### Pictorial Index

#### J5 - Serial Port

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RCV + RS-485</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>RCV - RS-232</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>XMT - RS-232</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>XMT + RS-485</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Com</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RCV - RS-485</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>XMT - RS-485</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Reserved</td>
<td></td>
</tr>
</tbody>
</table>

#### J2 - Encoder

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Encoder +5V Pwr</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Encoder 5V Com</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Encoder +5V Pwr</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Encoder 5V Com</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Encoder +5V Pwr</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Encoder 5V Com</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Mtr Enclr Input Chnl A+</td>
<td>7-137</td>
</tr>
<tr>
<td>8</td>
<td>Mtr Enclr Input Chnl A-</td>
<td>7-137</td>
</tr>
<tr>
<td>9</td>
<td>Mtr Enclr Input Chnl B+</td>
<td>7-137</td>
</tr>
<tr>
<td>10</td>
<td>Mtr Enclr Input Chnl B-</td>
<td>7-137</td>
</tr>
<tr>
<td>11</td>
<td>Mtr Enclr Input Chnl I+</td>
<td>7-137</td>
</tr>
<tr>
<td>12</td>
<td>Mtr Enclr Input Chnl I-</td>
<td>7-137</td>
</tr>
<tr>
<td>13</td>
<td>Hall A</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Hall B</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Hall C</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Absolute Position</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Thermal Switch +</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Thermal Switch -</td>
<td></td>
</tr>
</tbody>
</table>

#### J1 - Controller

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Encoder +5VDC</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Encoder 5V Com</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Encoder +5VDC</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Encoder 5V Com</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>External I/O Power</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>External I/O Com</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Mtr Output Chnl A+</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Mtr Output Chnl A-</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Mtr Output Chnl B+</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Mtr Output Chnl B-</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Mtr Output Chnl I+</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Mtr Output Chnl I-</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>External I/O Com</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Auxiliary Chnl A+</td>
<td>7-138</td>
</tr>
<tr>
<td>15</td>
<td>Auxiliary Chnl A-</td>
<td>7-138</td>
</tr>
<tr>
<td>16</td>
<td>Auxiliary Chnl B+</td>
<td>7-138</td>
</tr>
<tr>
<td>17</td>
<td>Auxiliary Chnl B-</td>
<td>7-138</td>
</tr>
<tr>
<td>18</td>
<td>Auxiliary Chnl I+</td>
<td>7-138</td>
</tr>
<tr>
<td>19</td>
<td>Auxiliary Chnl I-</td>
<td>7-138</td>
</tr>
<tr>
<td>20</td>
<td>Drive Enable</td>
<td>7-138</td>
</tr>
<tr>
<td>21</td>
<td>Fault Reset</td>
<td>7-138</td>
</tr>
<tr>
<td>22</td>
<td>Analog Cmd +</td>
<td>7-138</td>
</tr>
<tr>
<td>23</td>
<td>Analog Cmd -</td>
<td>7-138</td>
</tr>
<tr>
<td>24</td>
<td>Drive Ready +</td>
<td>7-138</td>
</tr>
<tr>
<td>25</td>
<td>Drive Ready -</td>
<td>7-138</td>
</tr>
<tr>
<td>26</td>
<td>External I/O Power</td>
<td>7-132</td>
</tr>
<tr>
<td>27</td>
<td>I Limit</td>
<td>6-121</td>
</tr>
<tr>
<td>28</td>
<td>Analog Com</td>
<td>6-121</td>
</tr>
<tr>
<td>29</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>30</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>31</td>
<td>Analog Output 1</td>
<td>6-121</td>
</tr>
<tr>
<td>32</td>
<td>Selectable Input 1</td>
<td>6-121</td>
</tr>
<tr>
<td>33</td>
<td>Selectable Output 1</td>
<td>6-121</td>
</tr>
<tr>
<td>34</td>
<td>Selectable Input 2</td>
<td>6-121</td>
</tr>
<tr>
<td>35</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>36</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>37</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>38</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>39</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>40</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>41</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>42</td>
<td>Selectable Output 1</td>
<td>6-121</td>
</tr>
<tr>
<td>43</td>
<td>Selectable Output 2</td>
<td>6-121</td>
</tr>
<tr>
<td>44</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>45</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>46</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>47</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>48</td>
<td>Reserved</td>
<td>6-121</td>
</tr>
<tr>
<td>49</td>
<td>Brake Enable +</td>
<td>6-121</td>
</tr>
<tr>
<td>50</td>
<td>Brake Enable -</td>
<td>6-121</td>
</tr>
</tbody>
</table>

---

**Diagram:**

- Page 10-213, 11-220
- Page 6-121
- Page 6-117
- Page 6-81
NOTE

Progress is an on-going commitment at Giddings & Lewis. We continually strive to offer the most advanced products in the industry; therefore, information in this document is subject to change without notice. The illustrations and specifications are not binding in detail. Giddings & Lewis shall not be liable for any technical or editorial omissions occurring in this document, nor for any consequential or incidental damages resulting from the use of this document.

DO NOT ATTEMPT to use any Giddings & Lewis product until the use of such product is completely understood. It is the responsibility of the user to make certain proper operation practices are understood. Giddings & Lewis products should be used only by qualified personnel and for the express purpose for which said products were designed.

Should information not covered in this document be required, contact the Customer Care Team, Giddings & Lewis, 660 South Military Road, P.O. Box 1658, Fond du Lac, WI 54936-1658. Giddings & Lewis can be reached by telephone at (920) 921-7100.

108-31017-00

0799


Microsoft and MS-DOS are registered trademarks and Windows is a trademark of Microsoft Corporation.
UL and cUL are registered trademarks of Underwriters Laboratories.
Centuñon, PiC900, PiC90, PiC9 are trademarks of Giddings & Lewis.
Product Notice
Use of DSM Drive Lines

DSM Drive Line drives are intended for use as transistorized electronic amplifiers powering servo motors in machinery. As such, they must be part of a controlled system that includes a controlling device. They are not intended to independently control a motor. Instructions in the motor and control system manuals must be observed; this document does not replace those instructions.

Unless specified otherwise, DSM Drive Line drives are intended for use in a normal industrial environment, installed in a suitable electrical cabinet without exposure to excessive or corrosive moisture or abnormal ambient temperatures. The exact operating conditions may be established by referring to the data for the drive. The connection and control of drives in machinery is a skilled operation, disassembly or repair must not be attempted. In the event that a drive fails to operate correctly, contact the place of purchase for return instructions.

Safety Notes

There are some possible hazards associated with the use of drives. The following precautions should be observed. Specific Warnings and Cautions are listed in the Preface and Safety sections of the manual.

Installation and Maintenance: Installation and maintenance or replacement must be carried out by suitably qualified service personnel, paying particular attention to possible electrical and mechanical hazards.

Weight: Large drives are heavy, the center of gravity may be offset and removable covers shield internal components. When handling, take appropriate precautions and lift the equipment using permanent, fixed surfaces, such as the base; avoid lifting the device using protective cover shields that may be loose. Beware of sharp edges; use protective gloves when handling such assemblies.

Flying Leads and Loose Cables: Ensure that flying leads or loose cables are suitably restrained, to prevent snagging or entanglement, or are disconnected before carrying drives with such leads or cables.

Generation: If a motor is driven mechanically, it may generate hazardous voltages which are conducted from its power input terminals to the drive. The power connector must be suitably guarded to prevent a possible shock hazard.

Loose Drives: When running an unmounted drive, ensure that the cooling fan is adequately guarded and sufficient airflow is provided around the drive to ensure adequate cooling. The mounting surface of the drive is a heatsink and its surface temperature may increase when the drive is operating. If a motor is connected to the drive, remove the key which otherwise could fly out and restrain the motor before applying power to the drive.

Damaged Cables: Damage to cables or connectors may cause an electrical hazard. Ensure there is no damage before energizing the system.

Supply: Drives connect to a permanent main power source; not a portable power source. Suitable fusing and circuit protection devices are required. Consult the instructions and adhere to local and national regulations before connecting and energizing the drive.

Safety Logic Signals: Logic signals from the drive are interruptible signals; they are removed when power is removed from the drive. Consult the manual for information on auxiliary power connections that may be employed when these signals are used for safety purposes.

Safety Requirements: The safe incorporation of DSM Drive Line products into a machine system is the responsibility of the machine designer, who should comply with the local safety requirements at the place where the machine is to be used. In Europe this is likely to be the Machinery Directive, the Electromagnetic Compatibility Directive and the Low Voltage Directive. In the United States this is likely to be the National Electrical Code.

Mechanical Connection: Drives must be installed inside an electrical cabinet that provides environmental controls and protection. Installation information for the drive is provided in the manual and list the minimum installation requirements for the drive are provided in the manual. Motors and controlling devices that connect to the drive should have specifications that complement the capabilities of the drive.

Motors: Motors controlled by the drive should only connect to the drive; they should not connect directly to the AC line. Use of custom motors requires the entering of a valid thermal time constant, otherwise the motor overload protection will not function properly.

Disposal: DSM Drive Line drives do not contain hazardous substances. They may be disposed of as mechanical scrap. You may return the drive at your cost for disposal by us.
# Table of Contents

## Preface

- Who Should Use this Manual .................................................. 25
- Purpose and Contents of this Manual ........................................ 25
- Additional Instructions and Manuals ........................................ 29
- Symbols and Conventions ...................................................... 30
- Centurion DSM Line Product Receiving and Storage Responsibility .... 32
- General Safety Guidelines .................................................... 33
- Giddings & Lewis Support ..................................................... 35

## Chapter 1  Safety

- Installing and Using the Centurion DSM Drive ................................ 37
- Safety Classifications .......................................................... 37
- Potential Hazards ..................................................................... 37
- Voltage Potentials ................................................................... 38
- Your Responsibilities .................................................................. 38
- General Safety Guidelines ..................................................... 40

## Chapter 2  Unpacking, Inspecting and Storing

- Unpacking the Drive ............................................................... 43
- Inspection Procedure ............................................................. 44
- Testing the Unit ....................................................................... 44
- Hardware Set Up ....................................................................... 45
- Drive Checkout Test ................................................................... 47
- Storing the Unit ....................................................................... 49
- Centurion DSM Drive Overview .................................................. 51

## Chapter 3  Selecting Other System Components

- Centurion DSM Drive Features .................................................. 52
- Drive Power Ratings ............................................................... 52
- High Performance Microcontroller Technology .......................... 52
- IPM Technology ....................................................................... 52

*Installation Manual for Models DSM 007, DSM 015 and DSM 030*
# Table of Contents

- Analog and Digital Interfaces ........................................... 53
- Encoder Control ......................................................... 53
- Encoder Output .......................................................... 53
- Digital I/O ............................................................... 54
- Analog I/O ................................................................. 54
- AC Input Power ............................................................ 54
- Personality Module ....................................................... 54
- Multiple Protection Circuits ............................................. 55
- Command Sources .......................................................... 55
  - Serial Command Sources ............................................... 55
  - Analog Command Sources .............................................. 56
- I/O Interface .............................................................. 57
  - Analog Input ............................................................ 57
  - Analog Output .......................................................... 57
  - Digital Inputs .......................................................... 57
  - Digital Outputs ........................................................ 58
  - Auxiliary Encoder Interface ......................................... 59
- DSMPro Software ............................................................ 60
  - Autotuning ............................................................... 60
- Agency Approvals .......................................................... 61
- Interface Cables ............................................................ 61
- Motors ........................................................................ 61
  - Options ..................................................................... 62
  - European Union Requirements ....................................... 62

## Chapter 4 DSMPro Installation

- Hardware and Software Requirements .................................. 63
- Installing DSMPro ............................................................ 64
- Starting and Quitting DSMPro ............................................. 65
  - From the C:> Prompt ....................................................... 65
  - From Windows .................................................................. 65
  - The DSMPro Start-Up Screen .......................................... 66
- Version Level ................................................................... 67
- The Readme File ............................................................. 67
- Miscellaneous Files ......................................................... 67
Chapter 5  Installation
Mechanical Installation Requirements ............................................. 69
Interface Connections ................................................................. 72
Wiring ......................................................................................... 73
Electromagnetic Compatibility ..................................................... 73
AC Line Filters ............................................................................ 76
Power Wiring Diagram ................................................................. 78

Chapter 6  Interfaces
J1 - Controller .............................................................................. 81
Digital I/O Power .......................................................................... 83
Digital Inputs ................................................................................ 83
Input Interface Circuit Examples .................................................. 88
Auxiliary Encoder Input Types ...................................................... 105
Interface Cable Examples ............................................................. 108
J1 Terminal Strip/Breakout Board .................................................. 116
J2 - Encoder ................................................................................ 117
J5 - Serial Port ............................................................................ 121
Serial Communications Overview .................................................. 123
Four Wire RS-485 Connections ...................................................... 126

Chapter 7  Power Connections
Motor Power Cabling .................................................................. 132
Shield Termination of Power Cables .............................................. 133
Motor Overload Protection ........................................................... 135
Power Supply Protection ............................................................... 135
Emergency Stop Wiring ................................................................. 135
AC Power Cabling ....................................................................... 137
DC Bus ....................................................................................... 139

Chapter 8  Application and Configuration Examples
Analog Control ............................................................................. 142

Installation Manual for Models DSM 007, DSM 015 and DSM 030
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardware Setup</td>
<td>142</td>
</tr>
<tr>
<td>Connection Diagram</td>
<td>143</td>
</tr>
<tr>
<td>Configuration</td>
<td>143</td>
</tr>
<tr>
<td>Tuning</td>
<td>145</td>
</tr>
<tr>
<td>Operation</td>
<td>146</td>
</tr>
<tr>
<td>Preset Controller</td>
<td>147</td>
</tr>
<tr>
<td>Hardware Setup</td>
<td>148</td>
</tr>
<tr>
<td>Connection Diagram</td>
<td>149</td>
</tr>
<tr>
<td>Configuration</td>
<td>149</td>
</tr>
<tr>
<td>Tuning</td>
<td>152</td>
</tr>
<tr>
<td>Operation</td>
<td>153</td>
</tr>
<tr>
<td>Position Follower (Master Encoder)</td>
<td>155</td>
</tr>
<tr>
<td>Hardware Setup</td>
<td>155</td>
</tr>
<tr>
<td>Connection Diagram</td>
<td>156</td>
</tr>
<tr>
<td>Configuration</td>
<td>157</td>
</tr>
<tr>
<td>Tuning</td>
<td>159</td>
</tr>
<tr>
<td>Operation</td>
<td>160</td>
</tr>
<tr>
<td>Position Follower (Step/Direction)</td>
<td>161</td>
</tr>
<tr>
<td>Hardware Setup</td>
<td>161</td>
</tr>
<tr>
<td>Connection Diagram</td>
<td>162</td>
</tr>
<tr>
<td>Configuration</td>
<td>163</td>
</tr>
<tr>
<td>Tuning</td>
<td>165</td>
</tr>
<tr>
<td>Operation</td>
<td>166</td>
</tr>
<tr>
<td>Position Follower (Step Up/Down)</td>
<td>167</td>
</tr>
<tr>
<td>Hardware Setup</td>
<td>167</td>
</tr>
<tr>
<td>Connection Diagram</td>
<td>168</td>
</tr>
<tr>
<td>Configuration</td>
<td>169</td>
</tr>
<tr>
<td>Tuning</td>
<td>171</td>
</tr>
<tr>
<td>Operation</td>
<td>172</td>
</tr>
<tr>
<td>Incremental Indexing</td>
<td>173</td>
</tr>
<tr>
<td>Hardware Setup</td>
<td>174</td>
</tr>
<tr>
<td>Connection Diagram</td>
<td>175</td>
</tr>
<tr>
<td>Configuration</td>
<td>176</td>
</tr>
<tr>
<td>Tuning</td>
<td>178</td>
</tr>
<tr>
<td>Operation</td>
<td>179</td>
</tr>
<tr>
<td>Chapter</td>
<td>Section</td>
</tr>
<tr>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>9</td>
<td>Tuning</td>
</tr>
<tr>
<td></td>
<td>Tuning Guidelines</td>
</tr>
<tr>
<td></td>
<td>General Tuning Rules</td>
</tr>
<tr>
<td></td>
<td>High Inertia Loads</td>
</tr>
<tr>
<td></td>
<td>Mechanical Resonance</td>
</tr>
<tr>
<td></td>
<td>Backlash</td>
</tr>
<tr>
<td></td>
<td>Auto Tune Mode</td>
</tr>
<tr>
<td></td>
<td>Auto Tuning</td>
</tr>
<tr>
<td></td>
<td>Manual Tune Mode</td>
</tr>
<tr>
<td></td>
<td>Gains</td>
</tr>
<tr>
<td></td>
<td>Filters</td>
</tr>
<tr>
<td></td>
<td>Manual Tuning</td>
</tr>
<tr>
<td></td>
<td>Velocity Loop Tuning Examples</td>
</tr>
<tr>
<td>10</td>
<td>Status Display</td>
</tr>
<tr>
<td></td>
<td>Status Indicator</td>
</tr>
<tr>
<td></td>
<td>Error Messages</td>
</tr>
<tr>
<td></td>
<td>Run Time Error Codes</td>
</tr>
<tr>
<td></td>
<td>Power-Up Error Codes</td>
</tr>
<tr>
<td>11</td>
<td>Maintenance</td>
</tr>
</tbody>
</table>

Installation Manual for Models DSM 007, DSM 015 and DSM 030
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>217</td>
</tr>
<tr>
<td>Periodic Maintenance</td>
<td>217</td>
</tr>
<tr>
<td>Firmware Upgrading</td>
<td>219</td>
</tr>
<tr>
<td>Firmware Upgrade Procedure using DSMPro</td>
<td>219</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td>220</td>
</tr>
<tr>
<td>Error Codes</td>
<td>220</td>
</tr>
<tr>
<td>RS-232 Communication Test</td>
<td>226</td>
</tr>
<tr>
<td>Testing Digital Outputs</td>
<td>228</td>
</tr>
<tr>
<td>Testing Digital Inputs</td>
<td>230</td>
</tr>
<tr>
<td>Testing Analog Output</td>
<td>231</td>
</tr>
<tr>
<td>Testing Analog Input</td>
<td>232</td>
</tr>
<tr>
<td>Testing Encoder Inputs</td>
<td>233</td>
</tr>
<tr>
<td><strong>Appendix A</strong> Options and Accessories</td>
<td></td>
</tr>
<tr>
<td>Centurion DSM Drives</td>
<td>236</td>
</tr>
<tr>
<td>Fuses</td>
<td>236</td>
</tr>
<tr>
<td>Options and Accessories</td>
<td>237</td>
</tr>
<tr>
<td>Interface Cables</td>
<td>238</td>
</tr>
<tr>
<td>Serial Interface Cables</td>
<td>238</td>
</tr>
<tr>
<td>Encoder Feedback Cables</td>
<td>239</td>
</tr>
<tr>
<td>Motor Power Cables</td>
<td>241</td>
</tr>
<tr>
<td>Connector Kits</td>
<td>242</td>
</tr>
<tr>
<td>Mating Connectors</td>
<td>243</td>
</tr>
<tr>
<td><strong>Appendix B</strong> Cable Diagrams, Schematics and Examples</td>
<td></td>
</tr>
<tr>
<td>Interface Cables</td>
<td>246</td>
</tr>
<tr>
<td>Serial Interface Cables</td>
<td>249</td>
</tr>
<tr>
<td>Encoder Feedback Cables</td>
<td>253</td>
</tr>
<tr>
<td>Motor Power Cables</td>
<td>259</td>
</tr>
<tr>
<td>Cabling Examples</td>
<td>265</td>
</tr>
<tr>
<td><strong>Appendix C</strong> TouchPad Instructions</td>
<td></td>
</tr>
<tr>
<td>Introduction</td>
<td>269</td>
</tr>
<tr>
<td>Installation and Operation</td>
<td>269</td>
</tr>
<tr>
<td>TouchPad Commands</td>
<td>270</td>
</tr>
</tbody>
</table>
Table of Contents

Supplemental Instructions ........................................... 272
Motor Selection ...................................................... 272
Analog Output Scaling ................................................ 272
Displays ................................................................. 273
Motor Table ............................................................. 279
TouchPad Options and Lists .......................................... 280
TouchPad Lists .......................................................... 280

Appendix D  Electromagnetic Compatibility Guidelines for Machine Design

Introduction ............................................................. 287
Filtering ................................................................. 289
AC Line Filter Selection .............................................. 289
Grounding ............................................................... 291
Shielding and Segregation .............................................. 292

Appendix E  Dynamic Braking Resistor Selection

Introduction ............................................................. 297
Dynamic Braking Equations .......................................... 297
Sample Calculations .................................................... 299

Appendix F  Specifications

Power ................................................................. 306
Power Dissipation ...................................................... 307
Pictorial Index .......................................................... 319
Interface Connections .................................................. 320

Index

Pictorial Index
List of Figures

Host Mode Connection Diagram ........................................ 46
DSM 007 and 007P Mounting Dimensions .............................. 70
DSM 015, 015P, 030 and 030P Mounting Dimensions .............. 71
MIF Single Phase AC Line Filter Mounting Diagram ............... 76
Digital Input Circuit .................................................. 83
Drive Input Connected to a Switch/Relay Contact ................ 88
Drive Input Connected to an Opto-Isolator ......................... 88
Drive Input Connected to an Active High Sourcing Transistor ... 88
Drive Input Connected to Active Low Output using a Switch/Relay 89
Drive Input Connected to Active Low Output using an Opto-Isolator 89
Drive Input Connected to Sourcing Output ........................ 89
READY and BRAKE/DRIVE ENABLED Circuits ...................... 90
Digital Output Circuit ............................................. 91
BRAKE/DRIVE ENABLE Application Examples ...................... 92
Drive Output Connected to an Opto-Isolator ....................... 95
Drive Output Connected to an LED Indicator ....................... 95
Drive Output Connected to a Resistive Load ....................... 95
Drive Output Connected to a Switch/Relay ......................... 96
Drive Output Connected to Active Low Input using a Switch/Relay 96
Drive Output Connected to Active Low Input using an Opto-Isolator 97
Drive Output Connected to Active High (Sinking) Input .......... 97
External Current Limit Circuit ..................................... 98
Analog COMMAND Input Circuit .................................... 99
ANALOG 1 Output Circuit .......................................... 100
Output Encoder Interface Circuits ................................. 101
J2 Breakout Board Assembly - European Union EMC Compliance 103
Auxiliary Encoder Inputs .......................................... 105
Auxiliary Encoder Input Circuit .................................. 106
External Encoder Interface via TTL Differential Line Drivers 108
<table>
<thead>
<tr>
<th>Figure Reference</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complementary Encoder Interface via 7406 Line Drivers with Pull-up Resistors</td>
<td>109</td>
</tr>
<tr>
<td>Complementary Encoder Interface via Standard TTL Logic</td>
<td>109</td>
</tr>
<tr>
<td>Single-Ended Encoder Interface via Open Collector Transistor without Pull-up (not recommended)</td>
<td>110</td>
</tr>
<tr>
<td>Single-Ended Encoder Interface via Standard TTL Signals (not recommended)</td>
<td>110</td>
</tr>
<tr>
<td>Single-Ended Encoder Interface via Open Collector Transistor with 5 VDC to 12 VDC Pull-up (not recommended)</td>
<td>111</td>
</tr>
<tr>
<td>Single-Ended Encoder Interface via Open Collector Transistor with 24 VDC Pull-up (not recommended)</td>
<td>112</td>
</tr>
<tr>
<td>External Step/Direction Interface via TTL Differential Line Drivers</td>
<td>114</td>
</tr>
<tr>
<td>External Step/Direction Interface via Single-Ended TTL Line Drivers (not recommended)</td>
<td>114</td>
</tr>
<tr>
<td>External CW/CCW (Step Up/Step Down) Interface via TTL Differential Line Drivers</td>
<td>115</td>
</tr>
<tr>
<td>External CW/CCW (Step Up/Step Down) Interface via Single-Ended Line Drivers (not recommended)</td>
<td>115</td>
</tr>
<tr>
<td>Motor Encoder Interface Circuit</td>
<td>118</td>
</tr>
<tr>
<td>Hall Effect Sensor Circuit</td>
<td>118</td>
</tr>
<tr>
<td>Centurion DSM Drive Motor Encoder Connections</td>
<td>120</td>
</tr>
<tr>
<td>RS-232/485 Interface Circuit</td>
<td>121</td>
</tr>
<tr>
<td>RS-232 Connection Diagram</td>
<td>124</td>
</tr>
<tr>
<td>RS-485/RS-422 Communication Comparison</td>
<td>126</td>
</tr>
<tr>
<td>RS-232 to RS-485 Connection Diagram</td>
<td>129</td>
</tr>
<tr>
<td>Motor Power EMC Shield Connection</td>
<td>133</td>
</tr>
<tr>
<td>YSM Series Motor Cable Termination</td>
<td>134</td>
</tr>
<tr>
<td>Emergency Stop Contactor Wiring</td>
<td>136</td>
</tr>
<tr>
<td>Analog Controller Connection Diagram</td>
<td>143</td>
</tr>
<tr>
<td>Preset Controller Connection Diagram</td>
<td>149</td>
</tr>
<tr>
<td>Position Follower (Master Encoder) Connection Diagram</td>
<td>156</td>
</tr>
<tr>
<td>Position Follower (Step/Direction) Connection Diagram</td>
<td>162</td>
</tr>
<tr>
<td>Position Follower (Step Up/Down Controller) Connection Diagram</td>
<td>168</td>
</tr>
<tr>
<td>Incremental Indexing Examples</td>
<td>173</td>
</tr>
<tr>
<td>Incremental Indexing Connection Diagram</td>
<td>175</td>
</tr>
</tbody>
</table>
List of Figures

Registration Indexing Examples ........................................ 181
Registration Indexing Connection Diagram ......................... 183
Absolute Indexing Examples ............................................ 189
Absolute Indexing Connection Diagram ............................... 191
PC Display Units - Default Dialog ..................................... 197
Velocity Loop Structure .................................................. 201
Torque Current Conditioning Structure ................................. 201
Signal Nomenclature ...................................................... 211
Underdamped Signal ....................................................... 211
Overdamped Signal ......................................................... 212
Critically Damped Signal (Ideal Tuning) ............................... 212

Installation Manual for Models DSM 007, DSM 015 and DSM 030
# List of Tables

DSM 007 and 007P Mounting Dimensions ........................................ 70  
DSM 015, 015P, 030 and 030P Mounting Dimensions .......................... 71  
AC Line Filters for Centurion DSM Drives .................................... 75  
MIF Single Phase AC Line Filter Engineering Specifications .............. 76  
J1 Controller Pin-Outs .................................................................. 82  
General and Dedicated Inputs ...................................................... 84  
INPUT1, INPUT2 and INPUT3 Functions .......................................... 84  
Operation and Override Mode Combinations .................................... 86  
Digital Input Specifications ......................................................... 87  
READY and BRAKE/DRIVE ENABLED Output Specifications .................. 91  
Current Draw for Brake Motor Coils ............................................. 93  
Selectable Output Circuits ............................................................ 93  
OUTPUT1 and OUTPUT2 Functions ................................................. 93  
Transistor Output Specifications .................................................. 94  
Analog Inputs (I LIMIT) ................................................................ 98  
External Current Limit Input Specification .................................... 98  
Analog Command Input ................................................................ 99  
Analog Command Input Specifications .......................................... 99  
Analogue Outputs: ANALOG 1 ........................................................ 100  
Analogue Output Specifications .................................................... 100  
Motor Encoder Output Signal ......................................................... 102  
Motor Encoder Output Specifications ............................................ 102  
Motor Encoder Output Signal ......................................................... 106  
Quadrature Interface Specifications .............................................. 107  
Step/Direction and CW/CCW (Step Up/Step Down) Interface Specifications 113  
J2- Motor Encoder Connector Pin-Outs .......................................... 118  
J5 Controller Pin-Outs .................................................................. 121  
J5 - Serial Port Connector Pin-Outs ............................................... 122  
TB1 - DC Bus and AC Power Terminal Block Connections ............... 131  
Motor Power Contact and Wire Size Recommendations ................... 134  
TB1 - AC Power Terminals ............................................................. 137  
AC Input Power Sizing Requirements ............................................ 138  
Preset Binary Inputs ..................................................................... 147  
Velocity Loop Gains .................................................................... 206

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Position Loop Gains ........................................... 206
Run Time Error Codes ..................................... 213
Power-Up Error Codes .................................... 215
Troubleshooting Guide .................................... 220
Preface

Read this preface to familiarize yourself with the rest of the manual. This preface covers the following topics:

- Who should use this manual
- The purpose and contents of this manual
- Storing the product
- Related documentation
- Conventions used in this manual
- Safety precautions
- Giddings & Lewis product support

Who Should Use this Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting the Centurion DSM family of products

If you do not have a basic understanding of the Centurion DSM Line, contact your local Giddings & Lewis representative for information on available training courses before using this product.

Purpose and Contents of this Manual

This manual is a user guide for the Centurion DSM Line. It gives you an overview of the Centurion DSM family and describes the procedures you use to install, setup, use, and troubleshoot the Centurion DSM Line.

This manual provides instructions on how to setup and connect the Centurion DSM Line drive to a controlling device and a motor. A Centurion DSM Line drive can operate in one of several different functional modes. The hardware connections necessary to run the drive are detailed in this manual and basic software instructions are provided for common setup procedures. For detailed explanation of software instructions, refer to the comprehensive online instructions available in the DSMPro software.
The instructions in this manual detail how to install your DSM Line drive using DSMPro software with a personal computer. If you are using a TouchPad device, abbreviated command titles are displayed but the setup steps remain the same. If you are using the serial Host Command Language to control the drive, comprehensive instructions are accessible through the Host Command Reference icon displayed in the DSMPro window.

This manual is organized into numbered chapters and alphabetical appendices. The topics covered in each chapter and section are briefly described. Typographical conventions, warning and cautions specific to the drive, and complementary manuals are also described.

<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>Lists general safety requirements that must be followed when installing or servicing the drive.</td>
</tr>
<tr>
<td>Selecting Other System Components</td>
<td>Identifies motors and signal types that are compatible with DSM Line drives.</td>
</tr>
<tr>
<td>DSMPro Installation</td>
<td>Provides snapshot instructions for installing, accessing and exiting DSMPro.</td>
</tr>
<tr>
<td>Unpacking, Inspecting and Storing</td>
<td>Lists what should be included with your DSM Line drive and explains how to perform a basic functional test before installing or storing the drive.</td>
</tr>
<tr>
<td>Installation</td>
<td>Instructs you on how to physically install your DSM Line drive.</td>
</tr>
<tr>
<td>Interfaces</td>
<td>Each signal or set of signals is identified by:</td>
</tr>
<tr>
<td></td>
<td>• Power requirements for driving the signal.</td>
</tr>
<tr>
<td></td>
<td>• Functions performed by the signal.</td>
</tr>
<tr>
<td></td>
<td>• Specifications, including ON and OFF states.</td>
</tr>
<tr>
<td></td>
<td>• Schematic depictions of the circuit design for each signal type.</td>
</tr>
<tr>
<td></td>
<td>The signals are grouped by the connector on which they are present.</td>
</tr>
<tr>
<td></td>
<td>Diagrams depict the cable connections necessary for common controller interfaces.</td>
</tr>
<tr>
<td></td>
<td>Provides comprehensive information about the encoder signals, Hall Effect switches and thermostat connections available through this connector.</td>
</tr>
</tbody>
</table>

- J1 - Controller

- J2 - Encoder
<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J5 - Serial Port</td>
<td>Diagrams and instructions detail how to communicate with a drive using serial communications.</td>
</tr>
<tr>
<td>Power Connections</td>
<td>Provides information on making motor power, DC bus and AC Power connections.</td>
</tr>
<tr>
<td>Application and Configuration Examples</td>
<td>Describes the hardware and software set up necessary to install the drive as one of the following types operating in a specific mode:</td>
</tr>
<tr>
<td>- Analog Control</td>
<td>• Velocity or torque mode</td>
</tr>
<tr>
<td>- Preset Controller</td>
<td>• Velocity or torque mode</td>
</tr>
<tr>
<td>- Position Follower (Master Encoder)</td>
<td>• Velocity mode</td>
</tr>
<tr>
<td>- Position Follower (Step/Direction)</td>
<td>• Velocity mode</td>
</tr>
<tr>
<td>- Position Follower (Step Up/Down)</td>
<td>• Velocity mode</td>
</tr>
<tr>
<td>- Incremental Indexing</td>
<td>• Velocity mode</td>
</tr>
<tr>
<td>- Registration Indexing</td>
<td>• Velocity mode</td>
</tr>
<tr>
<td>- Absolute Indexing</td>
<td>• Velocity mode</td>
</tr>
<tr>
<td>Tuning</td>
<td>Provides instructions on how to tune a drive and motor combination using the autotuning or manual tuning features in DSMPRO.</td>
</tr>
<tr>
<td>Status Display</td>
<td>Discusses the Status LED indicator on the front panel. Operating or Error Messages accessible through the TouchPad or a PC are explained.</td>
</tr>
<tr>
<td>Maintenance and Troubleshooting</td>
<td>Describes the minimal maintenance necessary with the DSM Line drives and provides a comprehensive troubleshooting chart of potential problems and their solutions.</td>
</tr>
<tr>
<td>Options and Accessories</td>
<td>Lists the optional equipment available for the DSM Line drives. Schematics and cabling examples are provided.</td>
</tr>
<tr>
<td>TouchPad Instructions</td>
<td>Describes how to program an DSM Line drive using the optional TouchPad device. Tables reference the various motor types that are programmed to work with the DSM Line drive. A copy of the TouchPad Command Tree card for the current firmware version is bound into the manual.</td>
</tr>
</tbody>
</table>

Installation Manual for Models DSM 007, DSM 015 and DSM 030
<table>
<thead>
<tr>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dynamic Braking Resistor Selection</strong></td>
<td>Provides equations to assist in sizing resistors for dynamic braking.</td>
</tr>
<tr>
<td><strong>Specifications</strong></td>
<td>Details the design and operational specifications for the DSM Line drives in a tabular format.</td>
</tr>
<tr>
<td><strong>Product Support</strong></td>
<td>Describes the product assistance available, and lists telephone numbers for product assistance and additional on-line information.</td>
</tr>
</tbody>
</table>
Additional Instructions and Manuals

Host Commands and DSMPro

All Centurion DSM Line drives are setup through serial Host Commands. The drives can be configured directly through the Host Command language or indirectly through the DSMPro software. DSMPro is a graphical user interface that provides a visual method of accessing the Host Command language through the Microsoft Windows Operating System.

All documentation for both the Host Commands and DSMPro is online. Host Command information is available through a comprehensive online reference manual. DSMPro information is available through Help menus. The online information provides in-depth explanations of the Host Command language as well as the menus, windows and dialog boxes that make DSMPro a convenient method for programming Centurion DSM Line drives.

To access the Host Command Reference

- Click on the Host Command Reference icon in the DSMPro program group.

To access DSMPro Help

- Open DSMPro by clicking on the DSMPro icon in the DSMPro group, and
- Press the F1 key.

TouchPad

The optional TouchPad can be used to monitor and configure the Centurion DSM Line drive. The TouchPad command structure is similar to the structure of DSMPro, but operates through an abbreviated keypad interface. A TouchPad Instruction card is provided with the TouchPad. It describes the installation and operational instructions in a pocket-sized directory. The TouchPad Command Tree card and additional instructions for the TouchPad are included in the section titled “TouchPad Commands”, which begins on page C-270. The TouchPad Command Tree card is a graphical presentation of both the operational instructions and the command structure for the Centurion DSM Line drives. You may find it convenient to refer to the TouchPad Command Tree card when using the TouchPad with a Centurion DSM Line drive.
Symbols and Conventions

Typographical and Wording Conventions:

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Set Up</td>
<td>Text shown in this font and underlined indicates a Hot Key (keystroke combination) to quickly access a command. For example, Choose Drive Set Up, indicates typing ALT+D followed by ENTER accesses this command.</td>
</tr>
<tr>
<td>DSMPro</td>
<td>Text shown in this font is information to enter in a window or dialog box. For example, Choose the icon DSMPro.</td>
</tr>
<tr>
<td>win</td>
<td>Text in lower case bold is information to enter at a keyboard. For example, To start Windows from the DOS prompt, type win and then press ENTER.</td>
</tr>
<tr>
<td>ALT+F4 a</td>
<td>Keys that should be pressed simultaneously are shown with a plus sign (+) between the key names. This example closes the active window.</td>
</tr>
<tr>
<td>ALT, F, N</td>
<td>Keys that should be pressed in sequence are shown with a comma (,) between the key names. This example opens the File menu and then opens a new file.</td>
</tr>
<tr>
<td>Choose</td>
<td>Indicates that an icon or a command is to be selected from a window or a command box. For example, the instruction for accessing the command icon Drive Set Up states: Choose Drive Set Up.</td>
</tr>
<tr>
<td>Select</td>
<td>Indicates that options are to be selected from a list. For example, the instruction for accessing or entering information states: Select Drive Type and Motor Model from the respective list box.</td>
</tr>
<tr>
<td>Type</td>
<td>Indicates that commands to enter in a command box. For example, the instruction for loading DSMPro states: Type a:setup and then press ENTER.</td>
</tr>
<tr>
<td>NOTE: or TIP:</td>
<td>Notes provide auxiliary information that is important to know. Tips provide hints or shortcuts that are useful. For example,</td>
</tr>
<tr>
<td>NOTE</td>
<td>This step assumes DSMPro was installed in the DSMPro directory during setup.</td>
</tr>
<tr>
<td>TIP</td>
<td>To disable the automatic Help display, choose the menu item Show Quick Start from the Help menu.</td>
</tr>
</tbody>
</table>

* a. Microsoft® Windows™ reserves certain multiple keystroke combinations to activate Windows commands.
Graphical Symbols

This manual uses the following graphic symbols.

