

**Serial Comm Direction Command**

- Default Setting: 00
- Settings:
  - 00 Forward
  - 01 Reverse

**P9.29**

**Serial Comm External Fault**

- Default Setting: 00
- Settings:
  - 00 No action
  - 01 External fault

**P9.30**

**Serial Comm Fault Reset**

- Default Setting: 00
- Settings:
  - 00 No action
  - 01 Fault Reset

**P9.31**

**Serial Comm JOG Command**

- Default Setting: 00
- Settings:
  - 00 Stop
  - 01 Jog
  - Do not write both RUN (P9.27) & JOG (P9.31) Commands in the same write instruction. Use separate write instructions from the master computer or PLC.

**P9.39**

**Firmware Version**

- Default Setting: ##
- Settings: Factory Set, Read Only
  - This parameter is available only with AC drive firmware v1.02 or higher.
P9.40  **Parameter Copy**  Default Setting: 00

Settings:

00  DISABLE Copy Keypad Function
01  ENABLE Copy Keypad Function

This parameter is used to upload or download information to the drive.

P9.41  **GS Series Number**  Default Setting: ##

Settings

01  GS1
02  GS3
03  GS3
04  GS4

P9.42  **Manufacturer Model Information**  Default Setting: ##

Settings

00  GS3-21P0  (230V / 3ph / 1.0 hp)
01  GS3-22P0  (230V / 3ph / 2.0 hp)
02  GS3-23P0  (230V / 3ph / 3.0 hp)
03  GS3-25P0  (230V / 3ph / 5.0 hp)
04  GS3-27P5  (230V / 3ph / 7.5 hp)
05  GS3-2010  (230V / 3ph / 10 hp)
06  GS3-2015  (230V / 3ph / 15 hp)
07  GS3-2020  (230V / 3ph / 20 hp)
08  GS3-2025  (230V / 3ph / 25 hp)
09  GS3-2030  (230V / 3ph / 30 hp)
10  GS3-2040  (230V / 3ph / 40 hp)
11  GS3-2050  (230V / 3ph / 50 hp)
12  GS3-41P0  (460V / 3ph / 1.0 hp)
13  GS3-42P0  (460V / 3ph / 2.0 hp)
14  GS3-43P0  (460V / 3ph / 3.0 hp)
15  GS3-45P0  (460V / 3ph / 5.0 hp)
16  GS3-47P5  (460V / 3ph / 7.5 hp)
17  GS3-4010  (460V / 3ph / 10 hp)
18  GS3-4015  (460V / 3ph / 15 hp)
19  GS3-4020  (460V / 3ph / 20 hp)
20  GS3-4025  (460V / 3ph / 25 hp)
21  GS3-4030  (460V / 3ph / 30 hp)
22  GS3-4040  (460V / 3ph / 40 hp)
23  GS3-4050  (460V / 3ph / 50 hp)
24  GS3-4060  (460V / 3ph / 60 hp)
25  GS3-4075  (460V / 3ph / 75 hp)
26  GS3-4100  (460V / 3ph / 100 hp)
Encoder Feedback Parameters

**P10.00  Encoder Pulses Per Revolution**  Default: 1024

Range: 01 to 20000

An encoder is used as a transducer to feed back the motor speed, and this parameter defines the number of pulses for each cycle of the PI control.

**P10.01  Encoder Type Input**  Default: 00

Range:

- 00 Disable
- 01 Single Phase
- 02 Quadrature, FWD - CCW
- 03 Quadrature, FWD - CW

This parameter is used to specify encoder signal type. Settings 02 and 03 are used to distinguish motor rotation in relation to the quadrature type encoder signal. Error message “ENC SIGNAL ERROR” will come up if motor rotation does not match quadrature settings.

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The diagram on the following page shows the output control relationship of P10.02, P10.03 and P10.04.

**P10.02  Proportional Control**  Default: 1.0

Range: 0.0 to 10.0

This parameter specifies proportional control and associated gain (I) used for vector control with encoder feedback (P2.10 = 03). As part of the drive’s control algorithm, the most recent feedback signal is multiplied on each scan by the scaling factor set by this parameter.

**P10.03  Integral Control**  Default: 1.00

Range: 0.00 to 100.00 sec

This parameter specifies integral control and associated gain (I) used for vector control with encoder feedback (P2.10 = 03). The drive calculates a running integral, or summation, of the feedback signal over the time period set by this parameter. This summation, rather than the most recent feedback signal, is used in the control algorithm. Integral control “smoothes” the effect of radical changes in the feedback signal.
**P10.04 Encoder Control Output Limit**

Default: 7.5

Range: 0.0 to 20.0%

This parameter limits the amount of correction by the encoder proportional and integral controls (P10.02 & P10.03) on the output frequency when controlling speed. It can limit the maximum output frequency, and is defined in percent of maximum output frequency.

**P10.05 Encoder Loss Detection**

Default: 00

Settings:
- 00 Warn and continue operation
- 01 Warn and RAMP to stop
- 02 Warn and COAST to stop

This parameter governs the response of the drive to the feedback signals, such as the analog or encoder pulse signals, when they are performing abnormally.

**Closed Loop Tuning Diagram (P10.02, P10.03, P10.04)**

Diagram showing the interactions between frequency command, encoder feedback, P gain, I gain, and output frequency.