<table>
<thead>
<tr>
<th>Example</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="example1.png" alt="protective-conductor-terminal" /></td>
<td>Protective conductor terminal (Earth ground)</td>
</tr>
<tr>
<td><img src="example2.png" alt="chassis-terminal" /></td>
<td>Chassis terminal (Not a protective ground)</td>
</tr>
<tr>
<td><img src="example3.png" alt="risk-of-electrical-shock" /></td>
<td>Risk of electrical shock symbol</td>
</tr>
<tr>
<td><img src="example4.png" alt="danger-warning-caution" /></td>
<td>DANGER, WARNING or CAUTION require accompanying information notices to prevent potential personal injury and equipment damage.</td>
</tr>
</tbody>
</table>
Centurion DSM Line Product Receiving and Storage Responsibility

You, the customer, are responsible for thoroughly inspecting the equipment before accepting the shipment from the freight company. Check the item(s) you receive against your purchase order. If any items are obviously damaged, it is your responsibility to refuse delivery until the freight agent has noted the damage on the freight bill. Should you discover any concealed damage during unpacking, you are responsible for notifying the freight agent. Leave the shipping container intact and request that the freight agent make a visual inspection of the equipment.

Leave the drive in its shipping container prior to installation. If you are not going to use the equipment for a period of time, store it:

- in a clean, dry location
- within an ambient temperature range of -40 to 70° C (-40 to 158° F)
- within a relative humidity range of 5% to 95%, non-condensing
- in an area where it cannot be exposed to a corrosive atmosphere
- in a non-construction area

The “Drive Checkout Test” on page 2-47 is useful to verify that the unit is operating correctly after delivery.
**General Safety Guidelines**

This section covers general safety guidelines for electronic devices. Safety information specific to Centurion DSM Line drives appears in the chapter “Safety” on page 1-37.

Hazards which can be encountered in the use of this equipment are:

- Electric Shock
- Electric Fire
- Mechanical
- Stored Energy

There are no chemical or ionizing radiation hazards.

Electrical shock and fire hazards are avoided by using normal installation procedures for electrical power equipment in an industrial environment. Installation must be undertaken by suitably qualified personnel. Note that this amplifier must be installed in an industrial cabinet such that access is restricted to suitable qualified personnel.

Mechanical hazards are associated with potentially uncontrolled movement of the motor shaft. If this imposes a risk in the machine, then appropriate precautions must be made to electrically disconnect the motor from the drive when personnel have access to moving parts of the machine. Note also that the motor must be securely mounted at all times.

Stored energy hazards are both electrical and mechanical.

1. Electrical hazards can be avoided by disconnecting the drive from its power source and measuring the DC bus voltage to verify it has reached a safe level or by waiting for the time indicated in the warning on the front of the drive prior to removing the protective covers or touching any connections.

2. Mechanical hazards require a risk analysis on the effects of stored mechanical energy when the machine is running at speed, as well as the potential for the conversion of electrical energy stored in the drive being converted to mechanical energy. Electrical energy may be stored in drive for the time indicated in the warning on the front of the drive.

The following points should be observed for the safety of personnel:
- Only qualified personnel familiar with the equipment are permitted to install, operate and maintain the device.
- System documentation must be available and observed at all times.
- All non-qualified personnel should maintain a safe distance from the equipment.
- The system must be installed in accordance with local regulations.
- The equipment is intended for permanent connection to a main power input. It is not intended for use with a portable power input.
- Do not power up the unit without the covers in place and the protective conductor connected.
- Do not operate the unit without connecting the motor conductor to the appropriate terminal on the drive.
- Always remove power before making or removing any connection on the unit.
- Before removing the cover of the unit, shut off the main power and measure the DC bus voltage to verify it has reached a safe level or wait for the time as indicated on the front of the drive.
- Do not make any connections to the internal circuitry. Connections on the front panel are the only points where users should make connections.
- Be careful of the DC bus and shunt terminals. High voltage is present when power is applied to the drive.
- Never connect the DC- (negative) terminal to earth ground, the drive requires a floating DC bus.
- Do not use the ENABLE input as a safety shutdown. Always remove power to a drive before maintaining or repairing the unit.
- Motors without thermal protection devices require a valid thermal time constant. Otherwise the motor overload protection will not function properly.
Giddings & Lewis Support

Giddings & Lewis offers support services worldwide.

Local Product Support

Contact your local Giddings & Lewis distributor for:
- sales and order support
- product technical training
- warranty support
- support service agreements

Technical Product Assistance

If you need to contact Giddings & Lewis for technical assistance, please review the information in the Troubleshooting chapter first. Then call your local Giddings & Lewis distributor. For the quickest possible response, we recommend that you have the part and model numbers and/or software revision level of your products available when you call. The Giddings & Lewis Product Support numbers are listed inside the back cover of this manual.
Installing and Using the Centurion DSM Drive

Read the complete manual before attempting to install or operate the drive. By reading the manual you will become familiar with practices and procedures that allow you to operate the drive safely and effectively.

You should always adhere to the safety guidelines listed in the “Product Notice” located on the back of the title page and the “General Safety Guidelines” on page 1-40. Specific Warnings and Cautions appear throughout the manual.

Safety Classifications

Safety notices describe the likelihood of exposure to hazardous situations and what could happen as a result of exposure to the hazard. Following are symbols and words used to introduce the information that is intended to prevent potential personal injury and equipment damage.

<table>
<thead>
<tr>
<th>Symbols</th>
<th>Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️</td>
<td><strong>DANGER</strong>: Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations.</td>
</tr>
<tr>
<td>or</td>
<td><strong>WARNING</strong>: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.</td>
</tr>
<tr>
<td>⚠️ ⚡</td>
<td><strong>CAUTION</strong>: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may be used for situations that cause property damage only. It may also be used to alert against unsafe practices.</td>
</tr>
</tbody>
</table>

Potential Hazards

The equipment described in this manual is intended for use in industrial drive systems. This equipment can endanger life through rotating machinery and high voltages, therefore it is essential that guards for both electrical and mechanical parts are *not* removed.
Hazards which can be encountered in the use of this equipment are:

- Electric Shock
- Electric Fire
- Mechanical
- Stored Energy

These hazards must be controlled by safe machine design, using specific local regulations, normal safety guidelines and the specific notices that follow. There are no chemical or ionizing radiation hazards.

**Voltage Potentials**

**DANGER**  
DC bus capacitors may retain hazardous voltages after input power has been removed, but will normally discharge in several seconds. Before working on the drive, measure the DC bus voltage to verify it has reached a safe level or wait the full time interval listed on the warning on the front of the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

Voltage potentials for the internal drive circuitry vary from 325 Volts above to 325 Volts below earth ground for a 240 Volt input. Voltages can reach 450 VDC within the drive. All circuits, including the connections on the front panel, should be considered “hot” when power is connected and for the time specified in the warning on the front of the drive after power is removed.

**Your Responsibilities**

As the user or person installing this drive, you are responsible for determining the suitability of the product for the intended application. Giddings & Lewis is neither responsible nor liable for indirect or consequential damage resulting from the inappropriate use of this product.

A qualified person is someone who is familiar with all safety notes and established safety practices, with the installation, operation and maintenance of this equipment and the hazards involved. For more detailed definitions, refer to IEC 364.
It is recommended that anyone who operates or maintains electrical or mechanical equipment should have a basic knowledge of First Aid. As a minimum, they should know where the First Aid equipment is kept and the identity of the trained First Responders in the facility.

Safety notes do not represent a complete list of the steps necessary to ensure safe operation of the equipment. If you wish further information, please contact the nearest distributor of Giddings & Lewis products.
General Safety Guidelines

This section covers general safety guidelines for electronic devices. Safety information specific to Centurion DSM Drives begins on page 1-37.

Hazards which can be encountered in the use of this equipment are:

- Electric Shock
- Electric Fire
- Mechanical
- Stored Energy

There are no chemical or ionizing radiation hazards.

Electrical shock and fire hazards are avoided by using normal installation procedures for electrical power equipment in an industrial environment. Installation must be undertaken by suitably qualified personnel. Note that this amplifier must be installed in an industrial cabinet such that access is restricted to suitable qualified personnel.

Mechanical hazards are associated with potentially uncontrolled movement of the motor shaft. If this imposes a risk in the machine, then appropriate precautions must be made to electrically disconnect the motor from the drive when personnel have access to moving parts of the machine. Note also that the motor must be securely mounted at all times.

Stored energy hazards are both electrical and mechanical.

1. Electrical hazards can be avoided by disconnecting the drive from its power source and measuring the DC bus voltage to verify it has reached a safe level or by waiting for the time indicated in the warning on the front of the drive prior to removing the protective covers or touching any connections.

2. Mechanical hazards require a risk analysis on the effects of stored mechanical energy when the machine is running at speed, as well as the potential for the conversion of electrical energy stored in the drive being converted to mechanical energy. Electrical energy may be stored in drive for the time indicated in the warning on the front of the drive.
The following points should be observed for the safety of personnel:

- Only qualified personnel familiar with the equipment are permitted to install, operate and maintain the device.
- System documentation must be available and observed at all times.
- All non-qualified personnel should maintain a safe distance from the equipment.
- The system must be installed in accordance with local regulations.
- The equipment is intended for permanent connection to a main power input. It is not intended for use with a portable power input.
- Do *not* power up the unit without the covers in place and the protective conductor connected.
- Do *not* operate the unit without connecting the motor conductor to the appropriate terminal on the drive.
- Always remove power before making or removing *any* connection on the unit.
- Before removing the cover of the unit, shut off the main power and measure the DC bus voltage to verify it has reached a safe level or wait for the time as indicated on the front of the drive.
- Do *not* make any connections to the internal circuitry. Connections on the front panel are the only points where users should make connections.
- Be careful of the DC bus and shunt terminals. High voltage is present when power is applied to the drive.
- Never connect the DC- (negative) terminal to earth ground, the drive requires a floating DC bus.
- Do *not* use the ENABLE input as a safety shutdown. Always remove power to a drive before maintaining or repairing the unit.
- Motors without thermal protection devices require a valid thermal time constant. Otherwise the motor overload protection will not function properly.
Micro DSM
This chapter describes the steps which ensure that the drive will function as specified. The steps include:

- Unpacking the Centurion DSM Drive
- Inspecting the drive for shipping damage
- Testing the basic functionality of the drive
- Guidelines for storing the drive.

**Unpacking the Drive**

1. Remove the Centurion DSM Drive from the shipping carton and remove all packing materials from the unit. The materials and carton may be retained for storage or shipment of the drive.

2. Check all items against the packing list. A label located on the side of the unit identifies:
   - Model number
   - Serial number
   - Manufacturing date code.
Inspection Procedure

To protect your investment and ensure your rights under warranty, we recommend the following steps be performed upon receipt of the unit:

- Inspect the unit for any physical damage that may have been sustained during shipment.
- Perform the Inspections Test to verify the functionality of the unit.

If you find damage, either concealed or obvious, contact your buyer to make a claim with the shipper. If degraded performance is detected when testing the unit, contact your distributor or Giddings & Lewis to obtain a Return Material Authorization (RMA). Do this as soon as possible after receipt of the unit.

Testing the Unit

Drives are burned-in and individually tested before they leave the factory. However, damage may occur during shipping. Perform the procedures below to ensure the Centurion DSM Drive is operational and undamaged.

Abbreviated directions for connecting the drive to a motor and a PC are provided.

The test requires:
- Approximately 20 minutes to complete
- A motor with appropriate power and encoder cables
- A PC with the DSMPro software package installed
- An RS-232 communications cable
- An external I/O power supply
- A single phase 100-240 VAC, 50/60 Hz power source. Standard wall outlet power is suitable for verification testing of Centurion DSM Drives.
- A test cable constructed from two normally open switches, several pieces of 1.5 mm\(^2\) (16 AWG) wire and a mating connector. Connectors are listed in “Mating Connectors” on page A-243. The Appendix “Options and Accessories” on page A-235 lists the cables.
During the test, power is removed several times. Always measure the DC Bus voltage to verify the bus capacitors are fully discharged, or wait for the time indicated in the warning on the front of the drive. The bus capacitors must be fully discharged for the subsequent steps to be valid.

If problems arise during this procedure, refer to “Troubleshooting” on page 11-220 and review other relevant sections in this manual, or call your local distributor.

**WARNING**
Perform the initial power-up with the motor shaft disconnected from a load and the shaft key removed. Improper wiring or undiscovered shipping damage could result in undesired motor motion. Be prepared to remove power if excessive motion occurs.

### Hardware Set Up

Make the connections described below and shown in Figure 2.1. “Options and Accessories” on page A-235 lists the interconnect cables available from the factory.

1. Connect an external I/O power supply (12-24 VDC) to J1-5 and J1-6, or J1-26 and J1-13.
2. Connect an RS-232 cable between the serial port on the PC and the J5 connector on the Centurion DSM Drive. A simple 3 wire cable is depicted in the figure below.
3. Connect a Motor/Feedback cable from the motor to the J2 connector on the Centurion DSM Drive.
4. Connect a jumper wire with a toggle switch with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR).
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).
   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including its normally open toggle switches.
5. Connect a Power Cable between an external 100-240 VAC, 50/60 Hz power source and the L1, L2/N and ☺ (Gnd) connections.
Be prepared to disable the drive or remove input power if excessive motor motion occurs while performing the following steps.
Drive Checkout Test

This test sequentially verifies that:

- Drive power wiring is correct and start-up logic is functioning.
- The drive and motor are correctly wired
- Drive serial communications are operational

Before beginning the “Initial Power-up”, please check the following:

- All wiring and mounting to verify correct installation
- Input voltages to ensure they do not exceed specifications for the drive or motor.

Initial Power-up

1. Verify the AC power is within specifications at the terminal strip.
2. Switch the AC Power to ON and verify the Status LED is green
3. Switch the power OFF and wait until the DC Bus Voltage is below 30 Volts.
4. Connect the motor windings to:
   - R (TB1-6) for the Phase R winding
   - S (TB1-7) for the Phase S winding
   - T (TB1-8) for the Phase T winding
   - Ground (TB1-9) for the Ground connection.
5. If a brake motor is being used for the test, connect the brake relay:
   - BRAKE ENABLE + (J1-49) to the Motor Brake +
   - BRAKE ENABLE - (J1-50) to the Motor Brake -.
6. Switch AC Power ON again and verify the STATUS LED is green
7. Switch the power OFF and wait until the DC Bus Voltage is below 30 Volts.

Communications Verification

8. Start DSMPro on the PC.
9. Close any windows that are open in DSMPro.
10. Select **PC Set Up** from the **Communications** menu in DSMPro.

11. Verify the communication port settings match those of the drive, then select **OK**. Factory default drive settings are:

- Baud Rate: 9600
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Serial Port: COM1

Assignment of communications ports on PCs varies between manufacturers. The COM port setting for the drive and PC must match. Refer to “Troubleshooting” on page 11-220 if communication problems are encountered.

12. Switch AC power ON.

13. Select **Read Drive Parameters** from the **Communications** menu in DSMPro.

14. Select **OK** in the Drive Select dialog box. A dialog box indicating that the PC is reading drive parameters should appear.

   If this dialog box does **not** appear, a message appears that advises you to check the COM settings and the communication cable. If necessary, refer to “Troubleshooting” on page 11-220 for instructions on how to perform these checks.

**Initial Drive Operation**

1. When the message appears that a motor must be selected, choose **OK**. The Drive Set Up dialog box is selected with Motor Model active.

2. Select the appropriate motor from the drop-down Motor Model box.

3. Choose **OK** when the message appears advising that the drive must reset. A change in motor parameters requires reselection of the firmware based drive/motor tables. The software reset prevents improper sequencing of these table parameters.

4. Choose **Close** from the Drive Set Up window.

5. Select the **Control Panel** icon from the Drive Window.

6. Close the connection between J1-26 and J1-20 to enable the drive.
7. Holding torque should be sufficient so that the shaft is either immovable or very resistant to rotation.

8. Move the Slide Bar in the Control Panel window to the right and then to the left. Verify that the motor rotates:
   - CW as the Slide Bar is moved right of center, and
   - CCW as the Slide Bar is moved left of center.
   If the motor rotates in the wrong direction (CCW when the slide bar is set to the right of center) or jumps and locks-up, motor phasing and encoder feedback phasing may be incorrect. If necessary, refer to the Troubleshooting chapter for instructions on how to correct the motor power connections at TB1-1, 2, 3 and 4 or the encoder feedback connections at J2.

9. Choose Set to Zero. The motor will stop rotating.

10. Choose Drive Disable and verify the motor shaft can be rotated by hand.

11. Choose Drive Enable and verify the motor shaft has holding torque. (i.e., The shaft cannot be moved or moves with resistance.)

12. Open the connection between J1-26 and J1-20 to disable the drive.

13. Choose Close from the Control Panel window.

A drive completing these steps is functional. If the Centurion DSM Drive did not pass the steps above, refer to “Troubleshooting” on page 11-220.


**Storing the Unit**

Return the drive to its shipping carton using the original packing materials to enclose the unit.
Store the drive in a clean, dry place that will not exceed the following ranges:

- Humidity: 5% to 95%, non-condensing
- Storage temperature: -40° to 158° Fahrenheit (-40° to 70° Celsius).
Selecting Other System Components

This chapter reviews the Centurion Model DSM 007, 007P, 015, 015P, 030 and 030P drives, command sources and interfaces for the drives, and complementary motors and accessory equipment. Selection of complementary servo components allows you to efficiently connect other devices to your microdrive. Pertinent information about each is provided to assist you in planning your servo system.

Centurion DSM Drive Overview

The Centurion DSM Drives are part of a family of universal digital drives. Centurion DSM Drives use microcontrollers to digitally manage the current, velocity, and position. All system and application parameters are set in software, which ensures repeatability of all functions and prevents element drift.

A single unit fully encloses all electronics. An external transformer is not required on the power line. All connectors and indicators are accessible and clearly marked on the front panel.
Centurion DSM Drive Features

Drive Power Ratings

Several power levels of Centurion DSM Drives are available. All models have integral power supplies\(^1\) and use a single phase power source. They differ only in physical size, indexing capability and output power:

- DSM 007 and 007P with continuous output power of 500 Watts.
- DSM 015 and 015P with continuous output power of 1000 Watts.
- DSM 030 and 030P with continuous output power of 2000 Watts.

The Centurion DSM Drives, when combined with brushless servo motors, provide continuous torque ranging from 0.17 Nm to 2.5 Nm (1.5 to 22.5 lb-in) and peak torque ranging from 0.48 Nm to 7.12 Nm (4.3 lb-in to 63 lb-in).

High Performance Microcontroller Technology

All digital current, velocity and position loop calculations as well as the motor commutation calculation are performed by a microcontroller.

IPM Technology

IPM (Intelligent Power Module) technology in the output stage provides a high frequency, digital PWM (Pulse Width Modulation) sine wave that controls the current loop, including overcurrent, short circuit and overtemperature protection.

---

1. DSM007, 007P, 015, 015P and 030 and 030P require an external 12-24VDC power source for I/O.
Analog and Digital Interfaces

All Centurion DSM Drives allow the user to select one of the following analog or digital command interfaces:

- ±10 Volt analog interface - velocity or torque control
- Presets (from one to eight binary inputs) - torque or velocity control
- Quadrature encoder digital interface - electronic gearing position follower
- Step/Direction digital interface - position control
- CW/CCW (step up/step down) interface - position control
- Indexing - position control from a single point in one of three ways
- Operating mode override - alternate movement interface

Encoder Control

A single, motor mounted encoder provides complete commutation information and velocity feedback. Low velocity regulation is enhanced by the use of a 5000 PPR (pulses per revolution) incremental encoder.

Encoder Output

A selectable output allows the encoder resolution to be specified for maximum performance without added circuitry. Outputs are differential line drivers capable of dividing the motor encoder signal by a factor of 1, 2, 4 or 8.
Digital I/O

Digital I/O channels allow the user to program the drive to fit the specific application. Power for the I/O must be supplied by an 12-24 VDC external I/O power source. Selections include:
- Four selectable (INPUT1, INPUT2, INPUT3 and FAULT RESET), optically isolated, active high inputs.
- One dedicated, control (ENABLE), optically isolated, active high input.
- Two selectable, optically isolated and short circuit protected, active high outputs.
- Two dedicated (BRAKE/DRIVE ENABLED and DRIVE READY), normally open relay outputs.

Analog I/O

A dedicated analog input provides current limiting capabilities, while the analog output can be customized to fit the application:
- One dedicated 0 - 10 Volt, analog input (EXTERNAL CURRENT LIMIT)
- One selectable, ±10 Volt analog output.

AC Input Power

Centurion DSM Drives covered by this manual are powered directly from a main 100-240 VAC single phase line.

Personality Module

EEPROM (electrically erasable programmable read only memory) stores both motor and application specific settings and parameters for the drive.
Multiple Protection Circuits

Device and circuit protection, and diagnostic information is provided by:

- Bi-color single point LED
- Overtemperature, short circuit and overcurrent protection for the power output
- $I^2T$ (power-time) protection for the motor and the power drive
- Bus Overvoltage
- Bus Undervoltage
- Overspeed
- Fault diagnostics
- Watchdog timers provide fail-safe operation.

Command Sources

Serial Command Sources

Centurion DSM Drives are configured and controlled via a serial communication link. Commands may be issued from a variety of sources through a serial communications port. Possible command sources include:

- Personal computers
- Host computers
- Programmable Logic Controllers
- Motion controllers
- TouchPad.

The serial communication interface for the Centurion DSM Drive supports:

- RS-232 and the four wire RS-485 communications standards
- NRZ (non-return to zero) asynchronous serial format
- Baud rates: 1200, 2400, 4800, 9600 and 19200
- Parity generation and checking: Even, Odd or None
Connection of communication cables between the drive and user-supplied equipment is described in the following sections:

- One Centurion DSM Drive - “Single Axis RS-232 Set Up” on page 6-123
- Multiple Centurion DSM Drives - “Multiple Axes Four-Wire RS-485 Communications” on page 6-127.

**Analog Command Sources**

In the analog mode of operation, the Centurion DSM Drive requires a variable ±10 Volt DC external analog signal capable of driving the servo regulator’s command input at an input impedance of 13.3 kOhms. Choose a source such as a PLC (programmable logic controller), the DAC (digital-to-analog converter) of a computer, or a motion controller that meets this requirement.

Differential or single-ended line drivers may supply the signals for the auxiliary encoder inputs, step and direction inputs, and step up/down inputs. The differential signal must be capable of supplying at least 5 mA with 2.0 Volts across the + and - inputs. A differential signal source provides the best noise margin of all the interface circuit options. Single-ended signals from TTL drivers must be capable of sourcing or sinking 5 mA.

In the preset mode, the controlling device should be capable of sourcing 10 mA into the digital inputs.
I/O Interface

Analog Input

One analog input channel is accessible to the user. The analog input limits the peak current available from the drive.

- I LIMIT (current limit)
  The analog signal must be within 0-10 Volt range and single-ended.

If this signal is not provided, the peak current of the drive may be set in software through the Drive Parameter window.

Analog Output

One analog output channel may be defined by the user through software:

- ANALOG is a ±10 Volt signal. The allowable current draw of the load is ±2 mA
  This analog output is designed for monitoring purposes only. This signal should not be used for control purposes due to the relatively high ripple voltage (1%).

Digital Inputs

➤

NOTE: Power for the I/O must be supplied by an external 12-24 VDC power source.

Control Inputs

One optically isolated, single ended, active high, dedicated control input provides the controller ENABLE function. This input operates with switch closure or sourcing type transistor outputs.

The current rating is 10 mA maximum.
Selectable Inputs

Four optically isolated, single ended, active high inputs (INPUT1, INPUT2, INPUT3 and FAULT RESET) support logic type interfaces. The input circuits operate with switch closure or sourcing type transistor circuits.

The current rating of each input is 10 mA maximum.

Digital Outputs

Control Outputs

Two normally open relays are dedicated control outputs to the following signals:

- BRAKE/DRIVE ENABLED
- DRIVE READY.

The current ratings of each relay is 1 Amp at 30 VDC.

If using a motor with the 90VAC brake option, a user-provided relay may be driven by these outputs up to the specified levels. Refer to “BRAKE/DRIVE ENABLE Application Examples” on page 6-92 for information about the necessary hardware connections. Consult the I/O Configuration in the on-line DSMPro help for additional information about the software parameters.

Selectable Outputs

Two optically isolated, single ended, active high, current sourcing, discrete output channels provide logic outputs under software control.

Each selectable output channel is capable of sourcing 50 mA maximum and is optically isolated and short circuit protected.
Auxiliary Encoder Interface

The external encoder I/O port permits quadrature type encoder signals for applications, such as electronic gearing.

Encoder Inputs
Software automatically selects the appropriate input based on the command source:
- Master Encoder
- Step/Direction
- Step Up/Step Down.

Encoder Output
The resolution of the encoder output channel is under software control. The motor encoder signal is divided by 1, 2, 4 or 8 to provide an output from a differential line driver measured in PPR (pulses per revolution). The maximum encoder frequency output is 1 MHz (4 MHz quadrature).

NOTE: If a controller requires synchronization to a specific output state, please refer to "IOUT Signal Generation" on page 6-103 for additional information.
DSMPro Software

A Windows-based software interface provides start-up selections. Tasks are organized for efficient setup, control and maintenance. Context sensitive, on-line help provides immediate assistance.

- Set up is simplified by a series of logically arranged setup screens.
- Files can be stored and printed for on-line or off-line modification, and on-site or off-site back-up.
- Diagnostic and setup tools make system integration easy.
- Critical information is available with complete Windows-based on-line help.
- Serial Host Language commands are explained through on-line help.
- User-defined velocity, acceleration, position and torque parameters.
- Tuning and diagnosis is aided with an on-screen dual channel digital oscilloscope.
- On-screen meters and software tools provide rapid debugging and measurement.

Autotuning

Digital auto tuning allows easy setup. All adjustments are made in software, which immediately sets the servo system compensation parameters. This eliminates the time-consuming adjustments required by potentiometers.
Agency Approvals

- UL listed
- cUL listed
- CE marked.

Interface Cables

Standard motor power and encoder feedback cables, as well as communications cables, are available to complete your motion control system and provide reliable, trouble free start-up. Refer to “Options and Accessories” on page A-235 for optional equipment. Use of factory supplied cables is required for compliance to the European Electromagnetic Compatibility (EMC) Directive and to protect your warranty rights.

Motors

The Centurion DSM Drive is compatible with many motors, both Giddings & Lewis motors and motors from other manufacturers. Drive and motor parameters for all compatible motors are programmed into each Centurion DSM Drive at the factory. Giddings & Lewis motors that are compatible with the Centurion DSM Drives include:

- FSM Series motors
- HSM Series motors
- NSM Series motors
- SSM Series motors
- YSM Series motors.

DSMPRO software speeds drive and motor set up by predefined parameters for each drive and motor combination.

Refer to the Torque/Speed curves in the Giddings & Lewis Product Guide or contact your local Giddings & Lewis distributor for motor sizing and compatibility assistance.
Options

- Power and feedback cables are potted and molded with 360 degree shielding.
- AC line filters.
- Breakout boards for I/O control and encoder interface.
- TouchPad - a compact and highly portable input and display device.

European Union Requirements

Centurion DSM Drives conform to the following European Union Directives:


Compliance with the EEC Directives is contingent on:

A. Installation of AC line filters between the power source and the drive, and

B. Use of factory authorized cables to connect motors.

“European Union EMC Directives” on page 5-74 and “Options and Accessories” on page A-235 lists this equipment and associated part numbers.

Use of this product with other non-CE products or in a manner inconsistent with established testing requirements invalidates the CE registration declaration.

Giddings & Lewis motors currently available for use with Centurion DSM Drives in installations requiring CE marking include:

- FSM Series motors
- HSM Series motors
- SSM Series motors
- YSM Series motors.
Installation of DSMPro on a PC is covered in this chapter, which:

- Lists the minimum PC hardware and software necessary to run DSMPro.
- Provides step-by-step instructions on how to load DSMPro.
- Shows you how to start and quit DSMPro and introduces the Drive Window, the main command window for DSMPro.
- Instructs you on how to access on-line help.

Instructions for using the features available in DSMPro are detailed in on-line help. To access the Help menu, depress the F1 key.

**Hardware and Software Requirements**

The minimum personal computer (PC) requirements to run the software are:

- A DOS computer with a 286 microprocessor
- A hard disk, with 2.0 MB of free disk space
- 3½ inch, 1.44MB floppy disk drive
- 2 MB of RAM
- A Video Graphics Array (VGA) monitor
- Microsoft Windows version 3.1
- A mouse is recommended.

Windows must be installed on your PC. If Windows is not already installed, refer to the appropriate Microsoft manual to install Windows on your computer.
Installing DSMPro

To install DSMPro software on a hard drive:

1. Make a backup copy of the DSMPro disk in one of the following ways:
   - Copy the DSMPro disk using the disk menu in the Windows File Manager or Windows Explorer.
   - If your computer has only one floppy disk drive, type from the DOS command line prompt `diskcopy a: b:` and then press ENTER. The software will prompt you when to insert the SOURCE (DSMPro) disk and when to insert the TARGET (blank) disk.
2. If Windows is not running, type `win` at the DOS prompt (`C:>` for Windows 3.1 or type `exit` for Windows 95).
   If Windows is already running, close any open applications.
3. Insert the DSMPro disk into a 1.44MB floppy disk drive, typically drive A:, and close the drive door.
4. Choose Run, from the File menu in Windows Program Manager or choose Start/Run in Windows 95.
5. Type `a:setup` and then press ENTER. A message box will appear saying that the setup is initializing. The message box may be present for up to 40 seconds, depending on the speed of the PC.
6. Follow the instructions in the dialog boxes.
7. A status bar will keep you informed of the installation progress. When Setup is complete, choose OK or press ENTER to return to Windows.
Starting and Quitting DSMPro

Setup automatically creates the DSMPro program group and then returns you to Windows. The DSMPro program group provides access to the DSMPro application icon.

From the C:> Prompt

1. Type `win c:\dsmpro\dsmpro.exe`.

   ▶ NOTE: This step assumes DSMPro was loaded into the *c:\dsmpro* directory during setup.

The DSMPro start-up screen will open.

From Windows

1. Choose the DSMPro program group from the Program Manager or Windows Explorer in Windows.

   ▶ TIP: If the DSMPro window is *not* active, hold down ALT and press TAB (ALT+TAB) until the DSMPro title bar and icon are highlighted, or select DSMPro from the list in the Window menu.

2. Choose the DSMPro icon from the DSMPro program group.

The DSMPro start-up screen will open.
The DSMPro Start-Up Screen

When DSMPro starts for the first time, its default instructions are:

- Display the Help menu - Quick Start.
- Present the Drive Select window. The Drive Select window offers Drive 0, which is the default drive address assigned at the factory.

The default DSMPro Start-up screen is shown below. The comments point out many of the Windows controls that are available in DSMPro.

Tool bar buttons provide quick access to common commands and windows.

Pop-up menus access PC-based commands.

Online Help explains tasks and commands.

Hypertext links to specific items in online Help.

Status bar reveals current menu selection and status information.

Buttons perform typical windows functions such as sizing, scrolling, and opening and closing windows.

➤ **TIP:** DSMPro displays the Help menu - Quick Start - when it is first accessed. To disable this automatic display, deselect the menu item Show Quick Start from the Help menu.
Version Level

The release level and date for DSMPro may be displayed by selecting About DSMPro from the Help menu. This information also appears in the initial DSMPro screen. The About DSMPro window includes additional data about system resources typically displayed in Windows Help.

The Readme File

A file, titled README, may be included in the DSMPro directory. This file contains installation instructions, change notes from previous revisions, and information that became available after this manual was printed. After you install DSMPro you can access this file by choosing the Read Me icon in the DSMPro window or by using Microsoft Write or an equivalent application program to view the file readme.wri in the directory path where DSMPro is installed.

Miscellaneous Files

Firmware Files

Firmware files are supplied in the Miscellaneous directory on the DSMPro diskette. The current revision level of drive firmware, excluding the TouchPad firmware, is displayed in the Drive Information window of DSMPro. The current revision level of TouchPad firmware is displayed as part of the TouchPad initialization when a TouchPad is connected to the drive.

The types of files and their functions are:

- Firmware - Main Operating firmware for the drive
- Boot Block - Drive Initialization firmware for the drive
Mechanical Installation Requirements

1. Mount the unit in an enclosure providing protection to IP54 (protected against dust and splashing water), or IP65 (dust free and protected against water jets) if the work environment is poor. Many NEMA (National Electrical Manufacturers Association) Type 4 cabinets provide this level of protection. Minimum cabinet requirements are:
   - Depth: 243.8 cm (9.6 inches).
   - Adequate sizing and/or ventilation to dissipate the heat generated by the Centurion DSM Drives. Refer to “Power Dissipation” on page F-307 for the amount of heat generated by Centurion DSM Drives and enclosure sizing equations.

2. Minimum unobstructed surrounding space for cooling air intake (and fan exhaust from the DSM 030 and 030P):
   - Above: 50.8 cm (2 inches)
   - Below: 50.8 cm (2 inches)
   - Sides: 1.25 cm (0.5 inches)
   - Front: 76.2 cm (3.0 inches) for cable clearance.

   **CAUTION**
   If the cabinet is ventilated, use filtered or conditioned air to prevent the accumulation of dust and dirt on electronic components. The air should be free of oil, corrosives, or electrically conductive contaminates.

3. Position the drive in a vertical position on a flat, solid surface that meets the following weight, vibration and shock, altitude and humidity, airflow clearance, and temperature requirements.

   Unit weights are:
   - DSM 007 and DSM 007P: 1.7 Kg (3.7 Lbs)
   - DSM 015 and DSM 015P: 2.05 Kg (4.5 Lbs)
   - DSM 030 and DSM 030P: 2.0 Kg (4.4 Lbs)
Figure 5.1 DSM 007 and 007P Mounting Dimensions

Minimum Unobstructed Surrounding Space for Cooling and Exhaust Air
Above 50.8 mm (2 inches)
Below 50.8 mm (2 inches)
Sides 12.5 mm (0.5 inches)
for Cable Bend Radius
Front 76.2 mm (3 inches)

Table 5.1 DSM 007 and 007P Mounting Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>mm</th>
<th>inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>188.12</td>
<td>7.40</td>
</tr>
<tr>
<td>A1</td>
<td>184.9</td>
<td>7.28</td>
</tr>
<tr>
<td>A2</td>
<td>63.5</td>
<td>2.50</td>
</tr>
<tr>
<td>A3</td>
<td>13.0</td>
<td>0.51</td>
</tr>
<tr>
<td>A4</td>
<td>6.07</td>
<td>0.24</td>
</tr>
<tr>
<td>A5</td>
<td>94.49</td>
<td>3.72</td>
</tr>
<tr>
<td>A6</td>
<td>5.0</td>
<td>0.20</td>
</tr>
<tr>
<td>A7</td>
<td>22.10</td>
<td>0.87</td>
</tr>
<tr>
<td>A8</td>
<td>31.75</td>
<td>1.25</td>
</tr>
<tr>
<td>A9</td>
<td>8.64</td>
<td>0.34</td>
</tr>
<tr>
<td>A10</td>
<td>31.75</td>
<td>1.25</td>
</tr>
<tr>
<td>A11</td>
<td>57.15</td>
<td>2.25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimension</th>
<th>mm</th>
<th>inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>72.60</td>
<td>2.86</td>
</tr>
<tr>
<td>B1</td>
<td>65.02</td>
<td>2.56</td>
</tr>
<tr>
<td>B2</td>
<td>38.10</td>
<td>1.50</td>
</tr>
<tr>
<td>B3</td>
<td>18.54</td>
<td>0.73</td>
</tr>
<tr>
<td>B4</td>
<td>13.21</td>
<td>0.52</td>
</tr>
<tr>
<td>B5</td>
<td>5.58</td>
<td>0.22</td>
</tr>
<tr>
<td>C</td>
<td>146.05</td>
<td>5.75</td>
</tr>
<tr>
<td>C1</td>
<td>129.03</td>
<td>5.08</td>
</tr>
</tbody>
</table>

a. Power Cable bracket extends up to 20mm (0.80 inches)
Figure 5.2 DSM 015, 015P, 030 and 030P Mounting Dimensions

![Diagram showing mounting dimensions for DSM 015, 015P, 030, and 030P]

Minimum Unobstructed Surrounding Space
for Cooling and Exhaust Air
Above 50.8 mm (2 inches)
Below 50.8 mm (2 inches)
Sides 12.5 mm (0.5 inches)
for Cable Bend Radius
Front 76.2 mm (3 inches)

NOTE: Fan on DSM030 only

Table 5.2 DSM 015, 015P, 030 and 030P Mounting Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>mm</th>
<th>inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>198.12</td>
<td>7.80</td>
</tr>
<tr>
<td>A1</td>
<td>184.9</td>
<td>7.28</td>
</tr>
<tr>
<td>A2</td>
<td>6.35</td>
<td>0.25</td>
</tr>
<tr>
<td>A3</td>
<td>13.0</td>
<td>0.51</td>
</tr>
<tr>
<td>A4</td>
<td>6.07</td>
<td>0.24</td>
</tr>
<tr>
<td>A5</td>
<td>94.49</td>
<td>3.72</td>
</tr>
<tr>
<td>A6@</td>
<td>5.0</td>
<td>0.20</td>
</tr>
<tr>
<td>A7</td>
<td>22.10</td>
<td>0.87</td>
</tr>
<tr>
<td>A8</td>
<td>31.75</td>
<td>1.25</td>
</tr>
<tr>
<td>A9</td>
<td>8.64</td>
<td>0.34</td>
</tr>
<tr>
<td>A10</td>
<td>31.75</td>
<td>1.25</td>
</tr>
<tr>
<td>A11</td>
<td>57.15</td>
<td>2.25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dimension</th>
<th>mm</th>
<th>inches</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>97.30</td>
<td>3.83</td>
</tr>
<tr>
<td>B1</td>
<td>65.02</td>
<td>2.56</td>
</tr>
<tr>
<td>B2</td>
<td>38.10</td>
<td>1.50</td>
</tr>
<tr>
<td>B3</td>
<td>18.54</td>
<td>0.73</td>
</tr>
<tr>
<td>B4</td>
<td>13.21</td>
<td>0.52</td>
</tr>
<tr>
<td>B5</td>
<td>5.58</td>
<td>0.22</td>
</tr>
<tr>
<td>C</td>
<td>146.05</td>
<td>5.75</td>
</tr>
<tr>
<td>G1</td>
<td>129.03</td>
<td>5.08</td>
</tr>
</tbody>
</table>

a. Power Cable bracket extends up to 20mm (0.80 inches)
Vibration and shock, altitude and humidity limits are:

- **Vibration**: 2g at 10 to 2000 Hz
- **Shock**: 15g 11 msec half sine
- **Altitude**: 1500 meters (5000 feet), Derate power performance 3% for each 300 m above 1500 m (1000 ft above 5000 ft).
- **Humidity**: 5% to 95% non-condensing

Ambient operating temperature range and airflow clearances are:

- **0°** to **55° Celsius (32° to 131° Fahrenheit)**.
- **50.8 mm (2 inches)** above and below unit for airflow.

4. Bolt the unit to the cabinet using the mounting slots in the drive. Mounting dimensions are shown in Figure 5.2. The recommended size of mounting hardware is:

- M5 Metric (1/4-20 equivalent), or
- #10 MS bolts.

**Interface Connections**

Input/Output and power cables connect to the front panel of a Centurion DSM Drive, no internal connections are necessary.

---

**DANGER**

The user is responsible for conforming with all applicable local, national and international codes. Wiring practices, grounding, disconnects and overcurrent protection are of particular importance. Failure to observe this precaution could result in severe bodily injury or loss of life.

---

I/O Connections, including the external I/O power supply, are fully described in the following sections:

- “J1 - Controller” on page 6-81 defines the controller connections
- “J2 - Encoder” on page 6-117 defines the motor encoder connections
- “J5 - Serial Port” on page 6-121 defines the RS-232/RS-485 serial port connections

Power Connections are fully described in the following sections:

- “Power Connections” on page 7-131 defines the AC, DC Bus and Motor power connections.
Specific operational set ups are depicted in Figure 8.1 through Figure 8.11 (pages 8-143 through 8-191, respectively). These figures cover velocity and torque mode controls for:

- Analog Controllers in velocity or torque modes,
- Preset Controllers in velocity or torque modes,
- Position Followers using a Master Encoder,
- Position Followers using a Step/Direction signal,
- Position Followers using Step Up/Down signals,
- Incremental Indexing over a specific distance,
- Registration Indexing from a mark, or
- Absolute Indexing to a home position.

**Wiring**

Wiring sizes and practices, as well as grounding and shielding techniques are described in the sections listed below. Refer to “Power Connections” on page 7-131.

The descriptions represent common wiring practices and should prove satisfactory in the majority of applications.

> **NOTE:** Cables, listed in “Options and Accessories” on page A-235, are *not* rated for continuous flexing.

Minimum wire gages for power cables are listed in:

- “Motor Power Contact and Wire Size Recommendations” on page 7-134,
- “AC Input Power Sizing Requirements” on page 7-138.

**Electromagnetic Compatibility**

**General Guidelines**

Refer to the appendix “Electromagnetic Compatibility Guidelines for Machine Design” on page D-287 for an in-depth discussion of electromagnetic compatibility (EMC) and electromagnetic interference (EMI).
European Union EMC Directives

The Centurion DSM Drives are designed and tested to meet the European EMC Directive. Declarations of conformity, which enumerate the standards used, are included in the manual.

Installation requirements necessary to meet this directive are:

1. Use of factory supplied cables,

2. Use of an external AC line filter, and

**WARNING**

Large leakage currents exist in AC line filters. They must be grounded properly before applying power. Filter capacitors retain high voltages after power removal. Before handling the equipment, voltages should be measured to determine safe levels prior to handling the equipment. Failure to observe this precaution could result in severe bodily injury.

3. If an external supply powers the I/O, grounding of this power supply is required.

Refer to the appendix “Options and Accessories” on page A-235 for part numbers. The following diagrams show the mounting dimensions for single phase AC Line Filters available from Giddings & Lewis.

Table 5.3 shows a typical filter selection matrix for Centurion DSM Drives. All the filters identified below are manufactured by Schaffner or Roxburgh and are widely available. There are many AC line filter manufacturers whose filters can be successfully integrated. Giddings & Lewis recommends Schaffner or Roxburgh filters based on our test results, but the machine builder is responsible for the suitability of the filter selection in a specific application. These filters can be used for distributing power to multiple drives, rather than using an individual filter for each drive. Further information is available from Schaffner (1-800-367-5566) or Roxburgh (01724.281770 [011.44.1724.281770 from the USA]).

AC line filters for use with Centurion DSM Drives are listed below:
Table 5.3 AC Line Filters for Centurion DSM Drives

<table>
<thead>
<tr>
<th>Drive</th>
<th>Roxburgh</th>
<th>Schaffner</th>
<th>Giddings &amp; Lewis</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSM 007 and DSM 007P</td>
<td>MIF 06, MDF 06</td>
<td>FN 350-8</td>
<td>401-30222-00</td>
</tr>
<tr>
<td>DSM 015, DSM 015P</td>
<td>MIF 10, MDF 16</td>
<td>FN 350-12</td>
<td>401-30216-00</td>
</tr>
<tr>
<td>DSM 030, DSM 030P</td>
<td>MIF 23, MDF 18</td>
<td>FN 350-20</td>
<td>401-30217-00</td>
</tr>
<tr>
<td>DSM 130</td>
<td>MIF 32, MDF 36</td>
<td>FN 350-30</td>
<td>401-34418-00</td>
</tr>
<tr>
<td>DSM175 (3-phase)</td>
<td>MIF 330, MIF 336</td>
<td>FN 351-36</td>
<td>401-34419-00</td>
</tr>
</tbody>
</table>

The Roxburgh filters differ in the number of stages. The MDF (Motor Drive Filters) filters are single stage filters; the MIF (Motor Inverter Filters) filters are three-stage filters. The three-stage filter will remove more of the noise, but the cost is more panel space in the higher current filters. In the lower current filters (<50 A), the panel space used is less for the MIF filters.

The Schaffner filters are single-stage filters. These differ from the Roxburgh filters in component types, values and placement. The leakage current is generally lower, but the amount of attenuation is lower too. These filters will work if the amount of noise in the environment is low, or if the design of the machine is such that only a nominal amount of attenuation is needed.

Basic guidelines for reducing electrical noise and increasing electromagnetic compatibility (EMC) are listed in “Electromagnetic Compatibility Guidelines for Machine Design” on page D-287.
AC Line Filters

Figure 5.3 MIF Single Phase AC Line Filter Mounting Diagram

Table 5.4 MIF Single Phase AC Line Filter Engineering Specifications

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>SINGLE PHASE 6A</th>
<th>SINGLE PHASE 10A</th>
<th>SINGLE PHASE 23A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P/N 401-30222-00</td>
<td>P/N 401-30216-00</td>
<td>P/N 401-30217-00</td>
</tr>
<tr>
<td>A</td>
<td>170 mm 6.7 in</td>
<td>214 mm 8.4 in</td>
<td>214 mm 8.4 in</td>
</tr>
<tr>
<td>A1</td>
<td>152 mm 6.0 in</td>
<td>192 mm 7.6 in</td>
<td>192 mm 7.6 in</td>
</tr>
<tr>
<td>A2</td>
<td>9 mm 0.4 in</td>
<td>11 mm 0.4 in</td>
<td>11 mm 0.4 in</td>
</tr>
<tr>
<td>B</td>
<td>92 mm 3.6 in</td>
<td>145 mm 5.7 in</td>
<td>204 mm 8.0 in</td>
</tr>
<tr>
<td>B1</td>
<td>55 mm 2.2 in</td>
<td>104 mm 4.1 in</td>
<td>164 mm 6.6 in</td>
</tr>
</tbody>
</table>
### SINGLE PHASE 6A
P/N 401-30222-00

### SINGLE PHASE 10A
P/N 401-30216-00

### SINGLE PHASE 23A
P/N 401-30217-00

#### DIMENSIONAL DATA

<table>
<thead>
<tr>
<th>MEASUREMENT</th>
<th>mm</th>
<th>in</th>
<th>mm</th>
<th>in</th>
<th>mm</th>
<th>in</th>
</tr>
</thead>
<tbody>
<tr>
<td>B2</td>
<td>18</td>
<td>0.7</td>
<td>20</td>
<td>0.8</td>
<td>20</td>
<td>0.8</td>
</tr>
<tr>
<td>C</td>
<td>25</td>
<td>1.0</td>
<td>40</td>
<td>1.6</td>
<td>47</td>
<td>1.8</td>
</tr>
<tr>
<td>C1</td>
<td>10</td>
<td>0.4</td>
<td>16</td>
<td>0.6</td>
<td>19</td>
<td>0.8</td>
</tr>
<tr>
<td>C2</td>
<td>15</td>
<td>0.6</td>
<td>24</td>
<td>1.0</td>
<td>28</td>
<td>1.0</td>
</tr>
</tbody>
</table>

#### ELECTRICAL and MECHANICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Voltage/Freq.</th>
<th>250 VAC @ 50/50 Hz</th>
<th>250 VAC @ 50/50 Hz</th>
<th>250 VAC @ 50/50 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>6A @ 50°C</td>
<td>10A @ 50°C</td>
<td>23A @ 50°C</td>
</tr>
<tr>
<td>Overload Current</td>
<td>150% 1 minute</td>
<td>150% 1 minute</td>
<td>150% 1 minute</td>
</tr>
<tr>
<td></td>
<td>200% 1 second</td>
<td>200% 1 second</td>
<td>200% 1 second</td>
</tr>
<tr>
<td>Temperature</td>
<td>-25 to 95°C</td>
<td>-25 to 95°C</td>
<td>-25 to 95°C</td>
</tr>
<tr>
<td>Leakage Current</td>
<td>5 mA @ 240V, 50 Hz</td>
<td>46 mA @ 240V, 50 Hz</td>
<td>200 mA @ 250V, 50 Hz</td>
</tr>
<tr>
<td>Electric Strength</td>
<td>2500 VAC/1 minute</td>
<td>2500 VAC/1 minute</td>
<td>2500 VAC/1 minute</td>
</tr>
<tr>
<td>Power Loss</td>
<td>3.5 Watts (Full Load)</td>
<td>2.7 Watts (Full Load)</td>
<td>10 Watts (Full Load)</td>
</tr>
<tr>
<td>Terminals</td>
<td>2mm sq. spring clamp</td>
<td>M4 screw cross/ sq.</td>
<td>M4 screw cross/ sq.</td>
</tr>
<tr>
<td></td>
<td>2x 2.5mm</td>
<td>2x 2.5mm</td>
<td>2x 2.5mm</td>
</tr>
<tr>
<td>Weight</td>
<td>0.3 Kg (0.66 Lb.)</td>
<td>0.95 Kg (2.0 Lb)</td>
<td>1.6 Kg (2.5 Lb)</td>
</tr>
<tr>
<td>Back Mounting</td>
<td>4 x M4</td>
<td>4 x M4</td>
<td>4 x M4</td>
</tr>
<tr>
<td>Side Mounting</td>
<td>2 x M5</td>
<td>2 x M6</td>
<td>2 x M6</td>
</tr>
</tbody>
</table>

Line filters are manufactured to millimeter dimensions (inches are approximate conversions).
Power Wiring Diagram

<table>
<thead>
<tr>
<th>MOTOR POWER WIRES R,S,T,GND</th>
<th>MOTOR POWER CONNECTOR</th>
<th>INPUT POWER WIRES</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOTOR</td>
<td>MOTOR POWER WIRING CONNECTOR CONTACT SIZE (GAUGE/mm²)</td>
<td>MOTOR POWER MINIMUM CONTACT SIZE POWER WIRE (GAUGE/mm²)</td>
</tr>
<tr>
<td></td>
<td>Terminal</td>
<td>Y</td>
</tr>
<tr>
<td>VM</td>
<td>16 AWG/1.5mm²</td>
<td>16 AWG/1.5mm²</td>
</tr>
<tr>
<td>HSM3/3</td>
<td>14 AWG/2.5mm²</td>
<td></td>
</tr>
<tr>
<td>HSM3/4</td>
<td>12 AWG/4.0mm²</td>
<td></td>
</tr>
<tr>
<td>HSM3/5</td>
<td>14 AWG/2.5mm²</td>
<td></td>
</tr>
<tr>
<td>HSM3</td>
<td>12 AWG/4.0mm²</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INPUT POWER WIRES</th>
<th>RECOMMENDED POWER WIRE (GAUGE/mm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Terminals</td>
<td>DCM 007 11.12A / 16 AWG/1.5mm²</td>
</tr>
<tr>
<td></td>
<td>DCM 015 11.12A / 14 AWG/2.5mm²</td>
</tr>
<tr>
<td></td>
<td>DCM 020 11.12A / 12 AWG/4.0mm²</td>
</tr>
</tbody>
</table>

NOTES

1. A SURGE DISCONNECT DEVICE IS REQUIRED FOR MAINTENANCE & SAFETY. LOCAL REGULATIONS SHOULD BE OBSERVED. IF A SCHURMANN'S HEAT-INDICATING UNIT IS USED, A RESISTOR OF 12 OHMS MAY BE INSTALLED ON FUSES.

2. CURRENT RATINGS ARE NOTATION OF THE INPUT VOLTAGE REDUCED VOLTAGE WILL RESULT IN A REDUCTION IN SPEED. BUT NOT TO 1.

3. DRIVE MOUNTS MAY BE POWERED FROM ONE TRANSFORMER OR OTHER AC SUPPLY SOURCE.


5. WIRE SIZES ARE MINIMUMS RECOMMENDED VALUES. THE INSTRUCTIONS OF LOCAL REGULATIONS SHOULD BE OBSERVED.

6. REMOVABLE MOTOR POWER CABLES MEET THE DRIVE WITH THE WIRING PROCEED. THIS WIRING CAN BE USED FOR CURTAIN ROLLER APPLICATIONS. THE FUSE CABLES ARE USED IN THIS MANNER. THE BLOB BRACKET SYSTEMS DO NOT OVERFLOW.

REVISED DECEMBER 10, 1988
### DIGITAL DRIVE MODULE INPUT CURRENT REQUIREMENTS

<table>
<thead>
<tr>
<th>ADVANTAGE TERMINAL</th>
<th>CURRENT REQUIREMENTS, MAXIMUM (AMPS AC RMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSM 007</td>
<td>100 Amps AC at 100-240 Volts AC</td>
</tr>
<tr>
<td>DSM 015</td>
<td>100 Amps AC at 100-240 Volts AC</td>
</tr>
<tr>
<td>DSM 030</td>
<td>180 Amps AC at 100-240 Volts AC</td>
</tr>
</tbody>
</table>

**NOTE:** Power initialization requires a short period of inrush current of 100A for the input dual element time delay fuse. Slow blow fuses are recommended. Fuse sizes must be selected according to local regulations.

---

**DIAGRAM:**

- Motor Power Connector
- Motor Power Wiring
- Common Grounding Point for Alternate System (One Per Axis)

---

**Installation Manual for Models DSM 007, DSM 015 and DSM 030**
This chapter provides information about:

- Interface signals available on the Centurion DSM Drive
  - J1 - The Controller interface for commanding and reporting motion
  - J2 - The Encoder interface for reporting movement by the motor
  - J5 - The Serial interface for communicating with the drive.
- Commonly encountered interface cabling methods
- Optional signal extension kits and standard cables.

**J1 - Controller**

J1 is a 50 pin female mini-D connector (AMP 2-178238-7) for connecting a host computer or controller to the drive. Contact between the connector’s shell and the grounded chassis provides shield termination. This section lists the connector pin-outs and provides signal specifications.
### Table 6.1 J1 Controller Pin-Outs

<table>
<thead>
<tr>
<th>Pin &amp; Signal</th>
<th>Description</th>
<th>Pin &amp; Signal</th>
<th>Description</th>
<th>Pin &amp; Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>+5VDC Encoder +5V DC</td>
<td>20</td>
<td>ENABLE Drive Enable</td>
<td>39</td>
<td>Reserved</td>
</tr>
<tr>
<td>2</td>
<td>ECOM Encoder Common</td>
<td>21</td>
<td>RESET Fault Reset</td>
<td>40</td>
<td>Reserved</td>
</tr>
<tr>
<td>3</td>
<td>+5VDC Encoder +5V DC</td>
<td>22</td>
<td>CMND+ Analog Command+</td>
<td>41</td>
<td>Reserved</td>
</tr>
<tr>
<td>4</td>
<td>ECOM Encoder Common</td>
<td>23</td>
<td>CMND- Analog Command-</td>
<td>42</td>
<td>OUTPUT 1 Selectable Output 1</td>
</tr>
<tr>
<td>5</td>
<td>I/O PWR External I/O Power (12-24 VDC)</td>
<td>24</td>
<td>READY+ Drive Ready+</td>
<td>43</td>
<td>OUTPUT 2 Selectable Output 2</td>
</tr>
<tr>
<td>6</td>
<td>I/O COM External I/O Common</td>
<td>25</td>
<td>READY- Drive Ready-</td>
<td>44</td>
<td>Reserved</td>
</tr>
<tr>
<td>7</td>
<td>AOUT+ Motor Encoder Output Channel A+</td>
<td>26</td>
<td>I/O PWR External I/O Power (12-24 VDC)</td>
<td>45</td>
<td>Reserved</td>
</tr>
<tr>
<td>8</td>
<td>AOUT- Motor Encoder Output Channel A-</td>
<td>27</td>
<td>I LIMIT Current Limit</td>
<td>46</td>
<td>Reserved</td>
</tr>
<tr>
<td>9</td>
<td>BOUT+ Motor Encoder Output Channel B+</td>
<td>28</td>
<td>ACOM Analog Common</td>
<td>47</td>
<td>Reserved</td>
</tr>
<tr>
<td>10</td>
<td>BOUT- Motor Encoder Output Channel B-</td>
<td>29</td>
<td>Reserved</td>
<td>48</td>
<td>Reserved</td>
</tr>
<tr>
<td>11</td>
<td>IOUT+ Motor Encoder Output Channel I+</td>
<td>30</td>
<td>Reserved</td>
<td>49</td>
<td>BRAKE+ Brake Enable+ (Drive Enabled+)</td>
</tr>
<tr>
<td>12</td>
<td>IOUT- Motor Encoder Output Channel I-</td>
<td>31</td>
<td>ANALOG1 Analog Output 1</td>
<td>50</td>
<td>BRAKE- Brake Enable- (Drive Enabled-)</td>
</tr>
<tr>
<td>13</td>
<td>I/O COM External I/O Common</td>
<td>32</td>
<td>INPUT1 Selectable Input 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>AX+/CW+/STEP+ Auxiliary Encoder Channel A+</td>
<td>33</td>
<td>INPUT2 Selectable Input 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>AX-/CW-/STEP- Auxiliary Encoder Channel A-</td>
<td>34</td>
<td>INPUT3 Selectable Input 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>BX+/CCW+/DIR+ Auxiliary Encoder Channel B+</td>
<td>35</td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>BX-/CCW-/DIR- Auxiliary Encoder Channel B-</td>
<td>36</td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>IX+ Auxiliary Encoder Channel I+</td>
<td>37</td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>IX- Auxiliary Encoder Channel I-</td>
<td>38</td>
<td>Reserved</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Cables are available in various lengths for connecting between J1 and a suitable controller. The appendix “Options and Accessories” on page A-235 lists the cables. “J1 Terminal Strip/Breakout Board” on page 6-116 details the optional signal extension kit that is available. “Interface Cable Examples” beginning on page 6-108 depict various interface cable types commonly encountered in applications.
Digital I/O Power

The drive requires an external 12 to 24VDC power source for the inputs and outputs.

External I/O Power

The external I/O power supply must be capable of supplying at least 250 mA.

The pin-outs are:

- I/O PWR (12 to 24 Volts)
- I/O COM

J1-5 J1-26
J1-6 J1-13

The external I/O COM must be grounded to meet the European Low Voltage Directive (LVD).

Digital Inputs

Centurion DSM Drives have active high inputs, which prevent disconnects and ground faults from activating a drive. The typical ON time for an input to be recognized is 2.0 msec.

Figure 6.1 Digital Input Circuit

Two discrete input circuits types are available on the J1 connector. Both circuits support logic type interfaces with optically isolated, single ended and active high characteristics.

Dedicated Control Circuits

The ENABLE input interface with switch closures or sourcing type outputs.
Selectable Circuits

INPUT 1, INPUT 2, INPUT 3 and FAULT RESET operate with switch closures or sourcing type circuitry. Selectable inputs are:

<table>
<thead>
<tr>
<th>Not Assigned (default)</th>
<th>Reverse Enable</th>
<th>Start Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Mode Select</td>
<td>Operation Mode Override</td>
<td>Define Home</td>
</tr>
<tr>
<td>Integrator Inhibit</td>
<td>Preset Select A</td>
<td>Sensor (available only on INPUT 2)</td>
</tr>
<tr>
<td>Follower Enable</td>
<td>Preset Select B</td>
<td>Remove COMMAND Offset</td>
</tr>
<tr>
<td>Forward Enable</td>
<td>Preset Select C</td>
<td></td>
</tr>
<tr>
<td>Fault Reset</td>
<td>Start Homing</td>
<td></td>
</tr>
</tbody>
</table>

Refer to the I/O Configuration section of the on-line DSMPro Help for information on choosing the input type for each channel.

Table 6.2 General and Dedicated Inputs

<table>
<thead>
<tr>
<th>Digital Input</th>
<th>Pin Number</th>
<th>Function/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENABLE</td>
<td>J1-20</td>
<td>Enables and disables the drive. Motor torque cannot be applied unless the ENABLE input is active.</td>
</tr>
<tr>
<td>FAULT RESET</td>
<td>J1-21</td>
<td>General purpose input selectable to one of several drive functions. Refer to DSMPro on-line Help and the table below for I/O configuration.</td>
</tr>
<tr>
<td>INPUT 1</td>
<td>J1-32</td>
<td></td>
</tr>
<tr>
<td>INPUT 2</td>
<td>J1-33</td>
<td></td>
</tr>
<tr>
<td>INPUT 3</td>
<td>J1-34</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.3 INPUT1, INPUT2 and INPUT3 Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive Mode Select</td>
<td>Active¹ state configures the drive for Torque Mode. Inactive² state selects the personality EEPROM setting as the command source.</td>
</tr>
<tr>
<td>Integrator Inhibit</td>
<td>Active¹ state zeros the Velocity Loop Error Integrator.</td>
</tr>
<tr>
<td>Follower Enable</td>
<td>Active¹ state allows the position loop to track the AUXILIARY POSITION LOOP signal when in the Follower mode.</td>
</tr>
</tbody>
</table>
### Forward Enable

Active\(^1\) state allows forward commands in velocity mode only. If this input is inactive or not connected, no velocity command will be allowed in the forward direction. If motion is in progress when the input is pulled low or disconnected, the drive halts immediately without deceleration control. The COMMAND signal is clamped internally to 0 Volts.

### Reverse Enable

Active\(^1\) state allows reverse commands in velocity mode only. If this input is inactive or not connected, no velocity command will be allowed in the reverse direction. If motion is in progress when the input is pulled low or disconnected, the drive halts immediately without deceleration control. The COMMAND signal is clamped internally to 0 Volts.

### Operation Mode Override

Active\(^1\) state selects the Operation Mode Override setting as the command source. Inactive\(^2\) state selects the Operation Mode setting as the command source. Table 6.4 on page 6-86 lists the valid Operation Mode and Operation Mode Override combinations.

### Preset Select A

- **Active\(^1\)** or **Inactive\(^2\)** states select one of the eight presets shown in the following binary table:

<table>
<thead>
<tr>
<th>Preset</th>
<th>C</th>
<th>B</th>
<th>A</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Preset 0 or Index 0 is selected.</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Preset 1 or Index 1 is selected.</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Preset 2 or Index 2 is selected.</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Preset 3 or Index 3 is selected.</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Preset 4 or Index 4 is selected.</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Preset 5 or Index 5 is selected.</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Preset 6 or Index 6 is selected.</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Preset 7 or Index 7 is selected.</td>
</tr>
</tbody>
</table>

### Start Index

A change from inactive to active starts an indexing move.

### Define Home

A change from inactive to active defines the home position for absolute indexing.

### Sensor

A change from inactive to active is sensed as a registration or home sensor. NOTE: This selection is available only on INPUT 2.

### Remove COMMAND Offset

A change from inactive to active sets the offset of the analog COMMAND input to achieve a zero command.
Fault Reset | A change from inactive to active will clear any faults and re-enable the drive, if any faults were pending.
---|---
Start Homing | A change from inactive to active will start the homing procedure.

1. Active state indicates current flow through the input optocoupler.
2. Inactive state indicates no current flow.

The specifications for these inputs are listed in Table 6.5 on page 6-87.

### Table 6.4 Operation and Override Mode Combinations

<table>
<thead>
<tr>
<th>Operation Modes</th>
<th>Analog Velocity</th>
<th>Analog Torque</th>
<th>Preset Velocity</th>
<th>Preset Torque</th>
<th>Follower Master Encoder</th>
<th>Follower Step/Dir</th>
<th>Follower Step Up/Down</th>
<th>Indexing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Velocity</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Analog Torque</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Preset Velocity</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Preset Torque</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Follower Master Encoder</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Follower Step/Dir</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Follower Step Up/Down</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Indexing</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
Table 6.5 Digital Input Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON state Voltage</td>
<td>Voltage applied to the input to guarantee an ON state.</td>
<td>10.8 VDC</td>
<td>28 VDC</td>
</tr>
<tr>
<td>ON state Current</td>
<td>Current flow into the input to guarantee an ON state.</td>
<td>3.0 mA</td>
<td>10.0 mA</td>
</tr>
<tr>
<td>OFF state Voltage</td>
<td>Voltage applied to the input to guarantee an OFF state.</td>
<td>-1 VDC</td>
<td>2 VDC</td>
</tr>
<tr>
<td>OFF state Current</td>
<td>External leakage current into the input to guarantee an OFF state.</td>
<td>-0.5 mA</td>
<td>0.5 mA</td>
</tr>
</tbody>
</table>
Input Interface Circuit Examples

Figure 6.2 Drive Input Connected to a Switch/Relay Contact

Figure 6.3 Drive Input Connected to an Opto-Isolator

Figure 6.4 Drive Input Connected to an Active High Sourcing Transistor
Installation Manual for Models DSM 007, DSM 015 and DSM 030
Digital Outputs

Two types of discrete output circuits are available on the J1 connector:

- Dedicated relay outputs
- Selectable transistor based outputs

Both types support 12-24 VDC logic interfaces:

Dedicated Relay Outputs

BRAKE/DRIVE ENABLED and DRIVE READY. Each output is a normally open relay. The relays are rated for 1 Amp at 30 VDC.

➤ NOTE: The Brake contacts may be used to control 24VDC brakes on Giddings & Lewis motors with a 4” frame or smaller. A user provided relay may be driven by these outputs if higher power levels are required. Refer to Figure 6.10 for examples.

Selectable Transistor Outputs

OUTPUT 1 and OUTPUT 2 are optically isolated and short circuit protected, active high, single ended transistor output channels. Each channel sources a maximum of 50 mA.

Figure 6.8 READY and BRAKE/DRIVE ENABLED Circuits

READY and BRAKE/DRIVE ENABLED Circuits

The specifications for these outputs are listed in Table 6.6 on page 6-91.
Table 6.6 READY and BRAKE/DRIVE ENABLED Output Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON state resistance</td>
<td>Internal resistance between J1-24 (+) and J1-25 (-) or J1-49 (+) and J1-50 (-) when the contacts are closed.</td>
<td>1 Ohm</td>
</tr>
<tr>
<td>ON state current</td>
<td>Current flow through the relay when contacts are closed.</td>
<td>1 Amp</td>
</tr>
<tr>
<td>OFF state current</td>
<td>Leakage current from either output when the relay contacts are open.</td>
<td>0.01 mA</td>
</tr>
<tr>
<td>OFF state Voltage</td>
<td>Voltage difference between the outputs with open relay contacts.</td>
<td>30 Volts</td>
</tr>
</tbody>
</table>

Figure 6.9 Digital Output Circuit.

Figure 6.10 depicts a typical applications for the BRAKE/DRIVE ENABLE outputs. Table 6.7 lists the current draw for 24VDC and 90VDC brake coils on Giddings & Lewis motors suitable for use with a DSM 007, 007P, 015, 015P, 030, or 030P.
Figure 6.10 BRAKE/DRIVE ENABLE Application Examples

Suggested brake wiring when 24VDC brake current exceeds 500mA or for 90VDC brakes:
Table 6.7 Current Draw for Brake Motor Coils

<table>
<thead>
<tr>
<th>MOTOR</th>
<th>24VDC</th>
<th>90VDC</th>
<th>MOTOR</th>
<th>24VDC</th>
<th>90VDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSM3XXX</td>
<td>0.60A</td>
<td>0.098A</td>
<td>YSM102</td>
<td>0.26A</td>
<td>NA</td>
</tr>
<tr>
<td>HSM4XXX</td>
<td>0.69A</td>
<td>0.17A</td>
<td>YSM103</td>
<td>0.26A</td>
<td>NA</td>
</tr>
<tr>
<td>SSM3XXX (old)</td>
<td>0.60A</td>
<td>0.21A</td>
<td>YSM206</td>
<td>0.31A</td>
<td>NA</td>
</tr>
<tr>
<td>SSM4XXX (old)</td>
<td>0.88A</td>
<td>0.26A</td>
<td>YSM212</td>
<td>0.31A</td>
<td>NA</td>
</tr>
<tr>
<td>SSM3XXX (new)</td>
<td>0.60A</td>
<td>0.098A</td>
<td>YSM323</td>
<td>0.37A</td>
<td>NA</td>
</tr>
<tr>
<td>SSM4XXX (new)</td>
<td>0.69A</td>
<td>0.17A</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6.8 Selectable Output Circuits

<table>
<thead>
<tr>
<th>Digital Output</th>
<th>Pin Number</th>
<th>Function/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>READY</td>
<td>J1-24 (+)</td>
<td>Relay closure indicates the drive is operational and does not have a fault. Refer to “READY and BRAKE/DRIVE ENABLED Output Specifications” on page 6-91</td>
</tr>
<tr>
<td></td>
<td>J1-25 (-)</td>
<td></td>
</tr>
<tr>
<td>BRAKE</td>
<td>J1-49 (+)</td>
<td>Relay closure releases the brake. Delay time is selectable (Refer to DSMPro - I/O configuration) and may be used as a drive enabled output. This signal is the inverse of the ENABLE output, although a time delay may be selected. Refer to “READY and BRAKE/DRIVE ENABLED Output Specifications” on page 6-91</td>
</tr>
<tr>
<td></td>
<td>J1-50 (-)</td>
<td></td>
</tr>
<tr>
<td>OUTPUT 1</td>
<td>J1-42</td>
<td>General purpose output. Selectable from one of several drive functions. (Refer to DSMPro - I/O configuration online Help and Table 6.9.)</td>
</tr>
<tr>
<td>OUTPUT 2</td>
<td>J1-43</td>
<td>General purpose output. Selectable from one of several drive functions. (Refer to DSMPro - I/O configuration online Help and Table 6.9.)</td>
</tr>
</tbody>
</table>

Table 6.9 OUTPUT1 and OUTPUT2 Functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Position</td>
<td>An active state indicates the position window condition is satisfied, and the zero speed condition is satisfied. The position window and zero speed range are selectable settings.</td>
</tr>
<tr>
<td>Within Window</td>
<td>An active state indicates the position window condition is satisfied. The position window range is a selectable setting.</td>
</tr>
</tbody>
</table>
Zero Speed | An active state indicates the velocity loop zero speed signal is active. The zero speed limit is a selectable setting.
---|---
Speed Window | An active state indicates the velocity loop speed window is active. The speed window range is a selectable setting.
Current Limit | An active state indicates the torque current is limited.
Up To Speed | An active state indicates the velocity loop AT SPEED signal is active. The at speed level is a selectable setting.
Drive Enabled | An active state indicates the ENABLE signal is active and no fault is detected.
Bus Charged | An active state indicates the DC bus is energized.
Disabling Fault | An active state indicates a fault disabled the drive.
In Motion | An active state indicates the indexing sequence is in the motion portion.
In Dwell | An active state indicates the indexing sequence is in the dwell portion.
Sequence Complete | An active state indicates all batches of the indexing sequence are finished.
Registered | An active state indicates the indexing move has been adjusted after sensing the registration sensor.
At Home | An active state indicates the drive is at the home position.
Axis Homed | An active state indicates the drive has been homed.

NOTE: Refer to the I/O Configuration section of the DSMPro on-line Help for further explanation of these output signals.

Table 6.10 Transistor Output Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON state Voltage</td>
<td>Voltage difference between the external I/O power supply and the output when the transistor is ON.</td>
<td>0 VDC</td>
<td>1.5 VDC</td>
</tr>
<tr>
<td>ON state current</td>
<td>Current flow when the transistor is ON.</td>
<td>0 mA</td>
<td>50 mA</td>
</tr>
<tr>
<td>OFF state Voltage</td>
<td>Voltage difference between the external I/O power supply and the output when the transistor is OFF.</td>
<td>0 Volts</td>
<td>50 Volts</td>
</tr>
<tr>
<td>OFF state current</td>
<td>Leakage current from the output when the transistor is OFF.</td>
<td>-0.1 mA</td>
<td>0.1 mA</td>
</tr>
</tbody>
</table>
Output Interface Circuit Examples

Figure 6.11 Drive Output Connected to an Opto-Isolator

![Diagram of Drive Output Connected to an Opto-Isolator]

Figure 6.12 Drive Output Connected to an LED Indicator

![Diagram of Drive Output Connected to an LED Indicator]

Figure 6.13 Drive Output Connected to a Resistive Load

![Diagram of Drive Output Connected to a Resistive Load]
Figure 6.14 Drive Output Connected to a Switch/Relay

Figure 6.15 Drive Output Connected to Active Low Input using a Switch/Relay
Figure 6.16 Drive Output Connected to Active Low Input using an Opto-Isolator

![Circuit Diagram for Active Low Input](image)

Figure 6.17 Drive Output Connected to Active High (Sinking) Input

![Circuit Diagram for Active High Input](image)
Analog Inputs

Two types of analog input circuits are available on the J1 connector:

- The current limiting input supports 0 to +10 Volt signals
- The command input supports 0 to ±10 Volt signals.

External Current Limit (I LIMIT)

Figure 6.18 External Current Limit Circuit

![External Current Limit Circuit Diagram]

I LIMIT limits the current, which provides torque, to the motor. The range is 0 to +10 Volts (where 10 Volts corresponds to maximum drive current). The analog I LIMIT signal is converted into a digital word by a 10-bit ADC (analog to digital converter). If the I LIMIT input is not connected, current is not limited.

Table 6.11 Analog Inputs (I LIMIT)

<table>
<thead>
<tr>
<th>Analog Input (I LIMIT)</th>
<th>Pin Number</th>
<th>Function/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Limit</td>
<td>J1-27</td>
<td>Limits the peak current command, which produces torque.</td>
</tr>
</tbody>
</table>

Table 6.12 External Current Limit Input Specification

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Current</td>
<td>Short circuit between the input and ground.</td>
<td>-1.5 mA</td>
<td></td>
</tr>
<tr>
<td>Input Signal Range</td>
<td>Allowable voltage applied to the input.</td>
<td>0 Volts</td>
<td>+10 Volts</td>
</tr>
</tbody>
</table>
Command Input

Figure 6.19 Analog COMMAND Input Circuit

The analog command signal to the drive has a range of ±10 Volts. The signal is either a torque or a velocity command, depending on the software configuration of the drive. The differential input is processed by a 14 bit analog to digital converter (ADC) to produce a digital value.

Table 6.13 Analog Command Input

<table>
<thead>
<tr>
<th>Analog Input</th>
<th>Pin Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMAND</td>
<td>J1-22 (+)</td>
<td>Analog command signal is a differential type signal to drive the servo controller. If the drive is in Velocity Mode configuration, the differential COMMAND signal is the velocity command. If the drive is in Torque Mode configuration, the differential COMMAND signal is the torque or current command. Separate scale and offset parameters are used for the input, depending on whether the signal is a velocity command or a torque current command.</td>
</tr>
<tr>
<td></td>
<td>J1-23 (-)</td>
<td></td>
</tr>
</tbody>
</table>

Table 6.14 Analog Command Input Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Impedance</td>
<td>Open circuit impedance measured between (+) and (-).</td>
<td>13.3 kOhms</td>
<td></td>
</tr>
<tr>
<td>Input Signal Range</td>
<td>Allowable voltage applied between (+) and (-) inputs.</td>
<td>0 Volts</td>
<td>±10 Volts</td>
</tr>
</tbody>
</table>
Analog Output

Figure 6.20 ANALOG 1 Output Circuit

A selectable output is available for monitoring by the user: ANALOG 1 (J1-31).

**WARNING**

The user must provide an external circuit to ignore the analog output signal for two seconds after power-up. After reset the analog output may be in an indeterminate state for a short period before it stabilizes at the software controlled setting. Failure to observe this precaution could result in severe bodily injury.

Table 6.15 Analog Outputs: ANALOG 1

<table>
<thead>
<tr>
<th>Analog Output</th>
<th>Pin Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANALOG 1</td>
<td>J1-31</td>
<td>Selectable analog output. Displays the selected firmware variable along with selectable scale and offset. The scale or offset are calculated as shown below.</td>
</tr>
<tr>
<td>ACOM</td>
<td>J1-28</td>
<td>Analog Common (return).</td>
</tr>
</tbody>
</table>

Table 6.16 Analog Output Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Current</td>
<td>Allowable current draw of the load</td>
<td>-2 mA</td>
<td>+2 mA</td>
</tr>
<tr>
<td>Output Signal Range</td>
<td>Voltage range of the signal</td>
<td>-10 Volts</td>
<td>+10 Volts</td>
</tr>
</tbody>
</table>
The following signals can be mapped to the analog output.

Current – Command
Current – Average
Current – Peak +
Current – Peak -
Current – Input Limit +
Current – Input Limit -
Velocity – Motor Feedback

Velocity – Command
Velocity – Error
Position – Motor Feedback
Position – Command
Position – Error
Position – Error Peak +
Position – Error Peak -

The following signals can also be monitored when DSMPro is configured for Advanced Mode.

Position – Master
Position – Loop Output
Velocity – Loop Output
Filter Output
R-Phase Current
T-Phase Current
Torque Current
Field Current
Torque Voltage Command
Field Voltage Command
Analog COMMAND Input
Bus Voltage

Motor Encoder Output Signal

Figure 6.21 Output Encoder Interface Circuits

The motor quadrature encoder signals are supplied to an external position controller. The signals are differential, quadrature, and TTL level. The output resolution is selectable and can be divided by 1, 2, 4 or 8.
The signal frequency \( f_{\text{out}} \) of the motor encoder output in Hertz (Hz) can be calculated with the equation:

\[
f_{\text{out}} = \frac{V_m \cdot \text{linecount}}{60 \cdot N}
\]

where:
- \( V_m \) is the motor encoder velocity in rpm
- Line count is the number of encoder lines/revolution of the motor mounted encoder, and
- \( N \) is the output divider from the software selected parameter (1, 2, 4 or 8).

If the device connected to the motor encoder output counts all edges, the count frequency is four times \( f_{\text{out}} \).

For example, a motor with a 2000 line encoder is rotating at 3000 rpm, and the Motor Encoder Output signal is set to Divide by 1, the encoder signal frequency is:

\[
f_{\text{out}} = \frac{3000 \cdot 2000}{60 \cdot 1} = 100 kHz
\]

A counter counting all edges registers 400 kHz for this example.

**Table 6.17 Motor Encoder Output Signal**

<table>
<thead>
<tr>
<th>Analog Output</th>
<th>Pin Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AOUT (+)</td>
<td>J1-7 (+)</td>
<td>Motor Output Channels A(+) and A(-). Differential TTL levels from line driver. Signal resolution is selectable.</td>
</tr>
<tr>
<td>AOUT (-)</td>
<td>J1-8 (-)</td>
<td></td>
</tr>
<tr>
<td>BOUT (+)</td>
<td>J1-9 (+)</td>
<td>Motor Output Channels B(+) and B(-). Differential TTL levels from line driver. Signal resolution is selectable.</td>
</tr>
<tr>
<td>BOUT (-)</td>
<td>J1-10 (-)</td>
<td></td>
</tr>
<tr>
<td>IOUT (+)</td>
<td>J1-11 (+)</td>
<td>Motor Output Channels I(+) and I(-). Differential TTL levels from line driver. Output pulse occurs once per motor shaft revolution.</td>
</tr>
<tr>
<td>IOUT (-)</td>
<td>J1-12 (-)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 6.18 Motor Encoder Output Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential Output Voltage</td>
<td>Voltage measured between the (+) and (-) pins with ( R_L = 100 ) Ohm.</td>
<td>2.0 Volts</td>
<td></td>
</tr>
<tr>
<td>Output Current</td>
<td>Current flowing out of the (+) or (-) pin.</td>
<td>-20 mA</td>
<td>+20 mA</td>
</tr>
</tbody>
</table>
IOUT Signal Generation

The Index output signal (IOUT) is not synchronized to a particular state of the A and B output signals (AOUT and BOUT). Some controllers, such as those used in the CNC industry, use the condition I=1, A=1, B=1 to indicate a home position. In such applications the encoder outputs from the drive cannot be used, since it cannot be guaranteed that the IOUT signal will be active during the state AOUT=1, BOUT=1. Instead, the unbuffered motor encoder signals can be used as shown below. The J2 Breakout Board assembly connects the motor encoder signals directly to the position feedback of the controller.

Figure 6.22 J2 Breakout Board Assembly - European Union

EMC Compliance

NOTE: An asterisk (*) indicates an installation option to comply with EU EMC Directives. Either a grounded metal enclosure or ferrite cores provide the requisite EMC protection.

NOTE: If a controller connected to the drive requires the Index Output (IOUT) signal to be synchronized to a particular state of the A and B Outputs (AOUT and BOUT) the unbuffered encoder outputs from the motor must be used.
J2 Breakout Board Assembly - European Union EMC Compliance

Two options are available to achieve EMC compliance when a Centurion DSM Drive uses the J2 Breakout Board Assembly to transfer an unbuffered encoder signal to a control device. Either method of installation reduces the radiated emissions to an acceptable level. Be aware that either installation option is in addition to the EMC requirements specified elsewhere in this manual.

- Install the drive and J2 breakout board assembly (terminal block and cable), and the pigtailed cable inside a grounded metal enclosure.
- or -

- Install ferrites of an appropriate rating at the specific locations:
  A. J2 Cable - 230 Ohm @ 100 MHz toroid (FerriShield P/N SS28B2032) immediately adjacent to the J2 connector on the drive.
  B. Pigtailed Motor Encoder Cable - 215 Ohm @ 100 MHz ribbon cable clamp (Fair-Rite P/N 2643164051 and two clips Fair-Rite P/N 0199001401) over the unshielded conductors.

**NOTE:** Drives are tested using specific installation methods, and the information above is based on successful tests. If the drives are installed in this manner, then compliance with European EMC requirements may be expected, although it is impossible to guarantee that a specific installation will meet EMC requirements without testing it.
The drive may be electronically geared by a remote signal. Electronic gearing may be driven by any of the following three signals:

A master incremental encoder that generates quadrature encoder signals

Step and direction signals, such as those created by indexers for step motors

CW (Step Up)/CCW (Step Down) signals, typically used with stepper indexers.

➤ NOTE: The use of differential signals is strongly recommended. Single-ended signals are susceptible to noise, which may cause intermittent or continuous errors.

➤ NOTE: To improve noise immunity, terminate cable shields at both ends of the cable. Connect shields to the backshell of the connector with a complete circumferential (360°) termination. The cable connector should then connect to chassis ground (not signal ground).
Figure 6.24 Auxiliary Encoder Input Circuit

Table 6.19 Motor Encoder Output Signal

<table>
<thead>
<tr>
<th>Auxiliary Encoder Input</th>
<th>Pin Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX+ and AX-, or Step+ and Step-, or CW+ (Step Up+) and CW- (Step Up-)</td>
<td>J1-14 (+)</td>
<td>Auxiliary Channels A(+) and A(-). Differential, quadrature, or TTL level encoder input. The signal input and resolution are selectable.</td>
</tr>
<tr>
<td>AX+ and AX-, or Step+ and Step-, or CW+ (Step Up+) and CW- (Step Up-)</td>
<td>J1-15 (-)</td>
<td>Auxiliary Channels A(+) and A(-). Differential, quadrature, or TTL level encoder input. The signal input and resolution are selectable.</td>
</tr>
<tr>
<td>BX+ and BX(-), or DIR+ and DIR(-), or CCW+ (Step Down+) and CCW- (Step Down-)</td>
<td>J1-16 (+)</td>
<td>Auxiliary Channels B(+) and B(-). Differential, quadrature, or TTL level encoder inputs. The signal input and resolution are selectable.</td>
</tr>
<tr>
<td>BX+ and BX(-), or DIR+ and DIR(-), or CCW+ (Step Down+) and CCW- (Step Down-)</td>
<td>J1-17 (-)</td>
<td>Auxiliary Channels B(+) and B(-). Differential, quadrature, or TTL level encoder inputs. The signal input and resolution are selectable.</td>
</tr>
<tr>
<td>IX+ and IX(-)</td>
<td>J1-18 (+)</td>
<td>Auxiliary Input Channels I(+) and I(-). Differential, quadrature, or TTL level encoder inputs.</td>
</tr>
<tr>
<td>IX+ and IX(-)</td>
<td>J1-19 (-)</td>
<td>Auxiliary Input Channels I(+) and I(-). Differential, quadrature, or TTL level encoder inputs.</td>
</tr>
</tbody>
</table>

The input circuits shown in the following diagrams support connections to differential TTL line drivers, single-ended TTL line drivers and open collector devices. These inputs are under software control.
Table 6.20 Quadrature Interface Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON State Voltage</td>
<td>Voltage difference between the + and - inputs that indicate an ON state.</td>
<td>1.0 Volts</td>
<td>+15 Volts</td>
</tr>
<tr>
<td>OFF State Voltage</td>
<td>Voltage difference between the + and - inputs that indicate an OFF state.</td>
<td>-1.0 Volts</td>
<td>-15 Volts</td>
</tr>
<tr>
<td>Common Mode Voltage</td>
<td>Voltage difference between an encoder signal input and the reference ground of the drive.</td>
<td>-15 Volts</td>
<td>+15 Volts</td>
</tr>
<tr>
<td>Current Draw</td>
<td>Current draw into the + input or - input</td>
<td>-5 mA</td>
<td>+5 mA</td>
</tr>
<tr>
<td>A or B Signal Frequency</td>
<td>Frequency of the A or B line inputs. Count frequency is 4 times this frequency, since the circuitry counts each of the four transitions in a single line.</td>
<td></td>
<td>1 MHz</td>
</tr>
<tr>
<td>Index Pulse Width</td>
<td>Pulse width of the index signal. The index signal is active for a percentage of the revolution, therefore the speed of the encoder dictates the pulse width.</td>
<td>500 nsec</td>
<td></td>
</tr>
</tbody>
</table>
## Interface Cable Examples

The use of differential signals is highly recommended. This is due to the immunity of differential signals to common mode interference. Single-ended encoder interface circuits are not recommended, and may result in system malfunction.

To improve noise immunity, a cable shield should terminate at both ends of the cable. Shields should connect to the backshell of the connectors with termination around the full circumference (360°). The connectors should attach to chassis ground (not signal common).

**Figure 6.25 External Encoder Interface via TTL Differential Line Drivers**

<table>
<thead>
<tr>
<th>Ch A</th>
<th>Ch B</th>
<th>Ch I</th>
<th>+5V Supply</th>
<th>+5V Supply Return</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For horizontal dashed lines, connect only if J1 sources Encoder power
Figure 6.26 Complementary Encoder Interface via 7406 Line Drivers with Pull-up Resistors

Figure 6.27 Complementary Encoder Interface via Standard TTL Logic
Figure 6.28 Single-Ended Encoder Interface via Open Collector Transistor without Pull-up (not recommended)

Figure 6.29 Single-Ended Encoder Interface via Standard TTL Signals (not recommended)
Figure 6.30 Single-Ended Encoder Interface via Open Collector Transistor with 5 VDC to 12 VDC Pull-up (not recommended)
Figure 6.31 Single-Ended Encoder Interface via Open Collector Transistor with 24 VDC Pull-up (not recommended)
Table 6.21 Step/Direction and CW/CCW (Step Up/Step Down)
Interface Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal frequency</td>
<td>Frequency of the input signal.</td>
<td></td>
<td>1 MHz</td>
</tr>
<tr>
<td>Pulse Width</td>
<td>Time interval the step (CW/CCW) signal must remain in a single state for detection.</td>
<td>500 nsec</td>
<td></td>
</tr>
<tr>
<td>Setup Time</td>
<td>Time interval the direction (CW/CCW) signal must be stable before the corresponding step (CCW/CW) signal changes state.</td>
<td>500 nsec</td>
<td></td>
</tr>
</tbody>
</table>

The following diagram shows the relationship between STEP and DIRECTION inputs.

![Diagram showing the relationship between STEP and DIRECTION inputs.](#)

Direction data must be steady for this time period.
Figure 6.32 External Step/Direction Interface via TTL Differential Line Drivers

Figure 6.33 External Step/Direction Interface via Single-Ended TTL Line Drivers (not recommended)
Figure 6.34 External CW/CCW (Step Up/Step Down) Interface via TTL Differential Line Drivers

For horizontal dashed lines, connect only if J1 sources +5VDC power to user electronics.

Figure 6.35 External CW/CCW (Step Up/Step Down) Interface via Single-Ended Line Drivers (not recommended)

Connect only if J1 sources +5VDC power to user electronics.

Installation Manual for Models DSM 007, DSM 015 and DSM 030
**J1 Terminal Strip/Breakout Board**

A 50-pin terminal strip kit is available for extending the signals from the J1 connector. The kit includes a 1 meter (3-foot) interface cable, a 50-pin terminal strip and mounting hardware. Refer to “Options and Accessories” on page A-235.

“Cabling Examples” on page B-265 depicts the use of this kit to pass a cable through a bulkhead.
## J2 - Encoder

<table>
<thead>
<tr>
<th>Pin &amp; Signal</th>
<th>Description</th>
<th>Pin &amp; Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EPWR Encoder Power</td>
<td>11</td>
<td>I (+) Motor Encoder Input Channel I(+)</td>
</tr>
<tr>
<td>2</td>
<td>ECOM Encoder Common</td>
<td>12</td>
<td>I (-) Motor Encoder Input Channel I(-)</td>
</tr>
<tr>
<td>3</td>
<td>EPWR Encoder Power</td>
<td>13</td>
<td>A Hall Effect A</td>
</tr>
<tr>
<td>4</td>
<td>ECOM Encoder Common</td>
<td>14</td>
<td>B Hall Effect B</td>
</tr>
<tr>
<td>5</td>
<td>EPWR Encoder Power</td>
<td>15</td>
<td>C Hall Effect C</td>
</tr>
<tr>
<td>6</td>
<td>ECOM Encoder Common</td>
<td>16</td>
<td>ABS Absolute Position</td>
</tr>
<tr>
<td>7</td>
<td>A (+) Motor Encoder Input Channel A(+)</td>
<td>17</td>
<td>Reserved</td>
</tr>
<tr>
<td>8</td>
<td>A (-) Motor Encoder Input Channel A(-)</td>
<td>18</td>
<td>Reserved</td>
</tr>
<tr>
<td>9</td>
<td>B (+) Motor Encoder Input Channel B(+)</td>
<td>19</td>
<td>TS(+) Thermal Switch (+)</td>
</tr>
<tr>
<td>10</td>
<td>B (-) Motor Encoder Input Channel B(-)</td>
<td>20</td>
<td>TS(-) Thermal Switch (-)</td>
</tr>
</tbody>
</table>

Cables are available in various lengths for connecting between J1 and a suitable controller. The appendix "Options and Accessories" on page A-235 lists the cables. "J2 Terminal Strip/Breakout Board" on page 6-120 details the optional signal extension kit.

**CAUTION**

Ensure that encoder signals are connected properly. Incorrect connection of encoder signals will result in improper rotor position and/or incorrect commutation.
Figure 6.36 Motor Encoder Interface Circuit

![Motor Encoder Interface Circuit Diagram]

Figure 6.37 Hall Effect Sensor Circuit

![Hall Effect Sensor Circuit Diagram]

Table 6.22 J2- Motor Encoder Connector Pin-Outs

<table>
<thead>
<tr>
<th>Motor Encoder</th>
<th>Pin Number</th>
<th>Function/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPWR</td>
<td>J2-1, J2-3, J2-5</td>
<td>Encoder power.</td>
</tr>
<tr>
<td>ECOM</td>
<td>J2-2, J2-4, J2-6</td>
<td>Encoder common</td>
</tr>
<tr>
<td>A+</td>
<td>J2-7 (+), J2-8 (-)</td>
<td>Motor Encoder Input Channel A+ and Channel A–. Accepts TTL level signals from a line driver.</td>
</tr>
<tr>
<td>A–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>J2-9 (+), J2-10 (-)</td>
<td>Motor Encoder Input Channel B+ and Channel B–. Accepts TTL level signals from a line driver.</td>
</tr>
<tr>
<td>B–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I+</td>
<td>J2-11 (+), J2-12 (-)</td>
<td>Motor Encoder Input Channel I+ and Channel I–. Accepts TTL level signals from a line driver. Output pulse occurs once per motor shaft revolution. a</td>
</tr>
<tr>
<td>I–</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HALL A</td>
<td>J2-13</td>
<td>Hall Effect A sensor logic level input. Internally pulled up to +5VDC through a 1 kOhm resistor.</td>
</tr>
<tr>
<td>Motor Encoder</td>
<td>Pin Number</td>
<td>Function/Description</td>
</tr>
<tr>
<td>---------------</td>
<td>------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>HALL B</td>
<td>J2-14</td>
<td>Hall Effect B sensor logic level input. Internally pulled up to +5VDC through a 1 kOhm resistor.</td>
</tr>
<tr>
<td>HALL C</td>
<td>J2-15</td>
<td>Hall Effect C sensor logic level input. Internally pulled up to +5VDC through a 1 kOhm resistor.</td>
</tr>
<tr>
<td>ABS</td>
<td>J2-16</td>
<td>Absolute Position used on Giddings &amp; Lewis motors for commutation.</td>
</tr>
<tr>
<td></td>
<td>J2-17</td>
<td>Reserved.</td>
</tr>
<tr>
<td></td>
<td>J2-18</td>
<td>Reserved.</td>
</tr>
<tr>
<td>TS+</td>
<td>J2-19</td>
<td>Thermal Switch + and Thermal Switch – are a motor overtemperature signal.¹</td>
</tr>
<tr>
<td>TS−</td>
<td>J2-20</td>
<td></td>
</tr>
</tbody>
</table>

¹ DSMPro software automatically determines the presence or absence of a motor thermal switch signal based on the motor selected in the Drive Select window. Giddings & Lewis FSM-, HSM-, NSM- and SSM-Series motors typically have thermal switches and signal continuity is provided on these motors. YSM-Series motors do not have thermal switches and signal continuity is not required.
**Figure 6.38 Centurion DSM Drive Motor Encoder Connections**

<table>
<thead>
<tr>
<th>Drive</th>
<th>MOTOR ENCODER</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPWR</td>
<td>+5V</td>
</tr>
<tr>
<td>ECOM</td>
<td>COM</td>
</tr>
<tr>
<td>EPWR</td>
<td></td>
</tr>
<tr>
<td>ECOM</td>
<td></td>
</tr>
<tr>
<td>EPWR</td>
<td></td>
</tr>
<tr>
<td>ECOM</td>
<td></td>
</tr>
<tr>
<td>J2-1</td>
<td>A+</td>
</tr>
<tr>
<td>J2-2</td>
<td>A-</td>
</tr>
<tr>
<td>J2-3</td>
<td>B+</td>
</tr>
<tr>
<td>J2-4</td>
<td>B-</td>
</tr>
<tr>
<td>J2-5</td>
<td>Z+</td>
</tr>
<tr>
<td>J2-6</td>
<td>Z-</td>
</tr>
<tr>
<td>J2-7</td>
<td>HALL A+</td>
</tr>
<tr>
<td>J2-8</td>
<td>HALL A-</td>
</tr>
<tr>
<td>J2-9</td>
<td>HALL B+</td>
</tr>
<tr>
<td>J2-10</td>
<td>HALL B-</td>
</tr>
<tr>
<td>J2-11</td>
<td>HALL C+</td>
</tr>
<tr>
<td>J2-12</td>
<td>HALL C-</td>
</tr>
<tr>
<td>J2-13</td>
<td>ABS</td>
</tr>
<tr>
<td>J2-14</td>
<td>THERMOSTAT+</td>
</tr>
<tr>
<td>J2-15</td>
<td>THERMOSTAT-</td>
</tr>
<tr>
<td>J2-16</td>
<td></td>
</tr>
<tr>
<td>J2-17</td>
<td></td>
</tr>
<tr>
<td>J2-18</td>
<td></td>
</tr>
<tr>
<td>J2-19</td>
<td></td>
</tr>
<tr>
<td>J2-20</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**
1. For encoders with differential Hall outputs (A+, A-, B+, B-, C+ and C-) connect only the + outputs to the drive.
2. The ABS signal is only available on selected Giddings & Lewis encoders.

**J2 Terminal Strip/Breakout Board**

A 25-pin terminal strip kit is available for extending the encoder signals from the J2 connector. The kit includes a 3-foot (1 meter) interface cable a 25-pin terminal strip, and mounting hardware. Refer to "Options and Accessories" on page A-235.

"Cabling Examples" on page B-265 depicts the use of this kit to pass a cable through a bulkhead.
J5 - Serial Port

Table 6.23 J5 Controller Pin-Outs

<table>
<thead>
<tr>
<th>Pin &amp; Signal</th>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RCV(+)</td>
<td>Receive (+)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS-485 (four wire)</td>
</tr>
<tr>
<td>2</td>
<td>RCV</td>
<td>Receive</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS-232</td>
</tr>
<tr>
<td>3</td>
<td>XMT</td>
<td>Transmit</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS-232</td>
</tr>
<tr>
<td>4</td>
<td>XMT(+)</td>
<td>Transmit (+)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS-485 (four wire)</td>
</tr>
<tr>
<td>5</td>
<td>COM</td>
<td>+5 VDC Common</td>
</tr>
<tr>
<td>6</td>
<td>Reserved a</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RCV(-)</td>
<td>Receive (-)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS-485 (four wire)</td>
</tr>
<tr>
<td>8</td>
<td>XMT(-)</td>
<td>Transmit (-)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS-485 (four wire)</td>
</tr>
<tr>
<td>9</td>
<td>Reserved a</td>
<td></td>
</tr>
</tbody>
</table>

a. Do not connect any device to J5-6 or J5-9 except a TouchPad.

J5 is a 9 pin female D-shell connector. This connector is a serial interface that allows communication with another Centurion DSM Drive, a PC, a terminal, a host computer, a controller or an optional TouchPad. The shell of the connector is grounded to the chassis for shield termination.

Figure 6.39 RS-232/485 Interface Circuit

The serial interface of the drive uses the standard NRZ asynchronous serial format, and supports both the RS-232 and the four wire RS-485 communications standards.
Standard baud rates include 1200, 2400, 4800, 9600 and 19200 baud. 9600 is the factory default setting.

Even, odd, and no parity generation/checking are supported. No parity is the factory default setting.

The maximum number of Centurion DSM Drives allowable on a four-wire RS-485 bus is 32.

The maximum length of an RS-232 cable is 15 meters (50 feet).

The maximum length of an RS-485 cable is 1220 meters (4000 feet) with 0.20 mm² (24 AWG) wire.

Cables are available in various lengths for connecting between the serial port of a drive and a control unit, such as a PC. "Options and Accessories" on page A-235 lists the cables, and the male and female connectors for the cables.

NOTE: The shell of the connector is grounded to the chassis for shield termination.

The following table lists the pin-outs for J5.

### Table 6.24 J5 - Serial Port Connector Pin-Outs

<table>
<thead>
<tr>
<th>Auxiliary Encoder Input</th>
<th>Pin Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCV (+)</td>
<td>J5 - 1 (+)</td>
<td>RS-485 differential receiver input (to drive)</td>
</tr>
<tr>
<td>RCV (-)</td>
<td>J5 - 7 (-)</td>
<td></td>
</tr>
<tr>
<td>XMT (+)</td>
<td>J5 - 4 (+)</td>
<td>RS-485 differential transmitter output (from drive)</td>
</tr>
<tr>
<td>XMT (-)</td>
<td>J5 - 8 (-)</td>
<td></td>
</tr>
<tr>
<td>COM</td>
<td>J5 - 5</td>
<td>Common serial port interface</td>
</tr>
<tr>
<td></td>
<td>J5 - 6</td>
<td>Reserved(^{a})</td>
</tr>
<tr>
<td>RCV</td>
<td>J5 - 2</td>
<td>RS-232 receiver input (to drive)</td>
</tr>
<tr>
<td>XMT</td>
<td>J5 - 3</td>
<td>RS-232 transmitter output (from drive)</td>
</tr>
<tr>
<td></td>
<td>J5 - 9</td>
<td>Reserved(^{a})</td>
</tr>
</tbody>
</table>

\(^{a}\) Do not connect any device to J5-6, or J5-9, except a TouchPad.
Serial Communications Overview

Centurion DSM Drives communicate via a standard NRZ (non-return to zero) asynchronous serial format, which supports either RS-232 or four wire RS-485. The pin-out arrangement on the drive serial ports provides self-sensing of the communication standard. To change from RS-232 to four wire RS-485 requires a simple change of the cable.

In multiple drive installations, a unique address must be assigned to each drive through software. The factory default drive address is setting is Address 0. All addresses changes are made through DSMPro software selection. Up to 32 (1 through 32) are supported.

➤ NOTE: Address and communications settings) changes are not immediate; they are logged but do not become active until after the drive is RESET.

Each drive may be assigned a unique name of up to 32 characters in length; a name is often easier to remember than the address of a drive. DSMPro software automatically associates a drive name with the correct drive address.

RS-232 Connections

The address of each drive is set using DSMPro software. Refer to the DSMPro on-line Help.

➤ NOTE: Do not connect any device to J5-6 or J5-9 except a TouchPad.

Single Axis RS-232 Set Up

A single Centurion DSM Drive may be selected using RS-232 communications. After cabling is attached to the unit and the drive address is assigned, configuration of (i.e., communications with) the unit may proceed.

Factory default settings for a Centurion DSM Drive are:

- Address 0
- 9600 Baud
- 8 Data, No Parity, 1 Stop bit

The following steps outline how to select the communications options:
1. Connect an RS-232 cable between the computer and a serial connector on the drive (J5).

**Figure 6.40 RS-232 Connection Diagrams**

![Connection Diagram](image)

*PC pin-outs may vary by manufacturer*

2. Verify the computer can communicate with the drive by performing the following:
A. Switch drive power to ON
B. Start DSMPro on the attached PC
C. Choose CANCEL from the Drive Select window
D. Select Communications from the menu
E. Select PC Set Up from the pull down menu
F. Verify the port settings, and if necessary, change them, then choose OK.
G. Select Communications from the menu
H. Select Read Drive Parameters from the pull down menu
I. Choose OK in the Drive Select window.

3. Verify that DSMPro reads the drive parameters. If not, refer to “Troubleshooting” on page 11-220.

**NOTE:** The Scan Port for Attached Drives option in the Drive Select window of DSMPro will identify any attached drives. If a drive is identified, but cannot be communicated with, the Baud Rate selection must be modified.

The cable diagrams provide wiring examples for both 9 pin and 25 pin serial ports from an IBM compatible personal computer to the drive. RS-232 pin-outs vary between computer manufacturers. Check the hardware reference manual of your machine to ensure correct signal connections between the computer and the drive.
**Four Wire RS-485 Connections**

The Centurion DSM Drives use a variation of the RS-485 standard, known as four wire RS-485. Four wire RS-485 uses one differential signal for host to drive transmissions, and another differential signal for drive to host transmissions. (The RS-485 standard specifies a single differential signal for transmissions in both directions.)

The four wire RS-485 configuration also allows the host to use a RS-422 type interface. Because the host is driving multiple receivers and receiving from multiple transmitters, RS-422 is limited to multiple axes connections with 10 or less drives. The figure below summarizes the four wire RS-485, RS-422, and RS-485 standards.

Figure 6.41 RS-485/RS-422 Communication Comparison

<table>
<thead>
<tr>
<th>Four Wire RS-485</th>
<th>![Diagram]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>4 Wires</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>2 Signal Pairs</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>1 to 32 Transmitters</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>1 to 32 Receivers</td>
<td>![Diagram]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RS-422</th>
<th>![Diagram]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>4 Wires</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>2 Signal Pairs</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>1 Transmitter</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>1 to 10 Receivers</td>
<td>![Diagram]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RS-485 Standard</th>
<th>![Diagram]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Differential</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>2 Wires</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>1 Signal Pair</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>1 to 32 Transmitters</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>1 to 32 Receivers</td>
<td>![Diagram]</td>
</tr>
</tbody>
</table>

NOTE: Not applicable to Centurion DSM Drive drives
Multiple Axes Four-Wire RS-485 Communications

➤ NOTE: Do not connect any device to J5-6 or J5-9 except a TouchPad.

1. Select a previously unused address (1 - 32) from DSMPro - Drive Set Up.

2. Connect cables between:

   A. The host computer and the serial port on the initial drive (J5) in the multiple drive configuration.

   B. The other serial port on the initial drive (J5) and the serial port on the next drive (J5) in the multiple drive configuration

   ➤ NOTE: Flat ribbon cabling is not recommended for RS-485 connections.

3. Verify the communication settings on the computer are correct:

   A. Start DSMPro on the attached PC

   B. Choose CANCEL from the Drive Select window

   C. Select Communications from the menu

   D. Select PC Set Up from the pull down menu.

   E. Verify the port settings, and if necessary, change them, then choose OK.

   ➤ NOTE: Address 0 is the preferred address for the initial configuration of a drive. It forces the drive to the default communications parameters.

4. Verify the ability to communicate between the computer and the connected drives by:
A. Switch drive power to ON

B. Select Communications from the menu

C. Select Read Drive Parameters from the pull down menu

D. Select the drive to communicate with from Drive Select window (the drive must have an address that matches one of the drive addresses in the chain)

E. Choose OK in the Drive Select window.

5. Verify that DSMPro loads the drive parameters. If not, refer to the troubleshooting section.

6. Repeat the preceding two steps for each additional drive.

Four wire RS-485 connections are shown below. The cable diagram provides a wiring example of a daisy chain connection in a typical installation A multi-drop cable, as shown in Figure 6.42 may also be used.

Multiple Axes RS-232 Communications

Multiple axes systems may be controlled by a computer with an RS-232 serial port. An RS-232 serial communication port may be converted to four wire RS-485 communication by attaching an RS-232 to four wire RS-485 converter. The figure below depicts the use of such a device.
Figure 6.42 RS-232 to RS-485 Connection Diagram

*Pin-outs may vary by manufacturer. This example uses a B&B 485 Adapter.

Installation Manual for Models DSM 007, DSM 015 and DSM 030
DC bus, single phase AC power and motor connections are provided on the Terminal Block (TB-1).

Table 7.1 TB1 - DC Bus and AC Power Terminal Block Connections

<table>
<thead>
<tr>
<th>Description</th>
<th>Identifier</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Bus + voltage</td>
<td>DC BUS +</td>
<td>1</td>
</tr>
<tr>
<td>DC Bus - voltage</td>
<td>DC BUS -</td>
<td>2</td>
</tr>
<tr>
<td>100-240 VAC input power</td>
<td>L1 (Line 1)</td>
<td>3</td>
</tr>
<tr>
<td>100-240 VAC input power</td>
<td>L2 (Line 2)/N (Neutral)</td>
<td>4</td>
</tr>
<tr>
<td>Safety (earth) ground</td>
<td>☀</td>
<td>5</td>
</tr>
<tr>
<td>R phase power to motor</td>
<td>R</td>
<td>6</td>
</tr>
<tr>
<td>S phase power to motor</td>
<td>S</td>
<td>7</td>
</tr>
<tr>
<td>T phase power to motor</td>
<td>T</td>
<td>8</td>
</tr>
<tr>
<td>Motor case ground</td>
<td>☀</td>
<td>9</td>
</tr>
</tbody>
</table>

Power Wiring Connection Diagrams for the DSM 007, 007P, 015, 015P, 030 and 030P are provided on page 5-78. Wiring for the external I/O power is described and depicted in the chapter “Application and Configuration Examples” on page 8-141.

**DANGER**

DC bus capacitors may retain hazardous voltages after input power has been removed, but will normally discharge in several seconds. Before working on the drive, measure the DC bus voltage to verify it has reached a safe level or wait the full time interval listed on the warning on the front of the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

**WARNING**

Motor power connectors are for assembly purposes only. They should not be connected or disconnected while the drive is powered.
Motor Power Cabling

TB1-6, TB1-7, TB1-8 and TB1-9 are the terminals for connecting the drive to the windings of a motor.

NOTE: Proper phasing of these outputs relative to the motor terminals is critical. Double check the connections after wiring the motor.

Table 7.3 lists the drive terminals and typical motor connections. Table 7.4 on page 7-138 lists the minimum wire size for making power wiring connections.

<table>
<thead>
<tr>
<th>Motor Phase Signal</th>
<th>Description</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>R phase from drive</td>
<td>TB1-6</td>
</tr>
<tr>
<td>S</td>
<td>S phase from drive</td>
<td>TB1-7</td>
</tr>
<tr>
<td>T</td>
<td>T phase from drive</td>
<td>TB1-8</td>
</tr>
<tr>
<td>☩</td>
<td>Ground for the motor case</td>
<td>TB1-9</td>
</tr>
</tbody>
</table>

NOTE: Torque all terminal connections to 1.25 Nm (11.0 lb-in).

Refer to “Options and Accessories” on page A-235 for a list of available Giddings & Lewis cables.
Shield Termination of Power Cables

**DANGER**

Shielded power cables must be grounded at a minimum of one point for safety. Failure to ground a shielded power cable will result in potentially lethal voltages on the shield and anything connected to it.

**FSM Series, HSM Series, NSM Series, SSM Series Motor Power Cable**

Factory supplied motor power cables are shielded. The power cable is designed to be terminated at the drive during installation. A small portion of the cable jacket is stripped, which exposes the shield wires. The exposed area must be clamped to the bottom of the drive chassis using the clamp provided. It is critical for EMC performance that the shield wires be clamped against the area of the chassis which is not painted.

**Figure 7.1 Motor Power EMC Shield Connection**

![Motor Power EMC Shield Connection](image)

Power cable shield termination clamp on bottom of DSM 007, DSM 015 and DSM 030

**YSM Series Motor Cables**

YSM Series motors have a short “pigtail” cable which connects to the motor but is not shielded. These motor power cables have a 6 inch shield termination wire with a ring lug which should be connected to the closest earth ground. The shield termination wire may be extended to the full length of the motor pigtail if necessary, but it is best to connect the supplied wire directly to ground without lengthening.
Figure 7.2 YSM Series Motor Cable Termination

**WARNING**

High voltage may be present on the terminals of the drive. Remove power and disconnect the power cable before making or removing any connection.

**CAUTION**

Do not tin (solder) the exposed leads on cables. Solder contracts over time and may loosen the connection.

Table 7.2 Motor Power Contact and Wire Size Recommendations

<table>
<thead>
<tr>
<th>Motor Size</th>
<th>Motor Power Matling Maximum Contact Size ( \text{mm}^2 ) (AWG)</th>
<th>Minimum Recommended ( 90^\circ \text{C} ) Power Wire ( \text{mm}^2 ) (AWG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005 through 3016</td>
<td>1.5 (16)</td>
<td>1.5 (16)</td>
</tr>
<tr>
<td>4030</td>
<td>4 (12)</td>
<td>1.5 (16)</td>
</tr>
<tr>
<td>4050</td>
<td>4 (12)</td>
<td>2.5 (14)</td>
</tr>
</tbody>
</table>
Motor Overload Protection

The drive utilizes solid state motor overload protection which operates:

- Within 8 minutes at 200% overload
- Within 20 seconds at 600% overload.

Power Supply Protection

The feedback encoder, auxiliary encoder and optional TouchPad are powered by a single internal power supply. The power supply has a "resettable" fuse that opens at 3 amps and automatically resets itself when the current falls below 3 amps. There are no internal fuses requiring replacement.

Emergency Stop Wiring

An overlapping contactor may be inserted between the motor and the drive for emergency stop purposes. The contactor must not simply break the motor current, it also must switch a three phase resistive load in parallel with the motor windings.

The three resistors provide dynamic braking. In addition, they prevent continuous arcing at the main contacts when breaking DC currents, such as when the motor stalls. Simply breaking the motor current can result in high voltages due to motor inductance, which will cause prolonged arcing in the contactor. In extreme cases, the prolonged arcing could result in the contactor catching fire. An overlapping contactor provides the required timing by engaging the braking contactors before the drive contactors disengage.
Figure 7.3 depicts a contactor installation with resistive loads. Guidelines for the installation include:

- Resistor values should be one to four times the winding resistance for good braking performance. Refer to the appendix “Dynamic Braking Resistor Selection” on page E-297 for resistor sizing equations.
- Screen and ground cables should be connected as shown.
- Shields should be unbraided (not a drain wire soldered to the shield).
- Connection lengths should be minimized.
- Safety ground (GND) and shield connections are permanently connected. This is essential for electrical safety.
- EMC guidelines require connection of the shield at the point where the contactor is inserted.

Figure 7.3 Emergency Stop Contactor Wiring
AC Power Cabling

The DSM 007, 007P, 015, 015P 030 and 030P drives require single phase, 100 to 240 VAC rms power with an input frequency of 47 - 63 Hz. “Power” on page F-306 lists the output power characteristics of the drives. The AC input supplies power to the motor. Alternatively, the drive may be powered by an external DC power source. In either case, an external power source must provide input power to the I/O.

TB1-3, TB1-4 and TB1-5 are the single phase AC input power terminals for the DSM 007, 007P, 015, 015P, 030 and DSM 030P.

Table 7.3 TB1 - AC Power Terminals

<table>
<thead>
<tr>
<th>Signal</th>
<th>Description</th>
<th>Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>100 to 240 Volts AC Line 1 input power.</td>
<td>TB1-3</td>
</tr>
<tr>
<td>L2/N</td>
<td>100 to 240 Volts AC Neutral.</td>
<td>TB1-4</td>
</tr>
<tr>
<td>♂️</td>
<td>Safety (earth) ground</td>
<td>TB1-5</td>
</tr>
</tbody>
</table>

NOTE: Torque all terminal connections to 1.25 Nm (11.0 lb-in).
Table 7.4 AC Input Power Sizing Requirements

<table>
<thead>
<tr>
<th>Drive Model</th>
<th>Input Current</th>
<th>Inrush Current</th>
<th>Fuse Size</th>
<th>Wire Size</th>
<th>Transformer Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSM 007 or DSM 007P</td>
<td>5 A AC_{rms}</td>
<td>75 A peak</td>
<td>5 A</td>
<td>1.5 (16)</td>
<td>1 kVA min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100 kVA max</td>
</tr>
<tr>
<td>DSM 015 or DSM 015P</td>
<td>9 A AC_{rms}</td>
<td>100 A peak</td>
<td>10 A</td>
<td>2.5 (14)</td>
<td>2 kVA min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100 kVA max</td>
</tr>
<tr>
<td>DSM 030 or DSM 030P</td>
<td>18 A AC_{rms}</td>
<td>100 A peak</td>
<td>20 A</td>
<td>4.0 (12)</td>
<td>4 kVA min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100 kVA max</td>
</tr>
</tbody>
</table>

1. In the United States, the National Electrical Code (NEC), specifies that fuses must be selected based on the motor full load amperage (FLA), which is not to be confused with the drive input current. The largest fuse allowed under any circumstances is four times the motor FLA. Therefore the largest fuse permissible for use with the Centurion DSM Drive is four times the motor rated continuous current (converted to an RMS value). The Digital Servo Drive has been evaluated and listed by Underwriters Laboratories Inc. with fuses sized as four times the continuous output current of the drives (FLA), according to UL 508C.

In almost all cases fuses selected to match the drive input current rating will meet the NEC requirements and provide the full drive capabilities. Dual element, time delay (slow acting) fuses should be used to avoid nuisance trips during the inrush current of power initialization. The fuse sizes listed are recommended values, but local regulations must be determined and adhered to.

The Centurion DSM Drive utilizes solid state motor short circuit protection rated as follows:

- **Short Circuit Current Rating with No Fuse Restrictions:**
  Suitable for use on a circuit capable of delivering not more than 5000 RMS symmetrical Amperes, 240 Volts maximum.

- **Short Circuit Current Rating with Fuse Restrictions:**
  Suitable for use on a circuit capable of delivering not more than 200,000 RMS symmetrical Amperes, 240 Volts maximum, when protected by high interrupting capacity, current limiting fuses (Class CC, G, J, L, R, T).

a. Application Note Number 17 details Transformer Sizing requirements for a variety of applications.
DC Bus

TB1-1 and TB1-2 are the DC Bus connections for an external shunt.

**WARNING**

External shunt resistors connect directly to the power bus. For safety reasons, external shunt resistors must be enclosed.

**DANGER**

DC bus capacitors may retain hazardous voltages after input power has been removed, but will normally discharge in several seconds. Before working on the drive, measure the DC bus voltage to verify it has reached a safe level or wait the full time interval listed on the warning on the front of the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

**CAUTION**

Do not connect an external I/O power supply to the DC Bus. The DC+ and DC- terminals connect directly to the power bus of the drive.
This section explains how to install and verify the Centurion DSM Drive for various modes of operation. The procedures verify the installation by:

- Showing how the power and logic wiring is connected.
- Selecting the Operation Mode setup for the drive.
- Tuning the drive for a particular motor type and size.
- Verifying the basic functionality of the drive and motor combination.

How to modify the units of measurement for DSMPro displays is explained on page 8-197.
Analog Control

The Centurion DSM Drive can be set up as an analog drive in either the Velocity or Torque mode by making the hardware connections and performing the software setup and tuning described below. The connection diagram depicts the minimum hardware necessary. Interfacing the drive to an external controller requires similar circuitry from the controller to J1. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

Hardware Set Up

Make the connections described below and shown in the figure.

1. Connect a ±10VDC power source between J1-22 and J1-23 (ANALOG CMND +/-) to provide the analog speed or torque command.
2. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the drive. A simple 3 wire cable is depicted in the figure below.
3. Connect a Motor/Feedback cable from the motor to the J2 connector on the drive.
5. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).
   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.
6. Connect an external 12 to 24 VDC power source for powering I/O to J1-5 (I/O PWR) and J1-6 (I/O COM).
7. Connect the drive to a single phase 100-240 VAC, 50/60 Hz power source.
Connection Diagram

Figure 8.1 Analog Controller Connection Diagram

**Configuration**

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Status LED is green. Refer to “Status Indicator” on page 10-213 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose Cancel from the Drive Select dialog box.
4. Select PC Set Up from the Communications menu in DSMPro to display the personal computer’s communication settings.
5. Verify the communications port settings of the PC match those of the drive.

*Installation Manual for Models DSM 007, DSM 015 and DSM 030*
• If the settings are correct, select OK in the Port - Settings dialog box.
• If the settings are different, correct the Port - Settings to allow communications with the drive.

Factory default communications Port - Settings for the drive are:
- Baud Rate: 9600
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Serial Port: COM1

Refer to “RS-232 Communication Test” on page 11-226 for troubleshooting instructions.

6. Select Read Drive Parameters from the Communications menu.

7. Verify the Drive Name and Address are correct for the drive that is being addressed.

8. Choose OK to load the drive parameters.

➤ NOTE: A motor must be selected for the parameters to load.

9. If the message box appears that a motor must be selected, select OK. The Drive Set Up window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.

10. Select or verify the correct motor model number from the drop down Motor Model list.

11. If a message advises that the drive must be reset, choose Yes.

12. Select the Operation Mode parameters for the drive:

   Velocity Mode Settings  Torque Mode Settings
   Analog Velocity Input as the Operation Mode  Analog Torque Input as the Operation Mode  

13. Choose Close to exit the Drive Set Up window.

14. Choose the Drive Parameters icon from the Drive window and then select the Analog tab.

15. Enter appropriate Scale and Offset values for the input.
16. Verify the Status indicator is green.

**Tuning**

NOTE: Do *not* attempt to Tune a drive with the Command mode set for Analog Torque Input. If the drive is set to torque mode, continue with the Operation section below.

NOTE: Do *not* attempt to Auto Tune systems that have gravitational effects. The Centurion DSM Drive will *not* hold initial position.

1. Choose the Tuning command icon from the Drive window. The drive must be configured in Velocity mode for tuning to be effective.

2. Select AutoTune from the Tuning mode group.

3. Select the appropriate values for the following Auto Tune commands:
   - Distance and
   - Step Current.

4. Select the appropriate entry for the Motor Direction:
   - BiDirectional,
   - Forward Only or
   - Reverse Only.

5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

**WARNING**

Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose Start from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.

7. Open the switch between J1-26 and J1-20 to disable the drive.
8. Choose **Normal Drive Operation** from the Tuning window.

9. Choose **Close** to exit the Tuning windows.

10. Verify the Status indicator is green.

11. Close any open windows or dialogs.

**Operation**

The drive is now configured as an Analog Controller in either the velocity or torque mode.

- The current loop is compensated properly for the selected motor.
- The servo parameters have been setup with an unloaded motor.
- The motor speed or current is commanded through the analog input.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-26 and J1-20 to enable the drive.
Preset Controller

The Centurion DSM Drive can be set up as a preset controller in the Velocity or Torque mode by making the connections described below. Three discrete digital inputs provide the programmable speed or torque control. Up to eight different preset speed or torque settings can be selected by using the three digital inputs in various binary combinations, as shown in the table below. The connection diagram depicts the minimum hardware necessary. Interfacing the drive to a controller requires similar circuitry from the controller to J1. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

Table 8.1 Preset Binary Inputs.

<table>
<thead>
<tr>
<th>Inputs</th>
<th>C</th>
<th>B</th>
<th>A</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preset 0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Preset 0 is a preprogrammed speed or current. All inputs are OFF.</td>
</tr>
<tr>
<td>Preset 1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>Preset 1 is a preprogrammed speed or current. Only Preset Select A input is ON.</td>
</tr>
<tr>
<td>Preset 2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Preset 2 is a preprogrammed speed or current. Only Preset Select B input is ON.</td>
</tr>
<tr>
<td>Preset 3</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Preset 3 is a preprogrammed speed or current. Preset Select A and Preset Select B are ON.</td>
</tr>
<tr>
<td>Preset 4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Preset 4 is a preprogrammed speed or current. Only Preset Select C input is ON.</td>
</tr>
<tr>
<td>Preset 5</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Preset 5 is a preprogrammed speed or current. Preset Select A and Preset Select C are ON.</td>
</tr>
<tr>
<td>Preset 6</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Preset 6 is a preprogrammed speed or current. Preset Select B and Preset Select C are ON.</td>
</tr>
<tr>
<td>Preset 7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Preset 7 is a preprogrammed speed or current. All Preset Select inputs are ON.</td>
</tr>
</tbody>
</table>

1. A preset input signal that is OFF is inactive, which means no current flows through the optocoupler.
2. A preset input signal that is ON is active, which means current flows through the optocoupler.
Hardware Set Up

Make the connections described below and shown in the Figure 8.2. The appendix “Options and Accessories” on page A-235 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the drive. A simple 3 wire cable is depicted in the figure below.

2. Connect a Motor/Feedback cable from the motor to the J2 connector on the drive.

3. Connect a Power cable from the motor to TB1 (terminals R, S, T and \( \pm \)) on the drive.

4. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-33 (INPUT2) and J1-26 (I/O PWR)
   - J1-34 (INPUT3) and J1-26 (I/O PWR)
   - Connect a switch between J1-21 (FAULT RESET) and J1-26 (I/O PWR).

These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.

1. Connect an external 12 to 24 VDC power source for powering I/O to J1-5 (I/O PWR) and J1-6 (I/O COM).

2. Connect the drive to a single phase 100-240 VAC, 50/60 Hz power source.
Connection Diagram

Figure 8.2 Preset Controller Connection Diagram

Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Status LED is green. Refer to “Status Indicator” on page 10-213 for an explanation of the display codes.

2. Start DSMPro on the PC.

3. Choose Cancel from the Drive Select dialog box.

4. Select PC Set Up from the Communications menu in DSMPro to display the personal computer’s communication settings.

5. Verify the communications port settings of the PC match those of the drive.

Installation Manual for Models DSM 007, DSM 015 and DSM 030
- If the settings are correct, select OK in the Port - Settings dialog box.
- If the settings are different, correct the Port - Settings to allow communications with the drive.

Factory default communications Port - Settings for the drive are:
- Baud Rate: 9600
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Serial Port: COM1

Refer to the section “RS-232 Communication Test” on page 11-226 for troubleshooting instructions.

6. Select Read Drive Parameters from the Communications menu.

7. Verify the Drive Name and Address are correct for the drive that is being addressed.

8. Choose OK to load the drive parameters.

   ➤ NOTE: A motor must be selected for the parameters to load.

9. If the message box appears that a motor must be selected, select OK. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.

10. Select or verify the correct motor model number from the drop down Motor Model list.

11. If a message advises that the drive must be reset, choose Yes,

12. Select the Operation Mode parameter for the drive:

   Velocity Mode Settings
   - Preset Velocities as the Operation Mode

   Torque Mode Settings
   - Preset Torques as the Operation Mode

13. Choose Close from the Drive Setup window.

14. Choose the Drive Parameters command icon from the Drive window and then select the Preset tab.
15. Enter the appropriate parameters for the Command mode in which the drive will operate:

<table>
<thead>
<tr>
<th>Velocity Mode Settings</th>
<th>Torque Mode Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter the appropriate velocity value for each speed required</td>
<td>Enter the appropriate current value for each torque required</td>
</tr>
</tbody>
</table>

Up to eight presets (0-7) may be programmed.

16. Choose Close to exit the Drive Parameters window.

17. Verify the Status indicator is green.

18. Select the I/O Configuration command icon from the Drive window.

19. Assign one of the three Preset Selects (A, B and C) to each of the Digital Input Assignments. For example, the following selects three presets:

- Input 1 to Preset Select A
- Input 2 to Preset Select B
- Input 3 to Preset Select C

The presets provide up to eight binary combinations of speed or current. Unassigned preset inputs should be set to Not Assigned, which forces an OFF state.

20. Verify all Digital Output Assignments are Not Assigned.

21. Choose Close to exit the I/O Configuration window.
Tuning

NOTE: Do not attempt to Tune a drive with the Command mode set for Preset Torques. If the drive is set to Torque mode, continue with the Operation section below.

NOTE: Do not attempt to Auto Tune systems that have gravitational effects. The Centurion DSM Drive will not hold initial position.

1. Choose the Tuning command icon from the Drive window. The drive must be configured in Velocity mode for tuning to be effective.

2. Select AutoTune from the Tuning mode group.

3. Select the appropriate values for the following Auto Tune commands:
   - Distance and
   - Step Current.

4. Select the appropriate entry for the Motor Direction:
   - BiDirectional,
   - Forward Only or
   - Reverse Only.

5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

   **WARNING**
   Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose Start from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.

7. Choose Normal Drive Operation from the Tuning window.

8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose Close to exit the Tuning window.
10. Verify the Status indicator is green.
11. Close any open windows or dialog boxes.

**Operation**

The drive is now configured as a Preset Controller in Velocity or Torque mode.

- The servo parameters have been setup with the unloaded motor.
- The motor speed or current is controlled through the digital inputs.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-26 and J1-20 to enable the drive.

2. Close any of the switches for INPUT1, INPUT2 or INPUT3 to run the drive at the programmed preset speed or torque.
Position Follower (Master Encoder)

The Centurion DSM Drive can be electronically geared to a master incremental encoder generating quadrature encoder signals by making the hardware connections and performing the software setup and tuning described below. The connection diagram depicts the minimum hardware necessary. Interfacing the drive to an external controller requires similar circuitry from the controller to J1. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

Hardware Set Up

Make the connections described below and shown in the Figure 8.3. The appendix “Options and Accessories” on page A-235 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM Drive. A simple 3 wire cable is depicted in the figure below.

2. Connect a Motor/Feedback cable from the motor to the J2 connector on the drive.


4. Connect the Master Encoder to the drive as shown in the diagram.

5. Connect a jumper wire with switches between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).
   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.

6. Connect an external 12 to 24 VDC power source for powering I/O to J1-5 (I/O PWR) and J1-6 (I/O COM).

7. Connect the drive to a single phase 100-240 VAC, 50/60 Hz power source.
Connection Diagram

Figure 8.3 Position Follower (Master Encoder) Connection Diagram

Note 1. Refer to Figure 6.25, 6.26, 6.27, 6.28, 6.29, 6.30 and 6.31 for additional details on the Control Interface Cable.
Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Status LED is green. Refer to “Status Indicator” on page 10-213 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose Cancel from the Drive Select dialog box.
4. Select PC Set Up from the Communications menu in DSMPro to display the personal computer’s communication settings.
5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select OK in the Port - Settings dialog box.
   - If the settings are different, correct the Port - Settings to allow communications with the drive.
   Factory default communications Port - Settings for the drive are:
   - Baud Rate: 9600
   - Data Bits: 8
   - Parity: None
   - Stop Bits: 1
   - Serial Port: COM1
   Refer to the section “RS-232 Communication Test” on page 11-226 for troubleshooting instructions.
6. Select Read Drive Parameters from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose OK to load the drive parameters.

   NOTE: A motor must be selected for the parameters to load.
9. If the message box appears that a motor must be selected, select **OK**. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.

10. Select or verify the correct motor model number from the drop down Motor Model list.

11. If a message advises that the drive must be reset, choose Yes.

12. Select **Follower: Master Encoder** as the Operation Mode for the drive.

13. Choose **Close** from the Drive Setup window.

14. Choose the Drive Parameter command icon from the Drive window, and then select the Follower tab.

15. Enter an appropriate Gear Ratio as the Follower Input. The default Gear Ratio is 1:1 (motor encoder pulses:master pulses). If a Gear Ratio of 3:1 is entered, the motor is moved 3 encoder pulses for every incoming master pulse.

16. Choose **Close** to exit the Drive Parameters window.

17. Verify the Status indicator is green.

18. Select the I/O Configuration command icon from the Drive Window.

19. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window. For example:
   - Follower Enable as Input 1
   - Not Assigned as Inputs 2 through 3.
   - Not Assigned as Inputs 1 and 2.

20. Choose **Close** to exit the I/O Configuration window.

21. Verify the Status indicator is green.
Tuning

NOTE: Do not attempt to Auto Tune systems that have gravitational effects. The Centurion DSM Drive will not hold initial position.

1. Choose the Tuning command icon from the Drive window.
2. Select AutoTune from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
   - Distance and
   - Step Current.
4. Select the appropriate entry for the Motor Direction:
   - BiDirectional,
   - Forward Only or
   - Reverse Only.
5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

WARNING

Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose Start from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Choose Normal Drive Operation from the Tuning window.
8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose Close to exit the Tuning window.
10. Verify the Status indicator is green.
11. Close any open windows or dialog boxes.
Operation

The drive is now configured as a Position Follower (Master Encoder).

- The current loop is compensated properly for the selected motor.
- The servo parameters have been setup with the unloaded motor.
- The motor position is controlled by the master encoder input.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:
1. Close the switch between J1-26 and J1-20 to enable the drive.
2. Close the switch between J1-26 and J1-32 to enable following.
Position Follower (Step/Direction)

The Centurion DSM Drive can be set up as a Position Follower using Step/Direction commands by making the hardware connections and performing the software setup and tuning described below. This configuration allows the Centurion DSM Drive to electronically gear or drive a servo motor using step and direction signals that typically control a stepper drive. The connection diagram depicts the minimum hardware necessary. Interfacing the drive to a stepper indexer requires similar circuitry from the stepper indexer to J1. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad may also be used.

Hardware Set Up

Make the connections described below and shown in the Figure 8.4. The appendix “Options and Accessories” on page A-235 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the drive. A simple 3 wire cable is depicted in the figure below.

2. Connect a Motor/Feedback cable from the motor to the J2 connector on the drive.


4. Connect the Step/Direction signals to the drive as shown in the diagram.

5. Connect a jumper wire with a switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

6. Connect an external 12 to 24 VDC power source for powering I/O to J1-5 (I/O PWR) and J1-6 (I/O COM).

7. Connect the drive to a single phase 100-240 VAC, 50/60 Hz power source.
Connection Diagram

Figure 8.4 Position Follower (Step/Direction) Connection Diagram

Note 1. Refer to Figure 6.25, 6.26, 6.27, 6.28, 6.29, 6.30 and 6.31 for additional details on the Control Interface Cable.
Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Status LED is green. Refer to “Status Indicator” on page 10-213 for an explanation of the display codes.

2. Start DSMPro on the PC.

3. Choose Cancel from the Drive Select dialog box.

4. Select PC Set Up from the Communications menu in DSMPro to display the personal computer’s communication settings.

5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select OK in the Port - Settings dialog box.
   - If the settings are different, correct the Port - Settings to allow communications with the drive.
     Factory default communications Port - Settings for the drive are:
     - Baud Rate: 9600
     - Data Bits: 8
     - Parity: None
     - Stop Bits: 1
     - Serial Port: COM1
     Refer to the section “RS-232 Communication Test” on page 11-226 for troubleshooting instructions.

6. Select Read Drive Parameters from the Communications menu.

7. Verify the Drive Name and Address are correct for the drive that is being addressed.

8. Choose OK to load the drive parameters.

   NOTE: A motor must be selected for the parameters to load.
9. If the message box appears that a motor must be selected, select OK. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.

10. Select or verify the correct motor model number from the drop down Motor Model list.

11. If a message advises that the drive must be reset, choose Yes,

12. Select Follower: Step/Direction as the Operation Mode for the drive.

13. Choose Close to exit the Drive Set Up window.

14. Choose the Drive Parameters command icon from the Drive window and then select the Follower tab.

15. Enter an appropriate Gear Ratio as the Follower Input. The default Gear Ratio is 1:1 (motor encoder pulses: master pulses). If a Gear Ratio of 3:1 is entered, the motor is moved 3 encoder pulses for every incoming step pulse.

16. Choose Close to exit the Drive Parameters window.

17. Verify the Status indicator is green.

18. Select the I/O Configuration command icon from the Drive Window.

19. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window.
   For example:
   - Follower Enable as Input 1
   - Not Assigned as Inputs 2 through 3.
   - Not Assigned as Outputs 1 and 2.

20. Choose Close to exit the I/O Configuration window.
Tuning

NOTE: Do not attempt to Auto Tune systems that have gravitational effects. The Centurion DSM Drive will not hold initial position.

1. Choose the Tuning command icon from the Drive window.

2. Select AutoTune from the Tuning mode group.

3. Select the appropriate values for the following Auto Tune commands:
   - Distance
   - Step Current

4. Select the appropriate entry for the Motor Direction:
   - BiDirectional
   - Forward Only
   - Reverse Only

5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

   WARNING: Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose Start from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.

7. Choose Normal Drive Operation from the Tuning window.

8. Open the switch between J1-26 and J1-20 to disable the drive.

9. Choose Close to exit the Tuning window.

10. Verify the Status indicator is green.

11. Close any open windows or dialog boxes.
Operation

The drive is now configured as a Position Follower (Step/Direction).

- The servo parameters have been setup with the unloaded motor.
- The motor position is controlled by the step/direction inputs.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-26 and J1-20 to enable the drive.

2. Close the toggle switch between J1-26 and J1-32 to enable following.
Position Follower (Step Up/Down)

The Centurion DSM Drive can be set up as a Position Following using Step Up and Step Down signals typically used to control stepper drives. The connection diagram depicts the minimum hardware necessary. Interfacing the drive to a controller requires similar circuitry from the indexer to J1. Instructions are provided to configure the drive with DSMPro software.

Hardware Set Up

Make the connections described below and shown in the Figure 8.5. The appendix “Options and Accessories” on page A-235 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM Drive. A simple 3 wire cable is depicted in the figure below.
2. Connect a Motor/Feedback cable from the motor to the J2 connector on the Centurion DSM Drive.
3. Connect a Power cable from the motor to TB1 (terminals R, S, T and $\bot$) on the drive.
4. Connect the Stepper Indexer to the drive as shown in the diagram.
5. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).
   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.
6. Connect an external 12 to 24 VDC power source for powering I/O to J1-5 (I/O PWR) and J1-6 (I/O COM).
7. Connect the drive to a single phase 100-240 VAC, 50/60 Hz power source.
Connection Diagram

Figure 8.5 Position Follower (Step Up/Down Controller)
Connection Diagram

Note 1. Refer to Figure 6.34 and 6.35 for additional details on the Control Interface Cable.
Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Status LED is green. Refer to "Status Indicator" on page 10-213 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose Cancel from the Drive Select dialog box.
4. Select **PC Set Up** from the Communications menu in DSMPro to display the personal computer’s communication settings.
5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select **OK** in the Port - Settings dialog box.
   - If the settings are different, correct the Port - Settings to allow communications with the drive.
     Factory default communications Port - Settings for the drive are:
     - Baud Rate: 9600
     - Data Bits: 8
     - Parity: None
     - Stop Bits: 1
     - Serial Port: COM1
     Refer to the section "RS-232 Communication Test" on page 11-226 for troubleshooting instructions.
6. Select **Read Drive Parameters** from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose **OK** to load the drive parameters.

   ➤ NOTE: A motor must be selected for the parameters to load.
9. If the message box appears that a motor must be selected, select OK. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.

10. Select or verify the correct motor model number from the drop down Motor Model list.

11. If a message advises that the drive must be reset, choose Yes.

12. Select Follower: Step Up/Step Down as the Operation Mode for the drive.

13. Choose Close to exit the Drive Set Up window.

14. Choose the Drive Parameters command icon from the Drive window and then select the Follower tab.

15. Enter an appropriate Gear Ratio as the Follower Input. The default Gear Ratio is 1:1 (motor encoder pulses:master pulses). If a Gear Ratio of 3:1 is entered, the motor is moved 3 encoder pulses for every incoming step pulse.

16. Choose Close to exit the Drive Parameters window.

17. Verify the Status indicator is green.

18. Select the I/O Configuration command icon from the Drive Window.

19. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window. For example:
   - Follower Enable as Input 1
   - Not Assigned as Inputs 2 through 3.
   - Not Assigned as Outputs 1 and 2.

20. Choose Close to exit the I/O Configuration window.
Tuning

NOTE: Do not attempt to Auto Tune systems that have gravitational effects. The Centurion DSM Drive will *not* hold initial position.

1. Choose the Tuning command icon from the Drive window.

2. Select AutoTune from the Tuning mode group.

3. Select the appropriate values for the following Auto Tune commands:
   - Distance and
   - Step Current.

4. Select the appropriate entry for the Motor Direction:
   - BiDirectional,
   - Forward Only or
   - Reverse Only.

5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

**WARNING** Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose Start from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.

7. Choose Normal Drive Operation from the Tuning window.

8. Open the switch between J1-26 and J1-20 to disable the drive.

9. Choose Close to exit the Tuning window.

10. Verify the Status indicator is green.

11. Close any open windows or dialog boxes.
Operation

The drive is now configured as either a Position Follower (Step Up/Step Down).

- The servo parameters have been setup with the unloaded motor.
- The motor position is controlled by the step indexer.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:
1. Close the switch between J1-26 and J1-20 to enable the drive.
2. Close the toggle switch between J1-26 and J1-32 to enable following.
Incremental Indexing

NOTE: This feature is available only on drives capable of indexing: DSM 007P, DSM 015P and DSM 030P.

The Centurion DSM Drive can be set up as a incremental indexer by making the hardware connections and performing the software setup and tuning described below. A connection diagram depicts the minimum hardware necessary. Interfacing the drive to an external controller requires similar circuitry from the controller to J1, refer to "J1 - Controller" on page 6-81. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

The following examples depict a simple incremental index move and a batched (multiple) move using incremental indexing.

Figure 8.6 Incremental Indexing Examples

[Diagram of incremental indexing examples]

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Hardware Set Up

Make the connections described below and shown in the Figure 8.7. The appendix “Options and Accessories” on page A-235 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM Drive. A simple 3 wire cable is depicted in the figure below.

2. Connect a Motor/Feedback cable from the motor to the J2 connector on the Centurion DSM Drive.

3. Connect a Power cable from the motor to TB1 (terminals R, S, T and \(\oplus\)) on the drive.

4. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.

5. Connect an external 12 to 24 VDC power source for powering I/O to J1-5 (I/O PWR) and J1-6 (I/O COM).

6. Connect the drive to a single phase 100-240 VAC, 50/60 Hz power source.
Connection Diagram

Figure 8.7 Incremental Indexing Connection Diagram

Installation Manual for Models DSM 007, DSM 015 and DSM 030
**Configuration**

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Status LED is green. Refer to "Status Indicator" on page 10-213 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose Cancel from the Drive Select dialog box.
4. Select **PC Set Up** from the Communications menu in DSMPro to display the personal computer’s communication settings.
5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select OK in the Port - Settings dialog box.
   - If the settings are different, correct the Port - Settings to allow communications with the drive.
     Factory default communications Port - Settings for the drive are:
     - Baud Rate: 9600
     - Data Bits: 8
     - Parity: None
     - Stop Bits: 1
     - Serial Port: COM1
     Refer to the section “RS-232 Communication Test” on page 11-226 for troubleshooting instructions.
6. Select **Read Drive Parameters** from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose OK to load the drive parameters.

> **NOTE:** A motor must be selected for the parameters to load.
9. If the message box appears that a motor must be selected, select OK. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.

10. Select or verify the correct motor model number from the drop down Motor Model list.

11. If a message advises that the drive must be reset, choose Yes.

12. Select Indexing as the Operation Mode for the drive.

13. Choose Close to exit the Drive Set Up window.

14. Choose the Drive Parameters command icon from the Drive window and then select the Indexing tab.

15. Enter the following values for Index Q. Refer to “Incremental Indexing Examples” on page 8-173 for examples of Single and Batched Incremental Indexing profiles.

<table>
<thead>
<tr>
<th>Single Move Settings</th>
<th>Batched Move Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incremental as Mode</td>
<td>Incremental as Mode</td>
</tr>
<tr>
<td>8000 as Distance</td>
<td>8000 as Distance</td>
</tr>
<tr>
<td>1 as the Batch Count</td>
<td>3 as the Batch Count</td>
</tr>
<tr>
<td>0 as Dwell</td>
<td>1000 as Dwell</td>
</tr>
<tr>
<td>Appropriate values for Acceleration and Deceleration</td>
<td>Appropriate values for Acceleration and Deceleration</td>
</tr>
</tbody>
</table>

16. Choose Close to exit the Drive Parameters window.

17. Verify the Status indicator is green.

18. Select the I/O Configuration command icon from the Drive Window.

19. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window.

For example:
- Start Index as Input 1
- Not Assigned as Inputs 2 through 3.
- Not Assigned as Outputs 1 and 2.

Installation Manual for Models DSM 007, DSM 015 and DSM 030
20. Choose Close to exit the I/O Configuration window.

**Tuning**

![NOTE] Do not attempt to Auto Tune systems that have gravitational effects. The Centurion DSM Drive will not hold initial position.

1. Choose the Tuning command icon from the Drive window.

2. Select AutoTune from the Tuning mode group.

3. Select the appropriate values for the following Auto Tune commands:
   - Distance and
   - Step Current.

4. Select the appropriate entry for the Motor Direction:
   - BiDirectional,
   - Forward Only or
   - Reverse Only.

5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

**WARNING** Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose Start from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.

7. Choose Normal Drive Operation from the Tuning window.

8. Open the switch between J1-26 and J1-20 to disable the drive.

9. Choose Close to exit the Tuning window.

10. Verify the Status indicator is green.

11. Close any open windows or dialog boxes.
Operation

The drive is now configured as an Incremental Indexing controller.

- The servo parameters have been setup with the unloaded motor.
- Motion is commanded through the inputs.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:
1. Close the switch between J1-26 and J1-20 to enable the drive.
2. Close the toggle switch between J1-26 and J1-32 to start Index 0.
Registration Indexing

NOTE: This feature is available only on drives capable of indexing: DSM 007P, DSM 015P and DSM 030P.

The Centurion DSM Drive can be set up as a registration indexer by making the hardware connections and performing the software setup and tuning described below. A connection diagram depicts the minimum hardware necessary. Interfacing the drive to an external controller requires similar circuitry from the controller to J1, refer to “J1 - Controller” on page 6-81. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

The following example depicts a batched (multiple) move using registration indexing.

Figure 8.8 Registration Indexing Examples

![Diagram showing velocity, acceleration, and dwell phases with defined velocity and registration distance.]
Hardware Set Up

Make the connections described below and shown in the Figure 8.9. The appendix “Options and Accessories” on page A-235 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM Drive. A simple 3 wire cable is depicted in the figure below.

2. Connect a Motor/Feedback cable from the motor to the J2 connector on the Centurion DSM Drive.

3. Connect a Power cable from the motor to TB1 (terminals R, S, T and \( \oplus \)) on the drive.

4. Connect the Index Sensor to the drive as shown in the diagram.

5. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-33 (INPUT2) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.

6. Connect an external 12 to 24 VDC power source for powering I/O to J1-5 (I/O PWR) and J1-6 (I/O COM).

7. Connect the drive to a single phase 100-240 VAC, 50/60 Hz power source.
Connection Diagram

Figure 8.9 Registration Indexing Connection Diagram

![Connection Diagram](image)

Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Status LED is green. Refer to “Status Indicator” on page 10-213 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose Cancel from the Drive Select dialog box.

Installation Manual for Models DSM 007, DSM 015 and DSM 030
4. Select PC Set Up from the Communications menu in DSMPro to display the personal computer's communication settings.

5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select OK in the Port - Settings dialog box.
   - If the settings are different, correct the Port - Settings to allow communications with the drive.

   Factory default communications Port - Settings for the drive are:
   - Baud Rate: 9600
   - Data Bits: 8
   - Parity: None
   - Stop Bits: 1
   - Serial Port: COM1

   Refer to the section "RS-232 Communication Test" on page 11-226 for troubleshooting instructions.

6. Select Read Drive Parameters from the Communications menu.

7. Verify the Drive Name and Address are correct for the drive that is being addressed.

8. Choose OK to load the drive parameters.

   ▶ NOTES: A motor must be selected for the parameters to load.

9. If the message box appears that a motor must be selected, select OK. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.

10. Select or verify the correct motor model number from the drop down Motor Model list.

11. If a message advises that the drive must be reset, choose Yes.

12. Select Indexing as the Operation Mode for the drive.

13. Choose Close to exit the Drive Set Up window.

14. Choose the Drive Parameters command icon from the Drive window and then select the Indexing tab.
15. Enter the following values for Index 0.

**Single Move Settings**
- Registration as Mode
- 8000 as Distance
- 1 as the Batch Count
- 0 as Dwell
- Appropriate values for Acceleration and Deceleration

**Batched Move Settings**
- Registration as Mode
- 8000 as Distance
- 8000 as Registration Distance
- 3 as the Batch Count
- 1000 as Dwell
- Appropriate values for Acceleration and Deceleration

➤ NOTE: The Registration Distance must be longer than the Deceleration Distance or the move will not be registered.

16. Choose Close to exit the Drive Parameters window.

17. Verify the Status indicator is green.

18. Select the I/O Configuration command icon from the Drive Window.

19. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window.
   - For example:
     - Start Index as Input 1
     - Registration Sensor as Input 2.
     - Not Assigned as Input 3.
     - Not Assigned as Outputs 1 and 2.

20. Choose Close to exit the I/O Configuration window.
**Tuning**

NOTE: Do not attempt to Auto Tune systems that have gravitational effects. The Centurion DSM Drive will not hold initial position.

1. Choose the Tuning command icon from the Drive window.
2. Select AutoTune from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
   - Distance and
   - Step Current.
4. Select the appropriate entry for the Motor Direction:
   - BiDirectional,
   - Forward Only or
   - Reverse Only.
5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

**WARNING** Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose Start from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Choose Normal Drive Operation from the Tuning window.
8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose Close to exit the Tuning window.
10. Verify the Status indicator is green.
11. Close any open windows or dialog boxes.
Operation

The drive is now configured as a Registration Indexing controller.

- The servo parameters have been setup with the unloaded motor.
- Motion is commanded through the inputs.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:
1. Close the switch between J1-26 and J1-20 to enable the drive.
2. Close the toggle switch between J1-26 and J1-32 to start Index 0.
3. Close the toggle switch between J1-26 and J1-33 to simulate registration.
Absolute Indexing

NOTE: This feature is available only on drives capable of indexing: DSM 007P, DSM 015P and DSM 030P.

The Centurion DSM Drive can be set up as an absolute indexer by making the hardware connections and performing the software setup and tuning described below. A connection diagram depicts the minimum hardware necessary. Interfacing the drive to an external controller requires similar circuitry from the controller to J1, refer to “J1 - Controller” on page 6-81. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

The following example depicts a simple move from a home position.

Figure 8.10 Absolute Indexing Examples

![Diagram showing velocity and acceleration with outputs in motion](image-url)
Hardware Set Up

Make the connections described below and shown in the Figure 8.11. The appendix “Options and Accessories” on page A-235 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM Drive. A simple 3 wire cable is depicted in the figure below.

2. Connect a Motor/Feedback cable from the motor to the J2 connector on the Centurion DSM Drive.


4. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-33 (INPUT2) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.

5. Connect an external 12 to 24 VDC power source for powering I/O to J1-5 (I/O PWR) and J1-6 (I/O COM).

6. Connect the drive to a single phase 100-240 VAC, 50/60 Hz power source.
Connection Diagram

Figure 8.11 Absolute Indexing Connection Diagram

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Status LED is green. Refer to “Status Indicator” on page 10-213 for an explanation of the display codes.

2. Start DSMPro on the PC.

3. Choose Cancel from the Drive Select dialog box.

4. Select PC Set Up from the Communications menu in DSMPro to display the personal computer's communication settings.

5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select OK in the Port - Settings dialog box.
   - If the settings are different, correct the Port - Settings to allow communications with the drive.
     Factory default communications Port - Settings for the drive are:
     - Baud Rate: 9600
     - Data Bits: 8
     - Parity: None
     - Stop Bits: 1
     - Serial Port: COM1
     Refer to the section “RS-232 Communication Test” on page 11-226 for troubleshooting instructions.

6. Select Read Drive Parameters from the Communications menu.

7. Verify the Drive Name and Address are correct for the drive that is being addressed.

8. Choose OK to load the drive parameters.

   ➤ NOTE: A motor must be selected for the parameters to load.
9. If the message box appears that a motor must be selected, select **OK**. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.

10. Select or verify the correct motor model number from the drop down Motor Model list.

11. If a message advises that the drive must be reset, choose Yes.

12. Select **Indexing** as the Operation Mode for the drive.

13. Choose **Close** to exit the Drive Set Up window.

14. Choose the Drive **Parameters** command icon from the Drive window and then select the Indexing tab.

15. Select the following values for **Index Q**:
   - **Absolute as Mode**
   - 8000 as Position
   - 1 as Batch Count
   - 0 as Dwell
   - Appropriate values for Velocity, Acceleration and Deceleration

16. Choose **Close** to exit the Drive Parameters window.

17. Verify the Status indicator is green.

18. Select the **I/O Configuration** command icon from the Drive Window.

19. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window.
   For example:
   - Start Index as Input 1.
   - Define Home as Input 2.
   - Not Assigned as Input 3.
   - Not Assigned as Outputs 1 and 2.

20. Choose **Close** to exit the I/O Configuration window.
Tuning

NOTE: Do not attempt to Auto Tune systems that have gravitational effects. The Centurion DSM Drive will not hold initial position.

1. Choose the Tuning command icon from the Drive window.
2. Select AutoTune from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
   - Distance and
   - Step Current.
4. Select the appropriate entry for the Motor Direction:
   - BiDirectional,
   - Forward Only or
   - Reverse Only.
5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

WARNING Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose Start from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Choose Normal Drive Operation from the Tuning window.
8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose Close to exit the Tuning window.
10. Verify the Status indicator is green.
11. Close any open windows or dialog boxes.
Operation

The drive is now configured as a Absolute Indexing controller.
- The servo parameters have been setup with the unloaded motor.
- Motion is commanded through the inputs.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:
1. Close the switch between J1-20 and J1-26 to enable the drive.
2. Close the toggle switch between J1-32 and J1-26 to start Index 0.
3. Close the switch between J1-33 and J1-26 to define the Home position.
Modifying User Units

The units displayed for any Centurion DSM Drive may be modified using a PC with DSMPro software. The PC Display Units help menu defines the various parameters displayed by DSMPro. Default settings for Units are shown in Figure 8.12.

Figure 8.12 PC Display Units - Default Dialog

Changing the Display Units Settings

The following example changes the Label and Conversion Factor for the Position and Acceleration parameters. This example assumes a 2000 line encoder (8000 pulses/revolution).

- Position - from Counts to Motor Revolutions
- Acceleration - from RPM/sec² to Revs/sec²

1. Choose the Drive Parameters command icon from the Drive window and then select the Units button. The PC Display Units dialog appears with default settings as shown.
2. Select the Position Label cell, and change counts to Mtr Revs.

    NOTE: Labels are limited to 8 characters.

3. Select the Position Conversion Factor cell, and change 1000 to 0.125.
   Mathematically 1/8 (0.125) of a motor revolution is 1000 counts, given that the motor
   has a 2000 line (8000 count) encoder.

4. Select the Acceleration Label cell, and change RPM/sec to Revs/sec.

5. Select the Acceleration Conversion Factor cell, and change 1. to .016.
   Mathematically 1.6 x 10^-2 revs/sec^2 is 1 RPM/sec, given the motor has a 2000 line (8000
   count) encoder.

6. Choose OK to exit the PC Display Units dialog.

   The modified units will be displayed where appropriate within the DSMPro windows. For
   example, these changes cause the Indexing tab in the Drive Parameters window to display:

   • Distance in Mtr Revs
   • Acceleration in Revs/sec^2
   • Deceleration in Revs/sec^2

   The following units were not affected by the changes:

   • Dwell in msec
   • Velocity in RPM
Centurion DSM Drives are tuned quickly and easily for a wide variety of applications. Two tuning modes are available through the software:

- Auto Tune
- Manual Tune

### Tuning Guidelines

The following tuning guidelines briefly describe the tuning adjustments. These guidelines provide you with a basic reference point should the application require additional adjustments.

#### General Tuning Rules

- Tune the velocity loop first and then, if the drive uses following or step/direction commands, tune the position loop.
- To widen the velocity loop bandwidth, increase the P-gain setting, decrease the I-gain setting or increase the low-pass filter bandwidth. This provides a faster rise time and increases drive response.
- To increase stiffness, increase the I-gain setting. It rejects load disturbance and compensates for system friction.
- To reduce velocity loop overshoot, increase P-gain or decrease I-gain.
- To reduce mechanical resonance, use a stiffer mechanical coupling or decrease the low-pass filter value and the velocity loop update rate.
- If the motor oscillates, decrease either individually or together the:
  - P-gain
  - I-gain
  - low-pass filter bandwidth.
High Inertia Loads

Proper compensation of load inertia may not be simply a matter of increasing the P-gain and I-gain settings. Problems are often encountered when tuning systems with a high load to motor inertia ratio.

Mechanical Resonance

Mechanical resonance between the motor and the load occurs when the motor and load are oscillating with the same frequency but opposite phase: when the motor is moving clockwise the load is moving counter clockwise. The amplitude of the motor and load oscillations is such that the total momentum of the oscillating system is zero. In the case of a high load to motor inertia ratio this means that the motor may be moving quite a lot while the load is not moving nearly as much. Mechanical resonance occurs as a result of compliance (springiness) between the motor inertia and load inertia. It may result from belts, flexible couplings or the finite torsional stiffness of shafts. In general, the stiffer the couplings, the higher the resonant frequency and lower the amplitude. If the motor shaft is directly coupled to the load, a mechanically resonating system usually emits a buzz or squeal at the motor.

There are several ways of dealing with this problem but they fall into two groups: change the mechanical system or change the servo-motor response. Changing the mechanical system might involve reducing the inertia ratio via gearboxes or pulleys, or by increasing the stiffness of the couplings. For very high performance systems and systems with low resonance frequencies the mechanics may require changing to effectively deal with the resonance.

The second way of dealing with mechanical resonance is by changing the servo-motor response. This may be done by reducing the P-gain, I-gain, velocity loop update rate or low-pass filter value.
Reducing the value of the P-gain, low-pass filter frequency and the update frequency all have the effect of reducing the servo-motor bandwidth. As long as the resonating frequency is fairly high this will likely be acceptable, but if the resonating frequency is low it may be necessary to modify the mechanics of the system.
Backlash

Backlash between the motor and load effectively unloads the motor over a small angle. Within this small angle, the increased gain can result in oscillations. Some backlash may be unavoidable, especially with gear reduction. If backlash is present, the inertia match between the load and motor must be properly sized for good servo performance (load inertia should roughly equal motor inertia). Gearing reduces the inertia reflected to the motor by the square of the gear reduction from motor to load. Therefore, the gear ratio must provide the required match.

Auto Tune Mode

The Auto Tune mode uses a “self-tuning” algorithm that automatically adjusts the drive’s position and velocity loop gain parameters. Adjustments do not require special equipment. This mode will tune a drive for constant response across different applications. The results often provide acceptable response, but in general should be considered a starting point.

Tuning parameters adjustments are set to achieve a reasonable bandwidth and servo response based on the system inertia and friction. Auto tune may be used when a significant amount of compliance or backlash exists (for example, belt systems) in the mechanical load, but precise tuning requires the load be fully coupled to the motor. Instability problems occur when the load is not fully coupled to the motor.

NOTE: The autotune algorithm will not provide satisfactory results in systems with significant gravitational effects.
Auto Tuning

A PC running DSMPro or the TouchPad is required to perform tuning on the drive.

Before auto tuning is invoked, three autotuning parameters must be set:

- **Distance** sets the rotation limit of the motor. This is the maximum distance the motor is allowed to move during any one test. **NOTE**: Autotuning in the bi-directional mode includes two different tests.

- **Step Current** sets the amount of current given to the motor during the test. If this is set too low, a system may not move enough to gather sufficient data, if it is set too high the test will be too short and very jerky.

- **Motor Direction** (Forward Only/Reverse Only/Bi-directional) sets the rotational direction for the test. The bi-directional test does the same test in both directions, with the forward rotation first.

Auto tune procedures are explained for each drive configuration in “Application and Configuration Examples” starting on page 8-141. The following steps generalize the DSMPro tuning procedures. Similar procedures apply for the TouchPad.

When autotuning is selected, the drive rotates the motor shaft for a short time interval, typically a few seconds. Motor movement should *not* exceed 30 seconds.

**WARNING**

Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

1. Choose the **Tuning** command icon from the Drive window.
2. Choose **Auto Tune** from the Tuning window. This activates the Auto Tune Command and Motor Direction boxes within the Tuning window. Then enter or select:

- appropriate values for **Distance** in the Auto Tune Command box,
- appropriate values for **Step Current** in the Auto Tune Command box, and
- an appropriate motor rotation in the Motor Direction box on a PC, either:
  - **BiDirectional**, if the motor will be powered in both the forward and reverse directions.
  - **Forward Only**, if the machinery is designed to operate only in the forward direction.
  - **Reverse Only**, if the motor will be powered only in the reverse direction.

Use the default settings if you are uncertain about what values to enter. The default settings are set to values appropriate to the drive and motor combination selected during drive initialization.

3. Enable the drive.

4. Choose **Start** from the Tuning window. The drive rotates the motor shaft and then motion will cease. The calculated gains are displayed and the drive is disabled.

5. Disable the drive manually.

6. Choose **Normal Drive Operation** from the Tuning window.

7. Enable the drive.

8. Choose **Close** to exit the Tuning window.

   **NOTE:** Auto tuning does not have a velocity limit, but it does adhere to the motor Overspeed setting in the Drive Parameters window.
Manual Tune Mode

Manual tuning may be used to adjust the gain settings and filter frequency of the velocity and position regulator. The following sections briefly explain these settings. An understanding of the function for each type of gain and filtering will allow you to effectively tune the system.

Two types of manual tuning are available:

- Velocity tuning
- Position tuning.

Before manual tuning is invoked, the Velocity, Distance and Motor Direction parameters must be set. Refer to “Auto Tune Mode” on page 9-202 for information on setting these parameters.

The velocity loop should always be tuned before the position loop, as velocity loop tuning affects the position loop response.

Gain settings and signal filtering are the primary methods to electrically tune a system. An understanding of the types of gain and their purposes, as well as a general understanding of filtering, are essential background knowledge to properly tune a servo system.
## Gains

### Table 9.1 Velocity Loop Gains

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-gain</td>
<td>Proportional gain of the velocity regulator. P-gain controls the bandwidth of the velocity regulator by adjusting the control response proportional to the error. The P term of the velocity regulator commands an acceleration current that is proportional to the velocity error.</td>
</tr>
<tr>
<td>I-gain</td>
<td>Integral gain of the velocity regulator. Integration in the velocity regulator forces the motor velocity to precisely follow the commanded velocity. This assumes operation under steady state conditions (velocity command or load does not change). I-gain controls: ● The stiffness or the ability to reject load torque disturbance. ● The amount of velocity overshoot, which may cause the system to become unstable or oscillate. The I term of the velocity regulator commands an acceleration current proportional to the integral of the velocity error.</td>
</tr>
</tbody>
</table>

### Table 9.2 Position Loop Gains

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kp-gain</td>
<td>Proportional gain of the position loop. Kp-gain changes: ● The position loop bandwidth. ● The settling time of the position loop. In general, the higher the value of Kp-gain the faster the settling time. However, a high value of Kp-gain with inadequate velocity loop bandwidth results in overshoot and ringing.</td>
</tr>
<tr>
<td>Kd-gain</td>
<td>Differential gain of the position loop. Provides position loop damping and reduces overshoot caused by Kp or Ki gain.</td>
</tr>
</tbody>
</table>
### Tuning

| Kff-gain | Feedforward gain of the position loop. Kff-gain reduces following error. However, a high value of Kff-gain can result in position overshoot. A reduction in following error allows the system to more closely approximate gear driven systems. |
| Ki-gain | Integral gain of the position loop. Ki-gain decreases the time period for the error to decay. A non-zero value of Ki allows integration in the position loop which eliminates the steady state following error. However, a non-zero value for Ki may introduce overshoot and ringing, which cause system instability (oscillation). NOTE: Ki-gain is used in conjunction with the Ki Zone value. Ki Zone is the area around the commanded position where Ki-gain is active. |

**NOTE:** Position Loop Gains are used in the Position Following mode only.

### Filters

The velocity regulator has one low pass filter. The filter bandwidth range is from 1 Hz to 992 Hz. The filter serves two purposes:

- Adjusts the frequency range to remove or filter the noise produced by encoder resolution.
- Reduces the amount of the mechanical resonance in the mechanical system (e.g., belt systems).

Similar results may often be achieved by reducing the update rate of the velocity loop.

---

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Manual Tuning

Manual tuning may be used to adjust the gain control parameters P and I, and the filters. A square wave is generated by the drive to assist in the adjustment. Manual velocity tuning requires the following:

- Step Period value to be specified
- Step Velocity value to be specified.

➤ NOTE: Always tune the velocity loop before the position loop, as Velocity loop tuning affects the position loop response.

Tuning the Velocity Loop

The Auto Tune procedure provides a starting point for velocity loop tuning. Manual tuning is desirable when very precise adjustments are required.

The following steps describe how to manually tune the velocity loop. These steps precede the manual position loop tuning procedure, which should follow velocity loop tuning.

1. Disable the drive.

2. Choose Manual Tune (Velocity Step) from the Tuning window.

3. Enter the desired step Velocity (rpm) of the internal square wave generator.

4. Enter the desired Time to complete one cycle of the square wave of the internal step velocity.

5. Select the desired Motor Direction (Forward Only, Reverse Only, or Bi-Directional).

6. Select the Oscilloscope.

7. Enable the drive.

8. Choose Start. The motor should start moving and the oscilloscope will display the commanded velocity and the motor velocity.

9. While monitoring the motor velocity waveform, increase P-gain until the desired rise time is achieved.

10. While monitoring the motor velocity waveform, increase I-gain until an acceptable amount of overshoot is reached.
11. Apply filtering by selecting Filters, and then select Filter Enable.

12. While monitoring the motor velocity waveform, decrease the filter Bandwidth until the overshoot begins to increase (in many applications the filter is not necessary).

13. Choose Stop.

14. Disable the drive.

15. Choose Normal Drive Operation.


17. Enable the drive.

The drive’s velocity loop is tuned.

**Tuning the Position Loop**

Specify the step period and step position values, and then input a square wave to the position loop. Adjust the gain parameters $K_p$, $K_d$, $K_{ff}$, $K_i$, and $K_i$ Zone to tune the system.

**NOTE:** Tune the velocity loop before attempting to tune the position loop. The bandwidth of the velocity loop must be set before position loop tuning is attempted.

1. Disable the drive.

2. Choose Manual Tune (Position Step) from the tuning window.

3. Enter an appropriate Distance count (step position) for the internal square wave.

4. Enter an appropriate time to complete one cycle of the square wave for the internal step position.

5. Select the desired Motor Direction (BiDirectional, Forward Only or Reverse Only).

6. Select the Oscilloscope.

7. Enable the drive.

8. Choose Start. The motor will move and the oscilloscope will display the commanded position and motor position.
9. Increase the $K_p$ gain while monitoring the signal on the scope. The $K_p$ gain should be adjusted until the desired rise time is achieved, with no overshoot. Refer to Figure 9.3.

10. Increase $K_i$ very slowly until the signal begins to overshoot.

11. Increase $K_d$ very slowly to remove the overshoot caused by $K_i$.

12. In general you may leave the $K_ff$ gain set to 100.

13. Choose Stop.

14. Disable the drive.

15. Choose Normal Drive Operation.


17. Enable the drive.

The position loop has been tuned. The drive may be operated as a master encoder, step/direction or step up/down configuration.
Velocity Loop Tuning Examples

Figure 9.3 Signal Nomenclature

Figure 9.4 Underdamped Signal

UNDERDAMPED
Motor Velocity consistently overshoots the Velocity Command. To correct:
Decrease P-gain
Decrease I-gain
**Figure 9.5 Overdamped Signal**

OVERDAMPED
Motor Velocity consistently undershoots the Velocity Command. To correct:
- Increase I-gain
- Increase P-gain

**Figure 9.6 Critically Damped Signal (Ideal Tuning)**

CRITICALLY DAMPED
Motor Velocity quickly settles to the Velocity Command.
A single front panel indicator displays the status of the drive on a continuous basis:
- The Status LED lights whenever the bus is energized.

### Status Indicator

The Status indicator is a three level LED, which indicates the current operational state of the drive. The status level is indicated by the color of the LED.
- **Green** = Normal operation
- **Blinking Green/Orange** = Drive Fault
- **Orange** = Hardware malfunction
- **Blank** = Power not supplied or hardware malfunction

Refer to “Troubleshooting” beginning on page 11-220 for troubleshooting tables.

### Error Messages

If there is a fault, the specific error messages may be accessed by attaching a PC or TouchPad to the Centurion DSM Drive. Faults are detected by the drive in two ways: power-up hardware and run-time faults. A power-up fault usually requires servicing of the hardware, while a run-time fault can be cleared by resetting the drive.

“Maintenance and Troubleshooting” lists error codes and possible actions or solutions to take when resolving the error condition.

### Run Time Error Codes

**Table 10.1 Run Time Error Codes**

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Fault Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 - 03</td>
<td>Reserved</td>
</tr>
<tr>
<td>04</td>
<td>Motor Overtemperature, Thermostat</td>
</tr>
<tr>
<td>05</td>
<td>IPM Fault (Overtemperature / Overcurrent / Short Circuit)</td>
</tr>
<tr>
<td>06 - 08</td>
<td>Reserved</td>
</tr>
<tr>
<td>09</td>
<td>Bus Undervoltage</td>
</tr>
<tr>
<td>Error Code</td>
<td>Fault Description</td>
</tr>
<tr>
<td>------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>10</td>
<td>Bus Overvoltage</td>
</tr>
<tr>
<td>11</td>
<td>Illegal Hall State</td>
</tr>
<tr>
<td>12 - 16</td>
<td>Reserved</td>
</tr>
<tr>
<td>17</td>
<td>Excessive Average Current</td>
</tr>
<tr>
<td>18</td>
<td>Motor Overspeed</td>
</tr>
<tr>
<td>19</td>
<td>Excessive Following Error</td>
</tr>
<tr>
<td>20</td>
<td>Motor Encoder State Error</td>
</tr>
<tr>
<td>21</td>
<td>Auxiliary Encoder State Error</td>
</tr>
<tr>
<td>22</td>
<td>Motor Thermal Protection</td>
</tr>
<tr>
<td>23</td>
<td>IPM Thermal Protection</td>
</tr>
<tr>
<td>24</td>
<td>Excess Velocity Error</td>
</tr>
<tr>
<td>25</td>
<td>Commutation Angle Error</td>
</tr>
<tr>
<td>26</td>
<td>Reserved</td>
</tr>
<tr>
<td>27</td>
<td>Axis not Homed</td>
</tr>
<tr>
<td>28</td>
<td>No Motor Selected</td>
</tr>
<tr>
<td>29</td>
<td>Motor Selection not in Table</td>
</tr>
<tr>
<td>30</td>
<td>EEPROM Write Error</td>
</tr>
<tr>
<td>31 - 50</td>
<td>Reserved</td>
</tr>
</tbody>
</table>
Power-Up Error Codes

A power-up error indicates in almost all cases that the drive should be returned to the factory for service. In general, any occurrence of a Power-up error should be treated with extreme caution. It may indicate the hardware is marginal.

Situations that may cause drive hardware errors, and which can be remedied outside the factory include:

A watchdog time-out error may result from electrical “noise” (electromagnetic interference - EMI), a firmware error, or a hardware malfunction. The context of the watchdog error needs to be investigated to determine the source of the problem.

The following table lists the Power-Up Error Codes

Table 10.2 Power-Up Error Codes

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Fault Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>51</td>
<td>Program Memory Boot Block Error</td>
</tr>
<tr>
<td>52</td>
<td>Program Memory Main Block Error</td>
</tr>
<tr>
<td>53</td>
<td>Uninitialized Personality EEPROM Error</td>
</tr>
<tr>
<td>54</td>
<td>Personality EEPROM Read Error</td>
</tr>
<tr>
<td>55</td>
<td>Personality EEPROM Data Corruption</td>
</tr>
<tr>
<td>56</td>
<td>Processor Watchdog Error</td>
</tr>
<tr>
<td>57</td>
<td>Reserved</td>
</tr>
<tr>
<td>58</td>
<td>Processor RAM Error</td>
</tr>
<tr>
<td>59</td>
<td>Reserved</td>
</tr>
<tr>
<td>60</td>
<td>Uninitialized Service EEPROM Error</td>
</tr>
<tr>
<td>61</td>
<td>Service EEPROM Read Error</td>
</tr>
<tr>
<td>62</td>
<td>Service EEPROM Data Corruption Error</td>
</tr>
<tr>
<td>63-73</td>
<td>Reserved</td>
</tr>
<tr>
<td>74</td>
<td>Personality EEPROM Write Error</td>
</tr>
<tr>
<td>75-78</td>
<td>Reserved</td>
</tr>
</tbody>
</table>
### Error Code vs. Fault Description

<table>
<thead>
<tr>
<th>Error Code</th>
<th>Fault Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>79-n</td>
<td>Data Out of Range</td>
</tr>
<tr>
<td></td>
<td>where n = suberror parameter</td>
</tr>
<tr>
<td>1</td>
<td>Serial baud rate selection</td>
</tr>
<tr>
<td>2</td>
<td>Serial stop bits/parity selection</td>
</tr>
<tr>
<td>3</td>
<td>Position Loop Kp</td>
</tr>
<tr>
<td>4</td>
<td>Position Loop Ki</td>
</tr>
<tr>
<td>5</td>
<td>Position Loop Kff</td>
</tr>
<tr>
<td>6</td>
<td>Position Loop Kd</td>
</tr>
<tr>
<td>7</td>
<td>Gear ratio</td>
</tr>
<tr>
<td>8</td>
<td>Encoder Output Divider</td>
</tr>
<tr>
<td>9</td>
<td>Velocity Loop Update Period</td>
</tr>
<tr>
<td>10</td>
<td>Velocity Loop P Gain</td>
</tr>
<tr>
<td>11</td>
<td>Velocity Loop I Gain</td>
</tr>
<tr>
<td>12</td>
<td>Velocity Loop D Gain</td>
</tr>
<tr>
<td>13</td>
<td>Reserved</td>
</tr>
<tr>
<td>14</td>
<td>Analog Command Velocity Offset</td>
</tr>
<tr>
<td>15</td>
<td>Analog Command Torque Offset</td>
</tr>
<tr>
<td>16</td>
<td>User D/A Variable Selection</td>
</tr>
<tr>
<td>17</td>
<td>Command Source</td>
</tr>
<tr>
<td>18</td>
<td>Drive Mode (Torque/Velocity)</td>
</tr>
<tr>
<td>19</td>
<td>Tuning Direction</td>
</tr>
<tr>
<td>20</td>
<td>Motor/Encoder User Alignment Offset</td>
</tr>
<tr>
<td>21</td>
<td>Encoder Size</td>
</tr>
<tr>
<td>22</td>
<td>Motor Torque Constant</td>
</tr>
<tr>
<td>23</td>
<td>Motor Inertia</td>
</tr>
<tr>
<td>24</td>
<td>Motor Back EMF</td>
</tr>
<tr>
<td>25</td>
<td>Motor Resistance per Phase</td>
</tr>
<tr>
<td>26</td>
<td>Motor Inductance per Phase</td>
</tr>
<tr>
<td>27</td>
<td>Motor Commutation Type</td>
</tr>
<tr>
<td>28</td>
<td>Motor Encoder Hall Offset</td>
</tr>
<tr>
<td>29</td>
<td>Motor Encoder Index Offset</td>
</tr>
<tr>
<td>30</td>
<td>Motor Pole Count</td>
</tr>
<tr>
<td>80-1</td>
<td>Service Data Out of Range (Drive Type)</td>
</tr>
<tr>
<td>81</td>
<td>Reserved</td>
</tr>
<tr>
<td>82</td>
<td>Mask ROM Block Checksum Error</td>
</tr>
<tr>
<td>83 - 99</td>
<td>Reserved</td>
</tr>
</tbody>
</table>
This section provides a description of suggested maintenance activities and an in-depth troubleshooting chart.

**Maintenance**

The Centurion DSM Drive is designed to function with minimum maintenance.

_DANGER_

DC bus capacitors may retain hazardous voltages after input power has been removed, but will normally discharge in several seconds. Before working on the drive, measure the DC bus voltage to verify it has reached a safe level or wait the full time interval listed on the warning on the front of the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

**Periodic Maintenance**

Normally the only maintenance required is removal of superficial dust and dirt from the drive and a quick check of cabling insulation and connections.

_Cleaning_

To clean the drive, use an OSHA approved nozzle that provides compressed air under low pressure ≤20 kPa (30 psi) to blow the exterior surface and the vents clean.

_Cable Inspection_

Inspect the cables, particularly the power connections, to verify the connection.

- All power connections should be torqued to 1.2 Nm (11 lb-in).
- D-shell connectors can be inspected for proper seating and signal continuity.
- Visually inspect all cables for abrasion.
Data Transfer

After you have configured the drive and tuned the drive, the data stored in the EEPROM personality module should be saved off-line. Saving the parameters off line will allow you to clone several machines with the same mechanics and provides an emergency backup of the drive data.

To transfer the data from the drive to a PC:
1. While on-line with a drive, click on File in the toolbar menu.
2. Select Save As..., the Save As window will appear.
3. Enter the file name and press ENTER or choose OK to save.

To transfer the data from a PC to a drive:
1. Close all windows in DSMPro.
2. Choose File in the toolbar menu.
3. Choose Open.
4. Select the desired file name or enter the file name to be loaded and press ENTER or choose OK.
   If you do not know the name of the file to be loaded, select the correct directory from the Directories box and select the file name from the displayed list of file names. The DSMPro Off-Line Drive window will appear along with the selected file name.
5. Select Communications from the toolbar menu.
6. Select Overwrite Drive Parameters.
   The Drive Select window will appear.
7. Select the drive to be configured, and then press ENTER or choose OK to load the parameters into the personality module.
Firmware Upgrading

Centurion DSM Drives may be upgraded in the field to the latest version of firmware. Firmware versions are available from the Giddings & Lewis Product Support group. The procedure describes how to reload the firmware installed in your drive using the Upgrade Firmware command available in DSMPro software.

DSMPro provides checks and controls through message boxes which ensure that the loading of firmware is performed properly.

Firmware Upgrade Procedure using DSMPro

1. Copy the new firmware into the Firmware subdirectory of the DSMPro application directory.
2. Start DSMPro.
3. When the Drive Select window appears, select Cancel. The Drive Select window closes without connecting to the drive.
4. Choose Upgrade Firmware from the File menu. The Drive Select window will appear.
5. Select the drive to upgrade, and then select OK. The Select Firmware File window will appear.
6. The Select Firmware File window contains a list of firmware files identified by version information. Only the files that can be applied to the connected drive are displayed, which minimizes the danger of transferring an incorrect file. To select the firmware files:
   - Select the appropriate file to upgrade the drive firmware.
   - Select OK when the file is highlighted.

A visual indicator traces the progress of the firmware upgrade.

➤ NOTE: Do not remove power or reset either the drive or the PC during the upgrade. Any interruption of the firmware upgrade could cause the drive to become inoperable.
7. When the upgrade is complete a dialog box confirms completion of the upgrade and reminds you that the drive must be reset at this time.

- Select Yes if you want to perform a software reset of the drive.
- Select No if you wish to reset the drive by removing power.

Troubleshooting

A single LED on the front panel indicates the status of the drive on a continuous basis:

- Green = Normal operation
- Blinking Green/Orange = Drive Fault
- Orange = Hardware malfunction
- Blank = Power not supplied or hardware malfunction

A table of problems, potential causes, and appropriate actions to take to resolve the problem is included below.

If problems persist after attempting to carefully troubleshoot the system, please contact your local distributor for further assistance.

Error Codes

Error codes may be accessed by attaching either a PC with DSMPro software or a TouchPad to the serial port (J5):

- DSMPro displays errors in two windows: Fault History and Display Fault Status,
- The TouchPad display errors in the DrvStat parameter under the STATUS branch title.

Table 11.1 Troubleshooting Guide

<table>
<thead>
<tr>
<th>Problem or Symptom</th>
<th>Error Code</th>
<th>Possible Cause(s)</th>
<th>Action/Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATUS LED not lit</td>
<td>No AC power</td>
<td>Verify power (115/230VAC single phase) is applied to the drive.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internal power supply malfunction.</td>
<td>Call factory</td>
<td></td>
</tr>
<tr>
<td>Problem or Symptom</td>
<td>Error Code</td>
<td>Possible Cause(s)</td>
<td>Action/Solution</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>------------</td>
<td>-------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Motor jumps when first enabled</td>
<td></td>
<td>Motor encoder wiring error</td>
<td>Check motor encoder wiring. See Figure 6.38 on page 120</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Absolute signal at J2-16</td>
<td>Monitor Absolute signal at J2-16.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Incorrect motor chosen in personality module</td>
<td>Select the proper motor in DSMPro.</td>
</tr>
<tr>
<td>Digital I/O not working correctly</td>
<td></td>
<td>I/O power supply disconnected</td>
<td>Verify connections and I/O power source</td>
</tr>
<tr>
<td>Motor Overtemperature</td>
<td>04</td>
<td>Motor TS+ (J2-19) and TS- (J2-20) pins open</td>
<td>Verify TS+ (J2-19) and TS- (J2-20) connections for continuity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor thermostat trips due to:</td>
<td>Operate within (not above) the continuous torque rating for the ambient temperature (40°C maximum). Lower ambient temperature.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High motor ambient temperature, and/or</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Excessive RMS torque</td>
<td></td>
</tr>
<tr>
<td>IPM Fault</td>
<td>05</td>
<td>Motor cables shorted</td>
<td>Verify continuity of motor power cable and connector.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor winding shorted internally</td>
<td>Check for short on R, S, T and Gnd windings of the motor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drive temperature too high</td>
<td>Check for clogged or defective fan. Ensure cooling is not restricted by insufficient space around the unit.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operation above continuous power rating</td>
<td>Verify ambient temperature is not too high (above 60°C). Operate within the continuous power rating.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Output short circuit or overcurrent</td>
<td>Drive has a bad IPM, replace drive.</td>
</tr>
<tr>
<td>Problem or Symptom</td>
<td>Error Code</td>
<td>Possible Cause(s)</td>
<td>Action/Solution</td>
</tr>
<tr>
<td>-------------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Bus Undervoltage</td>
<td>09</td>
<td>Low AC line/AC power input (100 V AC minimum for safe drive operation)</td>
<td>Verify voltage level of the incoming VAC power. Check AC power source for glitches or line drop (below 90 VAC). Install an uninterruptible power supply (UPS) on your VAC input.</td>
</tr>
<tr>
<td>Bus Overvoltage</td>
<td>10</td>
<td>Excessive regeneration of power When the drive is driven by an external mechanical power source, it may regenerate too much peak energy through the drive’s power supply. The system faults to save itself from an overload.</td>
<td>Change the deceleration or motion profile and/or reduce the reflected inertia of your mechanical system. Use a larger system (motor and drive).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Excessive AC input voltage</td>
<td>Verify input is below 264 VAC.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Output short circuit</td>
<td>Check for shorts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor cabling wires shorted together</td>
<td>Check for shorts.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal motor winding short circuit</td>
<td>Check for shorts.</td>
</tr>
<tr>
<td>Illegal Hall State</td>
<td>11</td>
<td>Incorrect phasing Bad connections</td>
<td>Check the Hall phasing. Verify the Hall wiring.</td>
</tr>
<tr>
<td>RESERVED</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVED</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVED</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVED</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVED</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem or Symptom</td>
<td>Error Code</td>
<td>Possible Cause(s)</td>
<td>Action/Solution</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Excessive Average Current</td>
<td>17</td>
<td>Excessive time at peak current</td>
<td>Reduce acceleration rates</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reduce duty cycle (ON/OFF) of commanded motion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Increase time permitted for motion.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mechanical jam or excessive frictional load.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>User larger drive and motor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Software parameter set too low</td>
<td>Increase Average Current parameter to a less restrictive setting.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insufficient bus voltage</td>
<td>Correct the under voltage condition or intermittent AC power or install a larger size transformer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor Phasing is incorrect</td>
<td>Check motor phasing.</td>
</tr>
<tr>
<td>Motor Overspeed</td>
<td>18</td>
<td>OVERSPEED parameter in the drive set to low for the application</td>
<td>Using DSMPro (refer to Drive Parameters section) set Overspeed parameter to an acceptable range for the application.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor commanded to run above Overspeed setting</td>
<td>Reduce command from position controller or change velocity parameter in the position controller.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor encoder phasing is incorrect</td>
<td>Check encoder phasing.</td>
</tr>
<tr>
<td>Excess Following Error</td>
<td>19</td>
<td>The software position error limit was exceeded</td>
<td>Increase the feed forward gain to 100%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Increase the following error window (refer to DSMPro Drive Parameters section).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Retune the drive to reduce the following error.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Increase the slew limit window (refer to DSMPro Drive Parameters).</td>
</tr>
<tr>
<td>Problem or Symptom</td>
<td>Error Code</td>
<td>Possible Cause(s)</td>
<td>Action/Solution</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>------------</td>
<td>---------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Motor Encoder State Error</td>
<td>20</td>
<td>The motor encoder encountered an illegal transition</td>
<td>Replace the motor/encoder encoder. Use shielded cables with twisted pair wires. Route the feedback away from potential noise sources. Check the system grounds.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bad encoder</td>
<td>Replace motor/encoder.</td>
</tr>
<tr>
<td>Auxiliary Encoder state error</td>
<td>21</td>
<td>The auxiliary encoder encountered an illegal transition</td>
<td>Use shielded cables with twisted pair wires. Route the encoder cable away from potential noise sources. Bad encoder - replace encoder. Check the ground connections.</td>
</tr>
<tr>
<td>Motor Thermal Protection Fault</td>
<td>22</td>
<td>The internal filter protecting the motor from overheating has tripped.</td>
<td>Reduce acceleration rates. Reduce duty cycle (ON/OFF) of commanded motion. Increase time permitted for motion. Use larger drive and motor.</td>
</tr>
<tr>
<td>IPM Thermal Protection Fault</td>
<td>23</td>
<td>The internal filter protecting the IPM at slow speed has tripped.</td>
<td>Reduce acceleration rates. Reduce duty cycle (ON/OFF) of commanded motion. Increase time permitted for motion. Use larger drive and motor.</td>
</tr>
<tr>
<td>Excess Velocity Error</td>
<td>24</td>
<td>Velocity exceeded allowable range.</td>
<td>Increase time or size of allowable error. Reduce acceleration.</td>
</tr>
<tr>
<td>Commutation Angle Error</td>
<td>25</td>
<td>Bad encoder</td>
<td>Replace encoder or motor/encoder. Check wiring of motor encoder index signal.</td>
</tr>
<tr>
<td>RESERVED</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RESERVED</td>
<td>27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Motor Selected</td>
<td>28</td>
<td>No motor was selected when the drive was enabled.</td>
<td>Select a motor before enabling the drive.</td>
</tr>
<tr>
<td>Problem or Symptom</td>
<td>Error Code</td>
<td>Possible Cause(s)</td>
<td>Action/Solution</td>
</tr>
<tr>
<td>------------------------</td>
<td>------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------</td>
</tr>
<tr>
<td>Motor Information Missing</td>
<td>29</td>
<td>The motor number is referencing a motor that is not currently in the drive.</td>
<td>Select a motor that is in the drive. Update the motor tables in the drive (contact the factory).</td>
</tr>
<tr>
<td>RESERVED</td>
<td>30-99</td>
<td></td>
<td>Call the factory.</td>
</tr>
</tbody>
</table>
RS-232 Communication Test

This test verifies communications between an Centurion DSM Drive and a personal computer by connecting the XMT pin to the RCV pin. The jumper bypasses the potentially defective cable and remote unit.

Test equipment requirements are:

- A PC running DSMPro
- The Terminal mode available in Microsoft® Windows™.

1. Close all DSMPro windows.

2. Select Communication from DSMPro and verify your communication settings.


4. If the communication cable is OK, do the following:
   A. Disconnect the communication cable from the drive (but leave the cable connected to the PC).
   B. Jumper pins 2 and 3 on the D connector of the communication cable.
   C. Close and exit from DSMPro.
   D. Select the Terminal from the Program Manager (Terminal is usually in the Accessories group).
   E. Select Settings from the Main menu:
      - Select Terminal Emulation from the drop down menu,
      - Choose DEC VT-100,
      - Choose OK to close the dialog box.
F. Select Settings from the Main menu
   - Select Communications from the drop down menu
   - Choose COM1 (or the number of the communication port the drive is connected to) from the Connections sliding list.
   - Set Baud Rate to 9600
   - Set Data Bits to 8
   - Set Stop Bits to 1
   - Set Parity to NONE
   - Set Flow Control to XON/XOFF
   - Choose OK to close the dialog box.

5. Type any character on the keyboard. The character should echo back on the screen.

   If you see the character on the screen remove the jumper between pins 2 and 3, close the Windows Terminal and restart DSMPro.

   If the character does not echo back on the screen, do the following:
   - Disconnect the cable from your PC.
   - Jumper Pins 2 and 3 on the communication port of the PC.
   - Type any character on the keyboard.
     - If the character echoes back, the communication port is OK and the cable or the connectors are defective. Replace the communication cable assembly.
     - If the character did not echo back, the communication port is defective. Replace the communication port.
Testing Digital Outputs

This test verifies the functionality of the selectable outputs.

Test equipment requirements are:
- A PC running DSMPro
- A multimeter.

This test assumes there are no error codes displayed, and the I/O power supply (internal for DSM110, 120, 130 or 175 and external for DSM 007, 007P, 015, 015P, 030 or 030P) for the drive is connected correctly.

➤ NOTE: Disconnect the outputs from any external hardware while performing this test.

1. Disable the drive by opening the switch connecting J1-26 and J1-20.
2. From the Drive Window select the Output Diagnostics command icon.
3. Verify each of the Digital Outputs in the Output Diagnostics window registers the appropriate readings on a multimeter when the following values are set:

➤ NOTE: This test assumes that I/O power is 24 VDC.

A. Drive Ready box, then measure the resistance between J1-24 and J1-25.
   - If the box is checked, the resistance should read approximately 1 Ohm.
   - If the box is not checked, the resistance should read very high (> 1 MOhm).

B. Brake Enable box, then measure the resistance between J1-49 and J1-50.
   - If the box is checked, the resistance should read approximately 10hm.
   - If the box is not checked, the resistance should be very high (> 1 MOhm).
A load is necessary to test the transistor outputs listed below. A 1 kOhm resistor may be connected from the transistor output (J1-42, J1-43, J1-44 or J1-45) to the I/O COM (J1-6).

C. Digital Output 1, then measure the voltage between J1-42 and J1-13.
   - If the box is checked, the voltmeter should read approximately +24 VDC.
   - If the box is not checked, the voltmeter should read approximately 0 VDC.

D. Digital Output 2, then measure the voltage between J1-43 and J1-13.
   - If the box is checked, the voltmeter should read approximately +24 VDC.
   - If the box is not checked, the voltmeter should read approximately 0 VDC.

4. After the test has been completed you may select Close to exit Output Diagnostics window.
Testing Digital Inputs

This test verifies the functionality of the selectable inputs.

► NOTE: This test assumes that I/O power is 24 VDC.

Test equipment requirements are:
• A PC running DSMPro
• A jumper wire.

It assumes there are no error codes displayed, and the 24V power supply is connected correctly.

1. Disable the drive by opening the switch connecting J1-26 and J1-20.

2. Choose the I/O Display command icon from the Drive Window.
   A. Connect J1-20 to J1-26. The Enable indicator activates.
   C. Connect J1-31 to J1-26. The Input 1 indicator activates.
   D. Connect J1-32 to J1-26. The Input 2 indicator activates.
   E. Connect J1-33 to J1-26. The Input 3 indicator activates.

3. Choose Close to exit the I/O Display window.
Testing Analog Output

The following tests verify the functionality of the analog outputs.

➤ NOTE: This test assumes that I/O power is 24 VDC.

Test equipment requirements are:
- A PC running DSMPro
- A voltmeter.

Testing Analog Output 1

1. Disable the drive, by opening the connections between the ENABLE input and the I/O Power (I/O PWR).
2. Disconnect the connections to J1-31.
3. Select Output Diagnostics icon from the Drive Window.
4. From the Output Diagnostics window select Analog Output 1.
5. Enter 1000 in the D/A level box.
6. Connect a DC voltmeter across analog test points J1-31 and J1-28. The meter should read approximately 1 Vdc.
7. Repeat step using different positive or negative values for the D/A Level. Verify the meter reads the values you enter.
Testing Analog Input

The following test verifies the functionality of the analog input.

➤ NOTE: This test assumes that I/O power is 24 VDC.

The tests require:

- a PC running DSMPro, and
- a 10 kOhm potentiometer.

Testing the Current Limit Input

1. Verify the accuracy of the potentiometer with an ohmmeter before installing.

2. Disable the drive by opening the connections between the ENABLE input and the I/O Power (I/O PWR).

3. Disconnect the connections to J1-27 and J1-28.

4. Connect the 10K potentiometer between J1-27 and J1-28. Refer to “J1 - Controller” on page 6-81 for a diagram showing the location of the pins.

5. Choose the Drive Signals command icon from DSMPro.

6. Choose Set Up, if the Drive Signals Set Up window is not already active.

7. Choose Current - Input Limit + as the analog signal.

8. Choose OK to close the Set Up window and activate the Drive Signals window.

9. Slowly adjust the potentiometer while viewing the Drive Signals window. The Current - Input Limit + value should update as the potentiometer is adjusted.
Testing Encoder Inputs

The following test verifies both reception and transmission of the line count from an encoder by the drive.

>> NOTE: This test assumes that I/O power is 24 VDC.

The tests require:
- A PC running DSMPro, and
- A motor encoder.

Testing Encoder Inputs

1. Disable the drive by opening the connections between the ENABLE input and I/O Power (I/O PWR).
2. Choose the Drive Set Up command icon from DSMPro.
3. Choose Divide by 1 as the Motor Encoder Output Signal.
4. Make the following hardware connections:
   - Connect the motor encoder to J2.
   - Jumper the Auxiliary Encoder Inputs to the Motor Encoder Outputs by connecting the following pins:
     - J1-7 to J1-14
     - J1-8 to J1-15
     - J1-9 to J1-16
     - J1-10 to J1-17
     - J1-11 to J1-18
     - J1-12 to J1-19
5. Choose the Encoder Diagnostics command icon from DSMPro.
6. Choose Zero Count for both the Motor Encoder and Master Position Input.
7. Slowly rotate the encoder shaft by hand while observing the counts for both the Motor Encoder and Master Position Input. The Motor Encoder and Master Position Input line counts should be equal.
Centurion DSM Drives conformance to the European Union Directives is contingent on:

1. Installation of AC line filters between the power source and the drive, and

2. Use of factory supplied cables to connect FSM, HSM, NSM, SSM, or YSM Series motors to a drive. Diagrams and schematics for all Giddings & Lewis cables are shown in Cable Diagrams, Schematics and Examples, beginning on page B-245.
Centurion DSM Drives

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSM 007 500 Watt Universal Drive, single phase</td>
<td></td>
</tr>
<tr>
<td>DSM 007P 500 Watt Universal Indexing Drive, single phase</td>
<td></td>
</tr>
<tr>
<td>DSM 015 1000 Watt Universal Drive, single phase</td>
<td></td>
</tr>
<tr>
<td>DSM 015P 1000 Watt Universal Indexing Drive, single phase</td>
<td></td>
</tr>
<tr>
<td>DSM 030 2000 Watt Universal Drive, single phase</td>
<td></td>
</tr>
<tr>
<td>DSM 030P 2000 Watt Universal Indexing Drive, single phase</td>
<td></td>
</tr>
<tr>
<td>DSM110 1000 Watt Universal Drive, single phase</td>
<td></td>
</tr>
<tr>
<td>DSM120 2000 Watt Universal Drive, single phase</td>
<td></td>
</tr>
<tr>
<td>DSM130 3000 Watt Universal Drive, single phase</td>
<td></td>
</tr>
<tr>
<td>DSM175 7500 Watt Universal Drive, single or three phase</td>
<td></td>
</tr>
<tr>
<td>DSM1150 15000 Watt Universal Drive, three phase</td>
<td></td>
</tr>
</tbody>
</table>

Fuses

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ampere, fast acting, inline for DSM110, 120, 130, 175, or 1150 (Littelfuse R451001, or equivalent)</td>
<td>0006-9071-001</td>
</tr>
<tr>
<td>Fuse for DSM110, 120, 130 or 175 External Shunt Resistor (Littelfuse CCMR-4.5 or equivalent)</td>
<td>0006-9070-001</td>
</tr>
</tbody>
</table>
Options and Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>TouchPad</td>
<td>401-34405-00</td>
</tr>
<tr>
<td>AC Line Filter for DSM 007 or 007P (6 $A_{\text{rms}}$ Continuous, Single Phase)</td>
<td>401-30222-00</td>
</tr>
<tr>
<td>AC Line Filter for DSM 015, 015P or -110 (10 $A_{\text{rms}}$ Continuous, Single Phase)</td>
<td>401-30216-00</td>
</tr>
<tr>
<td>AC Line Filter for DSM 030, 030 or -120 (23 $A_{\text{rms}}$ Continuous, Single Phase)</td>
<td>401-30217-00</td>
</tr>
<tr>
<td>AC Line Filter for DSM130 (30 $A_{\text{rms}}$ Continuous, Single Phase)</td>
<td>401-34418-00</td>
</tr>
<tr>
<td>AC Line Filter for DSM175 (55 $A_{\text{rms}}$ Continuous, Single Phase)</td>
<td>401-34420-00</td>
</tr>
<tr>
<td>AC Line Filter for DSM175 (36 $A_{\text{rms}}$ Continuous, Three Phase)</td>
<td>401-34419-00</td>
</tr>
<tr>
<td>J1 to 50-pin Terminal Strip (Breakout Board), includes 1m (3ft) cable and mounting hardware</td>
<td>401-34409-00</td>
</tr>
<tr>
<td>J2 to 25-pin Terminal Strip (Breakout Board), includes 1m (3ft) cable and mounting hardware</td>
<td>401-34408-00</td>
</tr>
<tr>
<td>DSM110/120/130 External Shunt Resistor</td>
<td>401-34308-00</td>
</tr>
<tr>
<td>Manuals</td>
<td></td>
</tr>
<tr>
<td>TouchPad Instructions</td>
<td>108-31019-00</td>
</tr>
<tr>
<td>Centurion DSM Drive Installation Manual for DSM110, 120, 130 or 175</td>
<td>108-30083-00</td>
</tr>
<tr>
<td>Centurion DSM Drive Installation Manual for DSM 007, 007P, 015, 015P, 030 or 030P</td>
<td>108-31017-00</td>
</tr>
</tbody>
</table>

Installation Manual for Models DSM 007, DSM 015 and DSM 030
### Interface Cables

Diagrams and schematics for these cables are shown beginning on page B-246.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1 to customer supplied connector (no connector) 3m (10ft)</td>
<td>401-34411-10</td>
</tr>
<tr>
<td></td>
<td>401-34411-25</td>
</tr>
<tr>
<td></td>
<td>401-34411-50</td>
</tr>
<tr>
<td></td>
<td>401-34411-75</td>
</tr>
<tr>
<td>J3 to customer supplied connector (no connector) 3m (10ft)</td>
<td>401-34410-10</td>
</tr>
<tr>
<td></td>
<td>401-34410-25</td>
</tr>
<tr>
<td></td>
<td>401-34410-50</td>
</tr>
<tr>
<td></td>
<td>401-34410-75</td>
</tr>
</tbody>
</table>

### Serial Interface Cables

Diagrams and schematics for these cables are shown beginning on page B-249.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>J4/J5 to PC [RS-232] (9 pin D-shell connector) 3m (10ft)</td>
<td>502-04020-10</td>
</tr>
<tr>
<td></td>
<td>502-04020-25</td>
</tr>
<tr>
<td></td>
<td>502-04020-50</td>
</tr>
<tr>
<td>J4/J5 to customer supplied connector (no connector) 3m (10ft)</td>
<td>401-34423-10</td>
</tr>
<tr>
<td></td>
<td>401-34423-25</td>
</tr>
<tr>
<td></td>
<td>401-34423-50</td>
</tr>
<tr>
<td>J4/J5 to J4/J5 four wire RS-485 communications 1m (3ft)</td>
<td>502-04021-01</td>
</tr>
</tbody>
</table>
# Encoder Feedback Cables

Diagrams and schematics for these cables are shown beginning on page -253.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSM, HSM or SSM Series Motors to customer supplied connector (i.e., no connector)</td>
<td>3 m (10 ft) 401-34425-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-34425-25</td>
</tr>
<tr>
<td></td>
<td>15 m (50 ft) 401-34425-50</td>
</tr>
<tr>
<td></td>
<td>23 m (75 ft) 401-34425-75</td>
</tr>
<tr>
<td></td>
<td>30 m (100 ft) 401-34425-00</td>
</tr>
<tr>
<td>(DSM 007, 015 and 030 require Rev C or higher cable)</td>
<td>(DSM 007, 015 and 030 require Rev C or higher cable)</td>
</tr>
<tr>
<td>FSM, HSM or SSM Series Motors to J2</td>
<td>3 m (10 ft) 401-34407-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-34407-10</td>
</tr>
<tr>
<td></td>
<td>15 m (50 ft) 401-34407-10</td>
</tr>
<tr>
<td></td>
<td>23 m (75 ft) 401-34407-10</td>
</tr>
<tr>
<td></td>
<td>30 m (100 ft) 401-34407-10</td>
</tr>
<tr>
<td>(DSM 007, 015 and 030 require Rev C or higher cable)</td>
<td>(DSM 007, 015 and 030 require Rev C or higher cable)</td>
</tr>
<tr>
<td>NSM Series Motors to customer supplied connector (no connector)</td>
<td>3 m (10 ft) 401-30252-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-30252-25</td>
</tr>
<tr>
<td></td>
<td>15 m (50 ft) 401-30252-50</td>
</tr>
<tr>
<td></td>
<td>23 m (75 ft) 401-30252-75</td>
</tr>
<tr>
<td></td>
<td>30 m (100 ft) 401-30252-00</td>
</tr>
<tr>
<td>NSM Series Motors to J2</td>
<td>3 m (10 ft) 401-30231-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-30231-25</td>
</tr>
<tr>
<td></td>
<td>15 m (50 ft) 401-30231-50</td>
</tr>
<tr>
<td></td>
<td>23 m (75 ft) 401-30231-75</td>
</tr>
<tr>
<td></td>
<td>30 m (100 ft) 401-30231-00</td>
</tr>
<tr>
<td>YSM Series Motors to customer supplied connector (no connector)</td>
<td>3 m (10 ft) 401-30231-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-30231-25</td>
</tr>
<tr>
<td></td>
<td>15 m (50 ft) 401-30231-50</td>
</tr>
<tr>
<td></td>
<td>23 m (75 ft) 401-30231-75</td>
</tr>
<tr>
<td></td>
<td>30 m (100 ft) 401-30231-00</td>
</tr>
<tr>
<td>(DSM 007, 015 and 030 require Rev C or higher cable)</td>
<td>(DSM 007, 015 and 030 require Rev C or higher cable)</td>
</tr>
<tr>
<td>YSM Series Motors to J2</td>
<td>0.6 m (2 ft) 401-30233-02</td>
</tr>
<tr>
<td>Description</td>
<td>Part Number</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>3 m (10 ft)</td>
<td>401-30233-10</td>
</tr>
<tr>
<td>7.6 m (25 ft)</td>
<td>401-30233-25</td>
</tr>
<tr>
<td>15 m (50 ft)</td>
<td>401-30233-50</td>
</tr>
<tr>
<td>23 m (75 ft)</td>
<td>401-30233-75</td>
</tr>
<tr>
<td>3 m (10 ft)</td>
<td>401-34424-10</td>
</tr>
<tr>
<td>7.6 m (25 ft)</td>
<td>401-34424-25</td>
</tr>
<tr>
<td>15 m (50 ft)</td>
<td>401-34424-50</td>
</tr>
<tr>
<td>23 m (75 ft)</td>
<td>401-34424-75</td>
</tr>
<tr>
<td>30 m (100 ft)</td>
<td>401-34424-00</td>
</tr>
</tbody>
</table>

(DSM-005, -009 and -019 require Rev D or higher cable)

J2 to customer supplied connector (no connector)

(DSM 007, 015 and 030 require Rev C or higher cable)

(DSM 007, 015 and 030 require Rev C or higher cable)
Motor Power Cables

Diagrams and schematics for these cables are shown beginning on page -259.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive to 2000 or 3000 Motors (HSM or SSM Series)</td>
<td>3 m (10 ft) 401-34413-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-34413-25</td>
</tr>
<tr>
<td></td>
<td>15 m (50 ft) 401-34413-50</td>
</tr>
<tr>
<td></td>
<td>23 m (75 ft) 401-34413-75</td>
</tr>
<tr>
<td></td>
<td>30 m (100 ft) 401-34413-00</td>
</tr>
<tr>
<td>Drive to 4000 Motors (FSM, HSM or SSM Series)</td>
<td>3 m (10 ft) 401-34414-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-34414-25</td>
</tr>
<tr>
<td></td>
<td>15 m (50 ft) 401-34414-50</td>
</tr>
<tr>
<td></td>
<td>23 m (75 ft) 401-34414-75</td>
</tr>
<tr>
<td></td>
<td>30 m (100 ft) 401-34414-00</td>
</tr>
<tr>
<td>DSM130 or DSM175 to 6000 Motors (FSM, HSM or SSM Series)</td>
<td>3 m (10 ft) 401-34415-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-34415-25</td>
</tr>
<tr>
<td></td>
<td>15 m (50 ft) 401-34415-50</td>
</tr>
<tr>
<td></td>
<td>23 m (75 ft) 401-34415-75</td>
</tr>
<tr>
<td></td>
<td>30 m (100 ft) 401-34415-00</td>
</tr>
<tr>
<td>DSM 1150 to 6000 Motors (FSM, HSM or SSM Series)</td>
<td>3 m (10 ft) 401-34416-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-34416-25</td>
</tr>
<tr>
<td></td>
<td>15 m (50 ft) 401-34416-50</td>
</tr>
<tr>
<td></td>
<td>23 m (75 ft) 401-34416-75</td>
</tr>
<tr>
<td></td>
<td>30 m (100 ft) 401-34416-00</td>
</tr>
<tr>
<td>DSM 1150 to 8000 Motors (FSM, HSM or SSM Series)</td>
<td>3 m (10 ft) 401-34417-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-34417-25</td>
</tr>
<tr>
<td></td>
<td>15 m (50 ft) 401-34417-50</td>
</tr>
<tr>
<td></td>
<td>23 m (75 ft) 401-34417-75</td>
</tr>
<tr>
<td></td>
<td>30 m (100 ft) 401-34417-00</td>
</tr>
<tr>
<td>Drive to NSM Series Motors</td>
<td>3 m (10 ft) 401-30230-10</td>
</tr>
<tr>
<td></td>
<td>7.6 m (25 ft) 401-30230-25</td>
</tr>
</tbody>
</table>

Installation Manual for Models DSM 007, DSM 015 and DSM 030
## Connector Kits

Connector kits provide the ability to construct custom length cables. Kits are available for all Centurion DSM Drive connectors. Each kit consists of the appropriate 3M connector with the corresponding plastic backshell, and instructions.

<table>
<thead>
<tr>
<th>Connector</th>
<th>Type</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>50 pin mini D-shell, 24-30 AWG cable solder cup, squeeze latch</td>
<td>401-56489-00</td>
</tr>
<tr>
<td>J2</td>
<td>20 pin mini D-shell, 24-30 AWG cable solder cup, squeeze latch</td>
<td>401-56490-00</td>
</tr>
<tr>
<td>J3</td>
<td>26 pin mini D-shell, 24-30 AWG cable solder cup, squeeze latch</td>
<td>401-56491-00</td>
</tr>
<tr>
<td>J4 or J5</td>
<td>9 pin D-shell for RS-232 or RS-485</td>
<td>401-56492-00</td>
</tr>
</tbody>
</table>
Mating Connectors

The following connectors are listed solely to provide a cross-reference of mating connectors for the J1, J2 or J3 connectors on the Centurion DSM Drives. Centurion DSM Drive conformance to the European EMC Directive is contingent on the use of Giddings & Lewis cables.

These connectors are not available from Giddings & Lewis. Please contact the manufacturer or a distributor for additional information. Manufacturer phone numbers are: 3M 1-800-225-5373 and AMP 1-800-522-6752

<table>
<thead>
<tr>
<th>DDM</th>
<th>Mating Connector</th>
<th>Mating Backshell</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>J1</td>
<td>AMP 2-175677-7</td>
<td>AMP 176793-7</td>
<td>50-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Plastic Backshell, Squeeze Latch</td>
</tr>
<tr>
<td></td>
<td>3M10150-6000EC</td>
<td>3M 10350-A200-00</td>
<td>50-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Metal Backshell, Squeeze Latch</td>
</tr>
<tr>
<td></td>
<td>3M 10150-3000VE</td>
<td>3M 10350-52F0-008</td>
<td>50-pin Mini D Ribbon, 24-30 AWG, Solder Cup, Plastic Backshell, Squeeze Latch</td>
</tr>
<tr>
<td>J2</td>
<td>AMP 2-175677-2</td>
<td>AMP 176793-2</td>
<td>20-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Plastic Backshell, Squeeze Latch</td>
</tr>
<tr>
<td></td>
<td>3M10120-6000EC</td>
<td>3M 10320-A200-00</td>
<td>20-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Metal Backshell, Squeeze Latch</td>
</tr>
<tr>
<td></td>
<td>3M 10120-3000VE</td>
<td>3M 10320-52F0-008</td>
<td>20-pin Mini D Ribbon, 24-30 AWG, Solder Cup, Plastic Backshell, Squeeze Latch</td>
</tr>
<tr>
<td>J3</td>
<td>AMP 2-175677-4</td>
<td>AMP 176793-4</td>
<td>26-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Plastic Backshell, Squeeze Latch</td>
</tr>
<tr>
<td></td>
<td>3M10126-6000EC</td>
<td>3M 10326-A200-00</td>
<td>26-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Metal Backshell, Squeeze Latch</td>
</tr>
<tr>
<td></td>
<td>3M 10126-3000VE</td>
<td>3M 10326-52F0-008</td>
<td>26-pin Mini D Ribbon, 24-30 AWG, Solder Cup, Plastic Backshell, Squeeze Latch</td>
</tr>
</tbody>
</table>

1. For use with MDR Hand Press Tool Kit, 3M part number 3829

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Cable Diagrams, Schematics and Examples

Factory supplied cables allow Centurion DSM Drives to conform to the European Union Directives when connecting the drive to motors, controllers or computers. The following diagrams provide information on the cables available from the factory.

Refer to the Appendix, “Options and Accessories” on page A-235 for ordering information.

The information below applies to all factory supplied cables.

- Wire Insulation Type: Polyvinyl Chloride
- Conductor size: 0.08 mm² (28 AWG) tinned copper, except as noted below.
  - [0.25 mm² (24 AWG) on 502-04020-XX, 502-0402-XX and 401-34423-XX]
  - [1.5 mm² (16 AWG) on 401-34413-XX and 401-30232-XX]
  - [2.5 mm² (14 AWG) on 401-34414-XX]
  - [6 mm² (10 AWG) on 401-34415-XX]
- Braid Shield Coverage: 85% minimum
- Jacket Material: Thermoplastic elastomer
- Moldings: 105°C (221°F) Black PVC
- Flex Rating: 1,000,000 cycles
- Minimum Bend Radius

<table>
<thead>
<tr>
<th>Control Cables</th>
<th>Motor Power Cables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>millimeters (inches)</td>
</tr>
<tr>
<td>Controller (J1)</td>
<td>171.45 (6.75)</td>
</tr>
<tr>
<td>Encoder (J2)</td>
<td>129.54 (5.10)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Cables are manufactured to inch dimensions. Millimeter dimensions are approximate conversions from inches.
- Alternate field wiring diagram for FSM, HSM, or NSM Series encoder cables is shown below

DEMONSTRATES TWISTED PAIR

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Interface Cables

Figure B.1 J1 to J3 Interface Cable (P/N 401-34422)
Figure B.2 J1 to No Connector Interface Cable (P/N 401-34411)

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Serial Interface Cables

Figure B.3 J5 to 9-pin D-Shell Interface Diagram (P/N 502-04020)

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Figure B.4 J5 to J5 Serial Interface Cable (P/N 502-04021)
Figure B.5 J5 to No Connector Serial Interface Cable (P/N 401-34423)

PIN 1 THIS END

PIN 6 THIS END

9 POSITION 45° 'D'-SUN PLUS WITH MALE PIN CONTACTS
(FACE VIEW)

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Encoder Feedback Cables

Figure B.6 FSM, HSM or SSM Series Motors to No Connector Encoder Cable (P/N 401-34425)

Installation Manual for Models DSM 007, DSM 015 and DSM 030
**Figure B.7 J2 to FSM, HSM or SSM Series Encoder Cable (P/N 401-4407)**

![Diagram of J2 to FSM, HSM or SSM Series Encoder Cable](image)

**Diagram Details:**
- Cable length: 12.5 feet
- Structural adapter, black
- Molex 15-45 retractable molded thumb screw (parting directly to board connector)

**Connector Specifications:**
- 20-pin, 15-way, 125 series
- Connector backshell, shielded 15-pin (other end)

**Wire Colors and Numbers:**
Figure B.8 J2 to YSM Series Encoder Cable (P/N 401-30233)

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Figure B.9 No Connector to YSM Series Encoder Cable (P/N 401-30253)
Figure B.10 J2 to No Connector Encoder Cable (P/N 401-34424)

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Motor Power Cables

**DANGER**

Shielded power cables must be grounded at a minimum of one point for safety. Failure to ground a shielded power cable will result in potentially lethal voltages on the shield and anything connected to it.

Figure B.11 200 or 300 FSM, HSM or SSM Series Power Cable (P/N 401-34413)

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Figure B.12 400 FSM, HSM or SSM Series Power Cable (P/N 401-34414 or 401-30273)
Installation Manual for Models DSM 007, DSM 015 and DSM 030
Figure B.14 YSM Series Power Cable (P/N 401-30232)

WIRING DIAGRAM

BLACK PRINTED #1
BLACK PRINTED #2
BLACK PRINTED #3
GREEN/YELLOW
BLACK PRINTED #7
BLACK PRINTED #9
BLACK PRINTED #10
BLACK 16 AWG
Cabling Examples

Figure B.15 FSM, HSM or SSM Series Motors to Centurion DSM Drive

**NOTES:**
This wiring method should be used to run cables through a bulkhead or enclosure without removing the connectors.
Cable 401-34407-XXX has connectors on both ends. The connectors are molded and potted to the cable and may not be disassembled.
Adaptor Kit 401-34409 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 50-pin Mini D ribbon connector at the drive end and a 50-pin D connector at the terminal strip end.
Motor Power Cables - Use Centurion DSM Drive cables if the CE Mark is required. DS100/200 cables may be used if the CE Mark is not an issue. In either case, the shield on the motor power cable must be properly grounded at both ends; the shield is grounded at the motor end when the MS connector is mated.

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Figure B.16 FSM, HSM or SSM Series Motors to Centurion DSM Drive using P2 Terminal Strip

Enclosure/Cabinet

FSM, HSM or SSM Series Motor

Encoder Connector

Motor Power Connector

Screw Terminal Strip

401-34409

To
Control
Interface

Screw Terminal Strip

401-34408

Clamp exposed motor cable shield to the chassis ground terminal

Motor Power Cable

NOTES:
This wiring method provides the option to run cables through a restrictive bulkhead or enclosure.
Cable 4001.34425-XXX has connectors on the motor end only. The cable connector is molded and potted to the cable and may not be disassembled. Refer to the schematic for cable 4001.34407-XXX for information on wiring this cable to the J2 Terminal Strip.
Adaptor Kit 401-34409 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 50-pin Mini D ribbon connector at the drive end and a 50-pin D connector at the terminal strip end.
Adaptor Kit 401-34408 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 20-pin Mini D Ribbon connector at the drive end and a 20-pin D connector at the terminal strip end.
Motor Power Cables - Use Centurion DSM Drive cables if the CE Mark is required. Digital Servo Drive-200/500 Series cables may be used if the CE Mark is not an issue. In either case, the shield on the motor power cable must be properly grounded at both ends; the shield is grounded at the motor end when the MS connector is mated.
Figure B.17 YSM Series Motors to Centurion DSM Drive Drive

NOTES:
This wiring method should be used to run cables through a bulkhead or enclosure without removing the connectors.
Cable 401-30232-XXX has connectors on both ends. The connectors are molded and potted to the cable and may not be disassembled.
Adaptor Kit 401-34409 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 50-pin Mini D ribbon connector at the drive end and a 50-pin D connector at the terminal strip end.

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Figure B.18 YSM Series Motors to Centurion DSM Drive using P2 Terminal Strip

NOTES:
This wiring method provides the option to run cables through a restrictive bulkhead or enclosure.

Cable 401-30253-XXX has a connector on the motor end only. The cable connector is molded and potted to the cable and may not be disassembled. Refer to the schematic for cable 401-30253-XXX for information on wiring this cable to the J2 Terminal Strip.

Adaptor Kit 401-34409 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 50-pin Mini D ribbon connector at the drive end and a 50-pin D connector at the terminal strip end.

Adaptor Kit 401-34408 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 20-pin Mini D Ribbon connector at the drive end and a 20-pin D connector at the terminal strip end.
Introduction

The optional TouchPad is a compact and rugged device for interfacing with Centurion DSM Drives. It provides the operator with a convenient device for accessing status information, program variables, and control functions, plus message display capabilities on any Centurion DSM Drive.

An 8-character dot matrix display and a sealed-membrane type keyboard are housed in a compact case. A locking tab and a single 9-pin D shell serial connector on the backpanel connects the TouchPad to any Centurion DSM Drive via four-wire RS-485 communications.

Four cursor keys and a Mode/Enter key provide access to the TouchPad menus and enable the user to select and change parameters, activate commands, and monitor drive variables. The TouchPad also allows the user to display drive status and diagnostic information, and to control functions, such as distances, speeds, and other alphanumeric data.

Installation and Operation

1. Power down the drive.

2. Plug the TouchPad into the serial port on the Centurion DSM Drive by latching the tab into the drive and then mating the connector as shown.

3. Power-up the drive. Installing the TouchPad defaults the drive to the following settings:
   - Address 0
   - 19200 Baud
   - 8 Data bits
   - 1 Stop bit
   - No Parity bit

Installation Manual for Models DSM 007, DSM 015 and DSM 030
The personality module settings stored in the drive are not affected by the installation or removal of the TouchPad.

4. Verify the Ver##.## displayed is correct at power-up. The version number designates the type of drive and its firmware level. Figure C.2 explains this display.

**Figure C.2 TouchPad Version Number Display**

Drive Type:
- 1 = DSM110, DSM120, DSM130 or DSM175
- 2 = DSM007, DSM015 or DSM030

Firmware Level:
- 1.00 = Version 1.00
- 1.10 = Version 1.10
- 2.00 = Version 2.00 (Indexing capable)

If you are referring to the TouchPad Command Tree card, verify the version number display and the Drive Type and Firmware Version of the card are the same.

5. After self-test is completed, the TouchPad display defaults to the branch title DRVSETUP.

6. Horizontal and vertical movement through the TouchPad Command Tree and parameter modification is explained below. The “TouchPad Command Tree” on page C-274 depicts the structure of the TouchPad Command Tree.

**TouchPad Commands**

Commands are entered by pressing a single key or combination of keys. Two modes of operation are available. Parameter mode allows you to move through the TouchPad Command Tree to each parameter. Modify mode allows you to monitor and change each parameter, often while the drive is operational.

The Parameter mode displays for the TouchPad Command Tree are depicted on the “Supplemental Instructions” on page C-272.
TouchPad Instructions C-271

---

**Key Function**

Toggles the parameter display between the two operating modes.

**Parameter** mode shows the abbreviated command name of the selected parameter. Refer to the TouchPad Command Tree Chart for a full text definition.

**Modify** mode shows the setting, often a number, for the selected parameter. Key functions in each mode are explained below.

---

### Mode of Operation

<table>
<thead>
<tr>
<th>Key</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode/Enter</td>
<td>Toggles the parameter display between the two operating modes.</td>
</tr>
<tr>
<td></td>
<td><strong>Parameter</strong> mode shows the abbreviated command name of the selected parameter. Refer to the TouchPad Command Tree Chart for a full text definition.</td>
</tr>
<tr>
<td></td>
<td><strong>Modify</strong> mode shows the setting, often a number, for the selected parameter. Key functions in each mode are explained below.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key</th>
<th>Parameter/Mode</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="leftarrow.png" alt="Left Arrow" /></td>
<td>Previous Branch/Decrement #</td>
<td>Move Left</td>
</tr>
<tr>
<td><img src="arrow-right.png" alt="Right Arrow" /></td>
<td>Next Branch/Increment #</td>
<td>Move Right</td>
</tr>
<tr>
<td><img src="arrow-down.png" alt="Down Arrow" /></td>
<td>Next Parameter</td>
<td>Decrement Character</td>
</tr>
<tr>
<td><img src="arrow-up.png" alt="Up Arrow" /></td>
<td>Previous Parameter</td>
<td>Increment Character</td>
</tr>
<tr>
<td><img src="arrow-up-down.png" alt="Up &amp; Down Arrows" /></td>
<td>Not functional in this mode.</td>
<td>Undo Change/Escape</td>
</tr>
<tr>
<td><img src="enter.png" alt="Mode/Enter" /></td>
<td>Next Mode/Last Parameter</td>
<td>Next Mode</td>
</tr>
</tbody>
</table>

---

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Supplemental Instructions

Motor Selection

Enter a Motor Identification number to load the correct motor parameters into the drive. Table C.3 on page C-279 and Table C.3 on page C-279 list the motors available in the motor table directory. Selection of a motor defines default operating parameters for the drive and motor combination.

Analog Output Scaling

Selection of Analog Output Scaling through the TouchPad requires manual input of the scaling parameters. To calculate the necessary scaling parameters, first determine the Command Source (Analog or Preset/Follower). If Analog is the Command source, then determine the Drive Mode (Velocity or Torque).

Depending on the Command Source/Drive Mode, calculate the scaling information to be input at the Analog Output Scaling display as follows:

Analog in Velocity Mode
1. Divide the desired velocity scale (rpm) by the maximum motor speed (rpm) and multiply that value by 16383.

Analog in Torque Mode
1. Divide the desired current scale by the lesser of the following:
   - Motor Continuous Current (Amps) times 3, or
   - Drive Rated Current (Amps)
2. Multiply that value by 8191.

Preset/Follower
1. Enter the desired position (in counts).
Displays

Text

A drive name longer than eight characters may require scrolling with the Left, , and Right, , arrow keys. Drive names may be up to 32 characters in length.

Flashing characters in the Modify mode display are the characters that are active.

- Change the cursor position and resolution using the ▲ and ▼ keys. For example: If the Drv Name in the Modify mode displays InFeed with the F flashing, pressing the ▲ key causes the first e to flash.
- Press the ▲ or ▼ keys to increment or decrement a character by scrolling through the list of valid ASCII characters. For example, If the Drv Name in the Modify mode displays InFed with the lowercase f is flashing, pressing the ▼ key causes the flashing character to decrement to e.

Numeric

Flashing characters in the Modify mode display are the numbers that are active.

- Change the cursor position and resolution using the ▲ or ▼ key. For example: If the Over Spd in the Modify mode displays 5200 and 52 is flashing, pressing the ▲ key causes 520 to flash.
- Press the ▲ or ▼ key to increment or decrement these numbers. For example: If the Over Spd value is 5200 and 52 is flashing, pressing the ▲ key causes the setting to increment by 100 rpm each time the key is pressed.
- Parameter values may not exceed the maximum or minimum limits, regardless of the cursor position.
  For example: If the SpeedWin setting is 5000 rpm and the Maximum Speed in the motor table is 5200, pressing the ▲ key increases the parameter to 5200 (the upper limit), but pressing the ▼ key decrements the parameter to 4000.

The most significant digit is reserved when a parameter allows a negative (-) setting or the parameter provides a list of possible selections. The ▲ or ▼ key toggles the minus sign.
Figure C.3 TouchPad Command Tree

* Up to eight presets (0 - 7) are available using [ ] and [ ] keys
** Up to nine index selections (0 - 9) are available using [ ] and [ ] keys
List

The most significant digit is reserved for an active/inactive selection marker when a parameter provides a list of possible selections.

- A filled arrow, ↬, in the most significant digit indicates the active setting from a list of possible settings. Inactive settings are indicated by an unfilled arrow, ↘.
  For example: If the drive is functioning as Preset Controller in the Velocity mode, pressing the ▶ key from DRVPARAM scrolls through the CmdSrc list which includes Presets, AuxEnc, StepDir, StepU/D, and Analog.
- The Mode/Enter, ↫, key selects a parameter from the list.
- List selections that are undefined are indicated by Unknown. This display indicates the TouchPad data table is incompatible with the drive.

Lists are associated with all parameters, except DISPLAY and DRVINFO. Refer to the tables beginning on page C-280 for the items in each list. Table C.17, “Drive Status List for TouchPad” on page C-285 is a read-only list, all other lists contain possible parameter selections. After an option is selected, the display reverts to the parameter from which the option was selected. For example: Selection of the EncAlign parameter under STATUS provides the options Normal and Align. Selection of either option returns you to the EncAlign display.
Ratio

A FoIRatio (gear ratio) longer than eight characters may require scrolling with the [▼] and [▲] keys. The ratios are numeric values that increment or decrement by 1 each time the [▼], or [▲] key is pressed.

The method of display is dependent on the length of the ratios:

- If the ratio is eight characters or less, the complete ratio is displayed.
  For example, a Master to Follower ratio of one-thousand to nine-hundred is displayed as 1000:900.

- If the ratio requires more than eight characters the ratio is displayed in two parts: a Master Ratio and a Follower Ratio. The position of the colon (:) after or before each numeric value indicates Master or Follower for these larger ratios.
  The [▼] and [▲] keys toggle between the Master Ratio and the Follower Ratio.
  For example: A Master to Follower ratio on 1001:1000 is displayed in two separate displays. The Master Ratio is displayed as 1001: and pressing [▼] displays the Follower Ratio :1000.

Fault/Error/Warning

C.1 lists the possible fault, error and warning messages that may appear on the TouchPad. The items below describe the different types of messages.

- The TouchPad displays Fault and a description. A Fault message requires additional troubleshooting of the drive.
  Clear the fault display by depressing the [▼] and [▲] keys simultaneously.
  Fault codes are stored in the TouchPad parameter DrvStat and are explained with troubleshooting guidelines in Table 11.1 on page 11-220.

- The TouchPad alternately displays Error and the error name. Clear an error by pressing the [←] key.

- The TouchPad momentarily displays and then clears a warning when an invalid entry is made.
Table C.1 TouchPad Fault/Error/Warning Displays

<table>
<thead>
<tr>
<th>Display</th>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BufOvFlo</td>
<td>Error</td>
<td>Communications buffer overflowed.</td>
</tr>
<tr>
<td>Can’tDo</td>
<td>Error</td>
<td>An invalid function type encountered in the TouchPad data table. The TouchPad data table is incorrect for the drive.</td>
</tr>
<tr>
<td>Checksum</td>
<td>Error</td>
<td>The checksum of the command is in error. Information is corrupted.</td>
</tr>
<tr>
<td>CmdNoEnb</td>
<td>Error</td>
<td>The command is not enabled.</td>
</tr>
<tr>
<td>DataDisp</td>
<td>Warning</td>
<td>The parameter is a live data display and cannot be modified.</td>
</tr>
<tr>
<td>DrvEnabl</td>
<td>Warning</td>
<td>The parameter cannot be changed while the drive is enabled.</td>
</tr>
<tr>
<td>Fault</td>
<td>Fault</td>
<td>Drive fault detected.</td>
</tr>
<tr>
<td>InvLDa</td>
<td>Warning</td>
<td>Invalid data was entered for the parameter.</td>
</tr>
<tr>
<td>invLDFn</td>
<td>Error</td>
<td>Illegal function code received by drive. The TouchPad data table is incorrect for the drive.</td>
</tr>
<tr>
<td>InvLDRef</td>
<td>Error</td>
<td>Invalid Response received from drive. Received code did not match transmitted code.</td>
</tr>
<tr>
<td>Lower Lim</td>
<td>Warning</td>
<td>The lower limit of the parameter has been reached.</td>
</tr>
<tr>
<td>NoMemory</td>
<td>Error</td>
<td>TouchPad memory has been exhausted.</td>
</tr>
<tr>
<td>NoRetSel</td>
<td>Warning</td>
<td>Mode/Enter key incorrectly pressed.</td>
</tr>
<tr>
<td>OverRng</td>
<td>Error</td>
<td>Value from drive is too large to display.</td>
</tr>
<tr>
<td>RAMWrite</td>
<td>Error</td>
<td>An error was detected while writing the drive’s parameter memory.</td>
</tr>
<tr>
<td>ReadOnly</td>
<td>Warning</td>
<td>The parameter is Read Only and cannot be modified.</td>
</tr>
<tr>
<td>Timeout</td>
<td>Error</td>
<td>The communications port timed out.</td>
</tr>
<tr>
<td>UnxpChar</td>
<td>Error</td>
<td>The communications port received an unexpected character.</td>
</tr>
<tr>
<td>UpperLim</td>
<td>Warning</td>
<td>The upper limit of the parameter has been reached.</td>
</tr>
</tbody>
</table>
## Motor Table

### Table C.2 TouchPad Motor Table Identification by Motor Series

<table>
<thead>
<tr>
<th>Motor</th>
<th>ID</th>
<th>Motor</th>
<th>ID</th>
<th>Motor</th>
<th>ID</th>
<th>Motor</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSM430 B24</td>
<td>15</td>
<td>FSM610</td>
<td>27</td>
<td>FSM4220 E5000</td>
<td>852</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSM460 B24</td>
<td>3</td>
<td>FSM620</td>
<td>28</td>
<td>NSM5630</td>
<td>85</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSM490 B24</td>
<td>18</td>
<td>FSM630</td>
<td>29</td>
<td>NSM5630 E5000</td>
<td>853</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSM610 B24</td>
<td>17</td>
<td>FSM635</td>
<td>30</td>
<td>NSM5637</td>
<td>86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSM620 B24</td>
<td>18</td>
<td>FSM645</td>
<td>31</td>
<td>NSM5637 E5000</td>
<td>854</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSM620 E5000</td>
<td>786</td>
<td>NSM2302</td>
<td>335</td>
<td>NSM5647</td>
<td>87</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FSM630</td>
<td>19</td>
<td>NSM2304</td>
<td>336</td>
<td>NSM5647 E5000</td>
<td>855</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSM205</td>
<td>20</td>
<td>NSM3406</td>
<td>81</td>
<td>YSM102 115V</td>
<td>69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSM307</td>
<td>21</td>
<td>NSM3406 E5000</td>
<td>849</td>
<td>YSM102 230V</td>
<td>68</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSM320</td>
<td>22</td>
<td>NSM3412</td>
<td>82</td>
<td>YSM103 115V</td>
<td>71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSM430</td>
<td>23</td>
<td>NSM3412 E5000</td>
<td>850</td>
<td>YSM103 230V</td>
<td>70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSM460</td>
<td>25</td>
<td>NSM4214</td>
<td>83</td>
<td>YSM206 230V</td>
<td>73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSM490</td>
<td>26</td>
<td>NSM4214 E5000</td>
<td>851</td>
<td>YSM206 115V</td>
<td>74</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HSM490 E5000</td>
<td>794</td>
<td>NSM4220</td>
<td>84</td>
<td>YSM212B24 115V</td>
<td>75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table C.3 TouchPad Motor Table Identification by Motor ID

<table>
<thead>
<tr>
<th>ID</th>
<th>Motor</th>
<th>ID</th>
<th>Motor</th>
<th>ID</th>
<th>Motor</th>
<th>ID</th>
<th>Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FSM40</td>
<td>17</td>
<td>FSM10 B24</td>
<td>68</td>
<td>YSM102 230V</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FSM490</td>
<td>18</td>
<td>FSM20 B24</td>
<td>69</td>
<td>YSM102 115V</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FSM490 B24</td>
<td>19</td>
<td>FSM30</td>
<td>70</td>
<td>YSM103 230V</td>
<td>335</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>FSM490</td>
<td>20</td>
<td>FSM30</td>
<td>71</td>
<td>YSM103 115V</td>
<td>336</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>FSM490</td>
<td>21</td>
<td>FSM30</td>
<td>72</td>
<td>YSM206 230V</td>
<td>786</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>FSM490</td>
<td>22</td>
<td>FSM30</td>
<td>73</td>
<td>YSM206 115V</td>
<td>794</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>FSM490</td>
<td>23</td>
<td>FSM30</td>
<td>74</td>
<td>YSM212B24 230V</td>
<td>849</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>FSM490</td>
<td>25</td>
<td>FSM30</td>
<td>75</td>
<td>YSM212B24 115V</td>
<td>850</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>FSM490</td>
<td>26</td>
<td>FSM40</td>
<td>77</td>
<td>YSM323 E5000</td>
<td>851</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>FSM490</td>
<td>27</td>
<td>FSM610</td>
<td>81</td>
<td>FSM30</td>
<td>852</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>FSM490</td>
<td>28</td>
<td>FSM610</td>
<td>82</td>
<td>FSM30</td>
<td>853</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>FSM490</td>
<td>29</td>
<td>FSM610</td>
<td>83</td>
<td>FSM30</td>
<td>854</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>FSM490</td>
<td>30</td>
<td>FSM610</td>
<td>84</td>
<td>FSM420</td>
<td>855</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>FSM490</td>
<td>31</td>
<td>FSM610</td>
<td>85</td>
<td>FSM5630</td>
<td>856</td>
<td></td>
</tr>
</tbody>
</table>
TouchPad Options and Lists

Table C.4 Option Selections for the TouchPad

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Options</th>
<th>Parameter</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRV Parm</td>
<td></td>
<td>TUNING</td>
<td></td>
</tr>
<tr>
<td>AccelEn</td>
<td>Enable/Disable</td>
<td>SWE Enable</td>
<td>Enable/Disable</td>
</tr>
<tr>
<td>SlewEnab</td>
<td>Enable/Disable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OverRd</td>
<td>Enable/Disable</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STATUS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW Enable</td>
<td>Enable/Disable</td>
<td>SWE Enable</td>
<td>Enable/Disable</td>
</tr>
<tr>
<td>Enc Align</td>
<td>Normal/Align</td>
<td>Start</td>
<td>Normal/CtlPanel</td>
</tr>
<tr>
<td>Rmv Ofst</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TouchPad Lists

Table C.5 Drive Communications Parameter List for the TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>7 Data Bits, 1 Stop Bit, Even Parity</td>
</tr>
<tr>
<td>01</td>
<td>7 Data Bits, 1 Stop Bit, Odd Parity</td>
</tr>
<tr>
<td>02</td>
<td>8 Data Bits, 1 Stop Bit, No Parity</td>
</tr>
<tr>
<td>03</td>
<td>8 Data Bits, 1 Stop Bit, Even Parity</td>
</tr>
<tr>
<td>04</td>
<td>8 Data Bits, 1 Stop Bit, Odd Parity</td>
</tr>
</tbody>
</table>

Table C.6 Baud Rate Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>1200 Baud</td>
</tr>
<tr>
<td>01</td>
<td>2400 Baud</td>
</tr>
<tr>
<td>02</td>
<td>4800 Baud</td>
</tr>
<tr>
<td>03</td>
<td>9600 Baud</td>
</tr>
<tr>
<td>04</td>
<td>19200 Baud</td>
</tr>
</tbody>
</table>
### Table C.7 Encoder Output Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>± by 1</td>
<td>Divide Encoder counts by 1</td>
</tr>
<tr>
<td>± by 2</td>
<td>Divide Encoder counts by 2</td>
</tr>
<tr>
<td>± by 4</td>
<td>Divide Encoder counts by 4</td>
</tr>
<tr>
<td>± by 8</td>
<td>Divide Encoder counts by 8</td>
</tr>
</tbody>
</table>

### Table C.8 IO Mode Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inc</td>
<td>Incremental Indexing</td>
</tr>
<tr>
<td>Abs</td>
<td>Absolute Indexing</td>
</tr>
<tr>
<td>Reg</td>
<td>Registration Indexing</td>
</tr>
</tbody>
</table>

Note: Parameters available only if the drive supports Indexing.

### Table C.9 Index Pointer Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Index 0</td>
</tr>
<tr>
<td>01</td>
<td>Index 1</td>
</tr>
<tr>
<td>02</td>
<td>Index 2</td>
</tr>
<tr>
<td>03</td>
<td>Index 3</td>
</tr>
<tr>
<td>04</td>
<td>Index 4</td>
</tr>
<tr>
<td>05</td>
<td>Index 5</td>
</tr>
<tr>
<td>06</td>
<td>Index 6</td>
</tr>
<tr>
<td>07</td>
<td>Index 7</td>
</tr>
<tr>
<td>08</td>
<td>RAM Index</td>
</tr>
</tbody>
</table>

Note: Parameters available only if the drive supports Indexing.
Table C.10 Index Termination Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parametera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stop</td>
<td>Stop</td>
</tr>
<tr>
<td>NxtNow</td>
<td>Start another Index immediately</td>
</tr>
<tr>
<td>NxtWt</td>
<td>Start another Index at next Start Index transition</td>
</tr>
</tbody>
</table>

a. Parameters available only if the drive supports Indexing.

Table C.11 Home Type Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parametera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sns/Mrk</td>
<td>Home to Sensor, then to Marker</td>
</tr>
<tr>
<td>Marker</td>
<td>Home to Marker</td>
</tr>
<tr>
<td>Sensor</td>
<td>Home to Sensor</td>
</tr>
</tbody>
</table>

a. Parameters available only if the drive supports Indexing.

Table C.12 Homing Auto-Start Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parametera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disable</td>
<td>Auto-Start Homing inactive</td>
</tr>
<tr>
<td>Enb/Rst</td>
<td>Auto-Start Homing if not already Homed</td>
</tr>
<tr>
<td>Enable</td>
<td>Auto-Start on every Enable</td>
</tr>
</tbody>
</table>

a. Parameters available only if the drive supports Indexing.

Table C.13 Reverse Enable for Homing

<table>
<thead>
<tr>
<th>Display</th>
<th>Parametera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactive</td>
<td>No reversing if started on Sensor</td>
</tr>
<tr>
<td>Active</td>
<td>Reverse if started on Sensor</td>
</tr>
</tbody>
</table>

a. Parameters available only if the drive supports Indexing.
### Table C.14 Digital Input Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Asgn</td>
<td>Not Assigned (not used)</td>
</tr>
<tr>
<td>DrvMode</td>
<td>Drive Mode</td>
</tr>
<tr>
<td>Intlnh</td>
<td>Integrator Inhibit</td>
</tr>
<tr>
<td>FolEnab</td>
<td>Follower Enable</td>
</tr>
<tr>
<td>FwdEnab</td>
<td>Forward Enable</td>
</tr>
<tr>
<td>RevEnab</td>
<td>Reverse Enable</td>
</tr>
<tr>
<td>CMD Ovrd</td>
<td>Analog COMMAND Input Override</td>
</tr>
<tr>
<td>PreSelA</td>
<td>Preset Select Line A</td>
</tr>
<tr>
<td>PreSelB</td>
<td>Preset Select Line B</td>
</tr>
<tr>
<td>PreSelC</td>
<td>Preset Select Line C</td>
</tr>
<tr>
<td>StrtInd</td>
<td>Start Index</td>
</tr>
<tr>
<td>DefHome</td>
<td>Define Home</td>
</tr>
<tr>
<td>Registr</td>
<td>Registration/Sensor</td>
</tr>
<tr>
<td>-CmdOfs</td>
<td>Remove Command Offset</td>
</tr>
<tr>
<td>Home</td>
<td>Start Homing</td>
</tr>
<tr>
<td>Faltrst</td>
<td>Fault Reset</td>
</tr>
</tbody>
</table>

### Table C.15 Digital Output Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Asgn</td>
<td>Not Assigned (not used)</td>
</tr>
<tr>
<td>InPos</td>
<td>In Position</td>
</tr>
<tr>
<td>PosWin</td>
<td>Within Position</td>
</tr>
<tr>
<td>0 Speed</td>
<td>Zero Speed</td>
</tr>
<tr>
<td>SpdWin</td>
<td>Speed Window</td>
</tr>
<tr>
<td>+ILimit</td>
<td>Positive Current Limit</td>
</tr>
<tr>
<td>-ILimit</td>
<td>Negative Current Limit</td>
</tr>
<tr>
<td>UpToSpd</td>
<td>Up to Speed</td>
</tr>
<tr>
<td>DrvEnab</td>
<td>Drive Enable</td>
</tr>
</tbody>
</table>

Installation Manual for Models DSM 007, DSM 015 and DSM 030
<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>BusChg</td>
<td>Bus Charged</td>
</tr>
<tr>
<td>Fault</td>
<td>Disabling Fault</td>
</tr>
<tr>
<td>AtHome</td>
<td>At Home</td>
</tr>
<tr>
<td>SeqEnd</td>
<td>Sequence Complete</td>
</tr>
<tr>
<td>Moving</td>
<td>In Motion</td>
</tr>
<tr>
<td>InDwell</td>
<td>In Dwell</td>
</tr>
<tr>
<td>Homed</td>
<td>Axis Homed</td>
</tr>
</tbody>
</table>

Table C.16 Analog Output Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Cmd</td>
<td>Current Command</td>
</tr>
<tr>
<td>I Avg</td>
<td>Average Current Command</td>
</tr>
<tr>
<td>IPeak+</td>
<td>Positive Current Peak</td>
</tr>
<tr>
<td>IPeak-</td>
<td>Negative Current Peak</td>
</tr>
<tr>
<td>ILimit+</td>
<td>Positive Current Limit</td>
</tr>
<tr>
<td>ILimit-</td>
<td>Negative Current Limit</td>
</tr>
<tr>
<td>VelMtr</td>
<td>Motor Velocity</td>
</tr>
<tr>
<td>VelCmd</td>
<td>Velocity Command</td>
</tr>
<tr>
<td>VelErr</td>
<td>Velocity Error</td>
</tr>
<tr>
<td>PosMtr</td>
<td>Motor Position</td>
</tr>
<tr>
<td>PosCmd</td>
<td>Position Command Slewed</td>
</tr>
<tr>
<td>PosErr</td>
<td>Position Error</td>
</tr>
<tr>
<td>PosEPk+</td>
<td>Positive Position Peak Error</td>
</tr>
<tr>
<td>PosEPk-</td>
<td>Negative Position Peak Error</td>
</tr>
<tr>
<td>PosMstr</td>
<td>Master Position</td>
</tr>
<tr>
<td>Display</td>
<td>Parameter</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>DrvEnab</td>
<td>Drive Enabled</td>
</tr>
<tr>
<td>DrvRdy</td>
<td>Drive Ready</td>
</tr>
</tbody>
</table>
| +24 Fuse | +24 VDC Fuse blown  
  not applicable to DSM 007, DSM 007P, DSM 015, DSM 015P, DSM 030 or DSM 030P |
| 5V Fuse | +5 VDC Fuse blown  
  not applicable to DSM 007, DSM 007P, DSM 015, DSM 015P, DSM 030 or DSM 030P |
| EncFuse | Encoder Power Fuse blown  
  not applicable to DSM 007, DSM 007P, DSM 015, DSM 015P, DSM 030 or DSM 030P |
| MtrOvT  | Motor Thermostat Overtemperature |
| IPMFalt | IPM Fault (Overtemperature/Overcurrent/Short Circuit) |
| IMLinBk | Channel IM Line Break |
| BMLinBk | Channel BM Line Break |
| AMLinBk | Channel AM Line Break |
| BusOvV  | Bus Undervoltage |
| BusUndV | Bus Overvoltage |
| llglHal | Illegal Hall State |
| SubIntr | Unused Interrupt - sub processor |
| MainInt | Unused Interrupt - main processor |
| ExsAvgI | Excessive Average Current |
| OvSpeed | Motor Overspeed |
| ExsFErr | Excessive Following Error |
| MtrEnc  | Motor Encoder State Error |
| MstrEnc | Auxiliary Encoder State Error |
| MtrThrm | Motor Thermal Protection |
| IPMThrm | IPM Thermal Protection |
| EnNoMtr | No Motor Selected while enabling drive |
| MtrType | Motor Selection not in Table |
| PersWrt | Personality Write Error |
| ServWrt | Service Write Error |

Installation Manual for Models DSM 007, DSM 015 and DSM 030
### Display Parameter

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPUComm</td>
<td>CPU Communications Error</td>
</tr>
<tr>
<td>MtrOvt</td>
<td>Motor Overtemperature</td>
</tr>
<tr>
<td>IPMFalt</td>
<td>IPM Fault</td>
</tr>
<tr>
<td>ExsVErr</td>
<td>Excess Velocity Error</td>
</tr>
<tr>
<td>Comutat</td>
<td>Commutation Angle Error</td>
</tr>
<tr>
<td>Not Homd</td>
<td>Axis Not Homed</td>
</tr>
</tbody>
</table>

NOTE: The Drive Status display is read-only. DrvEnab and DrvRdy indicate the drive is functional. The other displays indicate an error condition.

#### Table C.18 Input Flags Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>FltRst</td>
<td>Fault Reset Input Flag</td>
</tr>
<tr>
<td>ENABLE</td>
<td>Drive Enable Input Flag</td>
</tr>
<tr>
<td>Input1</td>
<td>Input 1 Input Flag</td>
</tr>
<tr>
<td>Input2</td>
<td>Input 2 Input Flag</td>
</tr>
<tr>
<td>Input3</td>
<td>Input 3 Input Flag</td>
</tr>
</tbody>
</table>

#### Table C.19 Output Flags Parameter List for TouchPad

<table>
<thead>
<tr>
<th>Display</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>READY</td>
<td>Ready Output Flag</td>
</tr>
<tr>
<td>BRAKE</td>
<td>Brake Output Flag</td>
</tr>
<tr>
<td>Outpt1</td>
<td>Output 1 Flag</td>
</tr>
<tr>
<td>Outpt2</td>
<td>Output 2 Flag</td>
</tr>
</tbody>
</table>
This appendix provides background information about Electromagnetic Interference (EMI) and machine design guidelines for Electromagnetic Compatibility (EMC). Installation requirements for compliance to the European Electromagnetic Compatibility Directive are specified in “European Union Requirements” on page 3-62. AC Line Filters necessary for European EMC compliance are listed in “AC Line Filters” on page 5-76.

Introduction

Perhaps no other subject related to the installation of industrial electronic equipment is so misunderstood as electrical noise. The subject is complex and the theory easily fills a book. This section provides guidelines that can minimize noise problems.

The majority of installations do not exhibit noise problems. However, the filtering and shielding guidelines are provided as counter measures. The grounding guidelines provided below are simply good grounding practices. They should be followed in all installations.

Electrical noise has two characteristics: the generation or emission of electromagnetic interference (EMI), and response or immunity to EMI. The degree to which a device does not emit EMI, and is immune to EMI is called the device’s Electromagnetic Compatibility (EMC).

Equipment which is to be brought into the European Union legally requires a specific level of EMC. Since this applies when the equipment is brought into use, it is of considerable importance that a drive system, as a component of a machine, be correctly installed.

“EMI Source-Victim Model” shows the commonly used EMI model. The model consists of an EMI source, a coupling mechanism and an EMI victim. Devices such as servo drives and computers, which contain switching power supplies and microprocessors, are EMI sources. The mechanisms for the coupling of energy between the source and victim are conduction and radiation. Victim equipment can be any electromagnetic device that is adversely affected by the EMI coupled to it.
Immunity to EMI is primarily determined by equipment design, but how you wire and ground the device is also critical to achieving EMI immunity. Therefore, it is important to select equipment that has been designed and tested for industrial environments. The EMI standards for industrial equipment include the EN61000-4-X series (IEC 1000-4-X and IEC801-X), EN55011 (CISPR11), ANSI C62 and C63 and MIL-STD-461. Also, in industrial environments, you should use encoders with differential driver outputs rather than single ended outputs, and digital inputs/outputs with electrical isolation, such as those provided with optocouplers.

The EMI model provides only three options for eliminating the EMC problem:

- reduce the EMI at the source,
- increase the victim’s immunity to EMI (harden the victim), or
- reduce or eliminate the coupling mechanism.

In the case of servo drives, reducing the EMI source requires slowing power semiconductor switching speeds. However, this adversely affects drive performance with respect to heat dissipation and speed/torque regulation. Hardening the victim equipment may not be possible, or practical. The final, and often the most realistic solution is to reduce the coupling mechanism between the source and victim. This can be achieved by filtering, shielding and grounding.
Filtering

As mentioned above, high frequency energy can be coupled between circuits via radiation or conduction. The AC power wiring is one of the most important paths for both types of coupling mechanisms. The AC line can conduct noise into the drive from other devices, or it can conduct noise directly from the drive into other devices. It can also act as an antenna and transmit or receive radiated noise between the drive and other devices.

One method to improve the EMC characteristics of a drive is to use an isolation AC power transformer to feed the amplifier its input power. This minimizes inrush currents on power-up and provides electrical isolation. In addition, it provides common mode filtering, although the effect is limited in frequency by the interwinding capacitance. Use of a Faraday shield between the windings can increase the common mode rejection bandwidth, (shield terminated to ground) or provide differential mode shielding (shield terminated to the winding).

NOTE: “Common mode” noise is present on all conductors referenced to ground. “Differential mode” noise is present on one conductor referenced to another conductor.

One alternative to AC line filters to reduce the conducted EMI emitting from the drive. This allows nearby equipment to operate undisturbed. In many cases an AC line filter will not be required unless other sensitive circuits are powered off the same AC branch circuit. The basic operating principle is to minimize the high frequency power transfer through the filter. An effective filter achieves this by using capacitors and inductors to mismatch the source impedance (AC line) and the load impedance (drive) at high frequencies.

For drives brought into use in Europe, use of the correct filter is essential to meet emission requirements. Detailed information on filters is included in the manual and transformers should be used where specified in the manual.

AC Line Filter Selection

Selection of the proper filter is only the first step in reducing conducted emissions. Correct filter installation is crucial to achieving both EMI attenuation and to ensure safety. All of the following guidelines should be met for effective filter use.
1. The filter should be mounted to a grounded conductive surface.

2. The filter must be mounted close to the drive input terminals, particularly with higher frequency emissions (5-30 MHz). If the distance exceeds 600mm (2 feet), a strap should be used to connect the drive and filter, rather than a wire.

3. The wires connecting the AC source to the filter should be shielded from, or at least separated from the wires (or strap) connecting the drive to the filter. If the connections are not segregated from each other, then the EMI on the drive side of the filter can couple over to the source side of the filter, thereby reducing, or eliminating the filter effectiveness. The coupling mechanism can be radiation, or stray capacitance between the wires. The best method of achieving this is to mount the filter where the AC power enters the enclosure. “AC Line Filter Installation” shows a good installation and a poor installation.

**Figure D.2 AC Line Filter Installation**

When multiple power cables enter an enclosure, an unfiltered line can contaminate a filtered line external to the enclosure. Therefore, all lines must be filtered to be effective. The situation is similar to a leaky boat. All the holes must be plugged to prevent sinking.

**WARNING**

Large leakage currents exist in AC line filters. They must be grounded properly before applying power. Filter capacitors retain high voltages after power removal. Before handling the equipment, voltages should be measured to determine safe levels prior to handling the equipment. Failure to observe this precaution could result in severe bodily injury.
If the filter is mounted excessively far from the drive, it may be necessary to mount it to a grounded conductive surface, such as the enclosure, to establish a high frequency (HF) connection to that surface. To achieve the HF ground, direct contact between the mounting surface and the filter must be achieved. This may require removal of paint or other insulating material from the cabinet or panel.

The only reasonable filtering at the drive output terminals is the use of inductance. Capacitors would slow the output switching and deteriorate the drive performance. A common mode choke can be used to reduce the HF voltage at the drive output. This will reduce emission coupling through the drive back to the AC line. However, the motor cable still carries a large HF voltage and current. Therefore, it is very important to segregate the motor cable from the AC power cable. More information on cable shielding and segregation is contained in the section on shielding.

**Grounding**

High frequency (HF) grounding is different from safety grounding. A long wire is sufficient for a safety ground, but is completely ineffective as an HF ground due to the wire inductance. As a rule of thumb, a wire has an inductance of 8 nH/in regardless of diameter. At low frequencies it acts as a constant impedance, at intermediate frequencies as an inductor, and at high frequencies as an antenna. The use of ground straps is a better alternative to wires. However the length to width ratio must be 5:1, or better yet 3:1, to remain a good high frequency connection.

The ground system’s primary purpose is to function as a return current path. It is commonly thought of as an equipotential circuit reference point, but different locations in a ground system may be at different potentials. This is due to the return current flowing through the ground systems finite impedance. In a sense, ground systems are the sewer systems of electronics and as such are sometimes neglected.

The primary objective of a high frequency ground system is to provide a well defined path for HF currents and to minimize the loop area of the HF current paths. It is also important to separate HF grounds from sensitive circuit grounds. "Single Point Ground Types" shows single point grounds for both series (daisy chain) and parallel (separate) connections. A single point, parallel connected ground system is recommended.
A ground bus bar or plane should be used as the "single point" where circuits are grounded. This will minimize common (ground) impedance noise coupling. The ground bus bar (GBB) should be connected to the AC ground, and if necessary, to the enclosure. All circuits or subsystems should be connected to the GBB by separate connections. These connections should be as short as possible, and straps should be used when possible. The motor ground conductor must return to the ground terminal on the drive, not the GBB.

**Shielding and Segregation**

The EMI radiating from the drive enclosure drops off very quickly over distance. Mounting the drive in an enclosure, such as an industrial cabinet, further reduces the radiated emissions. The cabinet should have a high frequency ground and the size of the openings should be minimized. In addition, the drive is considered an "open" device which does not provide the proper IP rating for the environment in which it is installed. For this reason the enclosure must provide the necessary degree of protection. An IP rating or Nema rating (which is similar to IP) specifies the degree of protection that an enclosure provides.

The primary propagation route for EMI emissions from a drive is through cabling. The cables conduct the EMI to other devices, and can also radiate the EMI. For this reason, cable segregation and shielding are important factors in reducing emissions. Cable shielding can also increase the level of immunity for a drive. For example:

- Shield termination at both ends is extremely important. The common misconception that shields should be terminated at only one end originates from audio applications with frequencies $\leq$20 kHz. RF applications must be terminate the shield at both ends, and possibly at intermediate points for exceptionally long cables.
- When shielded cables are not terminated at the cable connection and pass through the wall of a cabinet, the shield must be bonded to the cabinet wall to prevent noise acquired inside the cabinet from radiating outside the cabinet, and vice versa.
• When shielded cables are terminated to connectors, the shield must be provide complete 360° coverage and terminate through the connector backshell. The shield must not be grounded inside the connector through a drain wire. Grounding the shield inside the connector couples the noise on the shield to the signal conductors sharing the connector and virtually guarantees failure to meet European EMC requirements.

• The shield must be continuous. Each intermediate connector must continue the shield connection through the backshell.

• All cables, both power and signal, should use twisted wire pairing.

The shield termination described above provides a coaxial type of configuration which provides magnetic shielding, and the shield provides a return path for HF currents that are capacitively coupled from the motor windings to the frame. If power frequency circulating currents are an issue, a 250 VAC capacitor should be used at one of the connections to block 50/60 Hz current while passing HF currents. Use of a properly shielded motor cable is essential to meet European EMC requirements.

The following suggestions are recommended for all installations.

1. Motor cables must have a continuous shield and be terminated at both ends. The shield must connect to the ground bus bar or drive chassis at the drive end, and the motor frame at the motor end. Use of a properly shielded motor cable is essential to meet European EMC requirements.

2. Signal cables (encoder, serial, analog) should be routed away from the motor cable and power wiring. Separate steel conduit can be used to provide shielding between the signal and power wiring. Do not route signal and power wiring through common junctions or raceways.

3. Signal cables from other circuits should not pass within 300 mm (1 ft.) of the drive.

4. The length or parallel runs between other circuit cables and the motor or power cable should be minimized. A rule of thumb is 300 mm (1 ft.) of separation for each 10 m (30 ft.) of parallel run. The 30 mm (1 ft.) separation can be reduced if the parallel run is less than 1 m (3 ft.).

5. Cable intersections should always occur at right angles to minimize magnetic coupling.

6. The encoder mounted on the brushless servo motor should be connected to the amplifier with a cable using multiple twisted wire pairs and an overall cable shield. Encoder cables are offered in various lengths that have correct terminations.
Persistent EMI problems may require additional countermeasures. The following suggestions for system modification may be attempted.

1. A ferrite toroid or “doughnut” around a signal cable may attenuate common mode noise, particularly RS-232 communication problems. However, a ferrite toroid will not help differential mode noise. Differential mode noise requires twisted wire pairs.

2. Suppress each switched inductive device near the servo amplifier. Switch inductive devices include solenoids, relay coils, starter coils and AC motors (such as motor driven mechanical timers).

3. DC coils should be suppressed with a “free-wheeling” diode connected across the coil.

4. AC coils should be suppressed with RC filters (a 200 Ohm ½ Watt resistor in series with a 0.5 uF, 600 Volt capacitor is common).

Following these guidelines can minimize noise problems. However, equipment EMC performance must meet regulatory requirements in various parts of the world, specifically the European Union. Ultimately, it is the responsibility of the machine builder to ensure that the machine meets the appropriate requirements as installed.
EMC
DECLARATION OF CONFORMITY


Manufacturer's Name: Giddings & Lewis
Manufacturer’s Address: 666 South Military Road
                        Fond du Lac, Wisconsin 54936-1658

European Representative Name: Giddings & Lewis
European Representative Address: Randles Road, Knowsley Industrial Park
                                Prescot, Merseyside L34 9EZ England

Herewith declares that all servo drives listed below,

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Part Number</th>
<th>Model Name</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSM110</td>
<td>401-34400-00</td>
<td>DSM130</td>
<td>401-34402-00</td>
</tr>
<tr>
<td>DSM120</td>
<td>401-34401-00</td>
<td>DSM175</td>
<td>401-34403-00</td>
</tr>
</tbody>
</table>

when operating any of the following motor families,
SSM, HSM, and FSM
when operating with or without the optional Touch Pad,
P/N 401-34405-00
and when installed in accordance with the installation instructions contained in the “Centurion DSM100 Drive Hardware and Installation Manual,”
P/N 108-30083-00
conform to the following generic and basic standards.

EN 55011:1993 (CISPR 1) Group 1 class A
EN 50082-2:1995 EN 61000-4-2, ENV 50140, ENV 50204, EN 61000-4-4, ENV 50141, EN 61000-4-8

We, the undersigned, hereby declare that the equipment specified above conforms to the above directive(s).

Manufacturer  Legal Representative in Europe

Signature: [Signature]  Signature: [Signature]
Full Name: Douglas B. Vonderhaar  Full Name: Roger Michael Collins
Position: Vice President and General Manager  Position: Finance Director
Place: Giddings & Lewis Automation Control  Place: Giddings & Lewis Knowsley
Date: 29 MAR 96  Date: APRIL 4, 96

Installation Manual for Models DSM 007, DSM 015 and DSM 030
This appendix provides equations to assist in sizing resistors for dynamic braking.

**Introduction**

A properly sized resistive load may be required to dynamically brake the system by dissipating the energy stored in a motor. The section “Emergency Stop Wiring” on page 7-135 depicts the necessary circuitry.

Winding inductance is ignored in this analysis, which allows the load on the motor winding to be considered as purely resistive when dynamic braking occurs. This simplifies the evaluation to a scalar analysis, instead of a vector analysis. For simplicity, friction, damping and load torque also are ignored in the equations.

**Dynamic Braking Equations**

Equations for the magnitude of instantiates velocity, and per phase current, energy and power are derived by solving the differential equation governing the motor velocity. The equations are shown below.

**Table E.1 Dynamic Braking Resistor Parameters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>i(t)</td>
<td>Phase Current</td>
<td>R_L</td>
<td>Line-Neutral Dynamic Braking Resistance</td>
</tr>
<tr>
<td>E(t)</td>
<td>Per Phase Energy</td>
<td>K_E</td>
<td>Peak Line-to-Line Back EMF</td>
</tr>
<tr>
<td>J_m</td>
<td>Motor Inertia</td>
<td>K_T</td>
<td>Peak Line-to-Line Torque Constant</td>
</tr>
<tr>
<td>J_L</td>
<td>Load Inertia</td>
<td>w_0</td>
<td>Initial Angular Velocity</td>
</tr>
<tr>
<td>P(t)</td>
<td>Per Phase Power</td>
<td>w</td>
<td>Angular Velocity</td>
</tr>
<tr>
<td>R</td>
<td>Motor Line-to-Line Resistance</td>
<td>t</td>
<td>Time</td>
</tr>
</tbody>
</table>

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Figure E.1 Dynamic Braking Equations

\[ \omega(t) = \omega_0 e^{-t/\tau} \]

where

\[ \tau = 0.866 \left[ \frac{(R + 2R_L)(J_M + J_L)}{K_E K_T} \right] \]

\[ i(t) = \frac{K_E \omega_0 e^{-t/\tau}}{0.866(R + 2R_L)} \]

\[ E(t) = \frac{1}{2} (J_L + J_M) \omega_0^2 e^{-2t/\tau} \]

\[ P(t) = \left[ \frac{(J_L + J_M) \omega_0^2}{2\tau} \right] e^{-2t/\tau} = 1.154 \left[ \frac{K_E K_T \omega_0^2}{(R + 2R_L)} \right] e^{-2t/\tau} \]

For this type of response, 98\% of the energy will be dissipated in 4 time constants. Therefore the average power for each dynamic braking event can be calculated as:

\[ P_{AVE} = \frac{1}{2} (J_M + J_L) \omega_0^2 \left( \frac{1}{4\tau} \right) = 0.144 \frac{K_E K_T \omega_0^2}{(R + 2R_L)} \]

Equation 1 is used in equations 2 and 3 to put the power in terms of the motor parameters and the dynamic braking resistance (i.e., independent of the load inertia).
Sample Calculations

The following example uses an HSM490 motor with a 10 times inertia mismatch and dynamic braking resistors sized at four times the motor winding resistance. The average power of the motor is 1116 Watts for the selected parameters, but it is unlikely that a resistor with this Wattage is required. Pulse type currents, such as this example, require sufficient thermal mass to absorb the energy and to dissipate or accommodate the peak Voltage. Adequate information for intermittent duty cycle and surge current applications is seldom provided by resistor manufacturers. However, often they will assist in resistor selection when supplied with the current profile.

NOTE: The equations using the symbol ":=" are "assigned" in Mathcad®.

Figure E.2 HSM490 Motor Parameters in MKS Units

\[
K_T := 0.74 \quad R := 0.9 \quad J_m := 0.00068
\]

\[
K_E := 90 \quad K_E := \frac{K_E \cdot 60}{2 \cdot \pi \cdot 1000} \quad K_E = 0.859
\]

Figure E.3 Load Inertia, Dynamic Braking Resistance and Velocity in MKS Units

\[
R_L := 4 \cdot R \quad J_L := 10 \cdot J_m \quad \omega := \frac{3000 \cdot 2 \cdot \pi}{60} \quad \omega = 314.159
\]

Figure E.4 Time Vector

\[
t := 0, 0.01, \ldots 0.5
\]

Figure E.5 Time Constant (seconds)

\[
\tau = \frac{0.866(R + 2 \cdot R_T) \cdot (J_m + J_L)}{K_E \cdot K_T} \quad \tau = 0.083
\]
Figure E.6 Current Calculation (Amps)

\[ i(t) := \frac{2^\frac{t}{\tau}}{K_E \cdot \omega_0 \cdot e^{\frac{2\cdot t}{\tau}}} \cdot \frac{e^{\frac{2\cdot t}{\tau}}}{0.866(R + 2 \cdot R_L)} \]

Figure E.7 Instantaneous Power Calculation (Watts)

\[ P(t) := \left[ \frac{1.154 \cdot K_E \cdot K_T \cdot \omega_0^2}{(R + 2 \cdot R_L)} \right] \cdot e^{\frac{2\cdot t}{\tau}} \]

Figure E.8 Average Power (Watts)

\[ P_{ave} := 0.144 \left[ \frac{K_E \cdot K_T \cdot \omega_0^2}{R + 2 \cdot R_L} \right] \]

\[ P_{ave} = 1116 \]
## Specifications

### Agency Approvals

| UL and cUL | UL 508C File E15483 |

### Environmental

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>0°C to 55°C (32°F to 131°F)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40°C to 70°C (-40°F to 158°F)</td>
</tr>
<tr>
<td>Humidity</td>
<td>5% to 95% non-condensing</td>
</tr>
<tr>
<td>Altitude</td>
<td>1500 meters (5000 feet) Derate 3% for each 300 m above 1500 m (1000 ft. above 5000 ft.)</td>
</tr>
<tr>
<td>Vibration</td>
<td>10 to 2000 Hz @ 2g</td>
</tr>
<tr>
<td>Shock</td>
<td>15g 11 millisecond half sine</td>
</tr>
</tbody>
</table>

### Dielectric Withstanding (Hi-Pot)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main AC</td>
<td>1414 (1500) VDC for 1 minute, &lt;5mA leakage current</td>
</tr>
</tbody>
</table>

**NOTE:** Metal Oxide Varistors (MOVs) between line and earth ground must be removed when testing. Internal EMI filter capacitors require testing with DC Voltage.

### Weight

<table>
<thead>
<tr>
<th>Model</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSM 007, 007P</td>
<td>1.7 Kg (3.7 Lbs)</td>
</tr>
<tr>
<td>DSM 015, 015P</td>
<td>2.05 Kg (4.5 Lbs)</td>
</tr>
<tr>
<td>DSM 030, 030P</td>
<td>2.0 Kg (4.4 Lbs)</td>
</tr>
</tbody>
</table>

### Motor Encoder Interface

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal Output Power</td>
<td>5 Volts DC</td>
</tr>
<tr>
<td>Encoder Inputs</td>
<td>A/B, Differential, 26LS33 input, 1 MHz (4 MHz Quadrature) Maximum Signal Frequency, 1/T Low Speed Measurement</td>
</tr>
<tr>
<td>Thermostat Inputs</td>
<td>Normally closed</td>
</tr>
<tr>
<td>Hall Inputs</td>
<td>Single-ended, 5 Volt Logic</td>
</tr>
<tr>
<td>ABS Input</td>
<td>0 to 5 Volt, 10-bit</td>
</tr>
</tbody>
</table>

Installation Manual for Models DSM 007, DSM 015 and DSM 030
### User Interface

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Port</td>
<td>RS-232 or four wire RS-485, 1200 to 19200 baud</td>
</tr>
<tr>
<td>Status Display</td>
<td>3 Level LED</td>
</tr>
<tr>
<td>Addressing</td>
<td>Software selected</td>
</tr>
</tbody>
</table>

### Digital Inputs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selectable (4) ENABLE</td>
<td>12-24 Volt, Optically Isolated, Single ended, Active High, 4.5 mA nominal. Minimum ON time = 1.5 msec.</td>
</tr>
</tbody>
</table>

### Digital Outputs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selectable (2) BRAKE READY</td>
<td>12-24 Volt, Short Circuit Protected, Optically Isolated, Single-ended, Active High, 50 mA maximum Normally Open Relay, 1 A Normally Open Relay, 100 mA</td>
</tr>
<tr>
<td>Digital I/O Power Supply</td>
<td>User supplied 12 to 24 VDC</td>
</tr>
</tbody>
</table>

### Analog Inputs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Limit (I LIMIT) COMMAND</td>
<td>0 to 10 Volt, single-ended, 5 kOhm input Impedance ±10 Volt, Differential, 13 kOhm input Impedance, offset software adjustable</td>
</tr>
</tbody>
</table>

### Analog Outputs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANALOG1</td>
<td>0 to 10 Volt, 8 bits, 2 mA maximum</td>
</tr>
</tbody>
</table>

### Auxiliary Encoder Input

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auxiliary Encoder Signal Input</td>
<td>26LS33 Input, 4 MHz Count Frequency Differential/Single-ended A/B Step/Direction CW/CCW</td>
</tr>
</tbody>
</table>

### Motor Encoder Output

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Encoder Output</td>
<td>AM26C31 or AM26LS31 Differential Driver, Divide by 1, 2, 4, or 8 Differential output is 2.0 Vdc across a 100 Ohm load</td>
</tr>
</tbody>
</table>
### Memory

| Parameter Data Retention | 20 years |

### Motor Protection

<table>
<thead>
<tr>
<th>Motor Overload Protection</th>
<th>The drive utilizes solid state motor overload protection which operates:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>within 8 minutes at 200% overload</td>
</tr>
<tr>
<td></td>
<td>within 20 seconds at 600% overload</td>
</tr>
</tbody>
</table>

### Speed Regulation

<table>
<thead>
<tr>
<th>Type</th>
<th>Digital, PI</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3dB Bandwidth</td>
<td>300 Hz</td>
</tr>
<tr>
<td>-45° Bandwidth</td>
<td>50 Hz</td>
</tr>
<tr>
<td>Ripple</td>
<td>±0.44 rpm with 5000 line encoder</td>
</tr>
<tr>
<td>Speed Range</td>
<td>1:8000 rpm</td>
</tr>
</tbody>
</table>

### Position Regulation

| Type | Digital, PI with Feedforward |

### Filters

| Low Pass | Digital, 0 - 1000 Hz, -3 dB Bandwidth, Selectable |

### Software Controls

<table>
<thead>
<tr>
<th>Data Collection (2)</th>
<th>128 samples @ 5 kHz Sample Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firmware</td>
<td>Factory installed EEPROM</td>
</tr>
<tr>
<td>Operating Modes</td>
<td>Torque, Velocity or Position</td>
</tr>
<tr>
<td>Command Sources</td>
<td>Analog</td>
</tr>
<tr>
<td></td>
<td>Auxiliary Encoder</td>
</tr>
<tr>
<td></td>
<td>Presets</td>
</tr>
<tr>
<td></td>
<td>Step/Direction</td>
</tr>
<tr>
<td></td>
<td>CW/CCW</td>
</tr>
<tr>
<td></td>
<td>Indexing: Incremental, Registration, Absolute</td>
</tr>
<tr>
<td></td>
<td>(Indexing on DSM 007P, 015P and 030P only)</td>
</tr>
<tr>
<td>Autotuning</td>
<td>Position and</td>
</tr>
<tr>
<td></td>
<td>Velocity Loop</td>
</tr>
<tr>
<td>Manual Tuning</td>
<td>Position or</td>
</tr>
<tr>
<td></td>
<td>Velocity Loop</td>
</tr>
<tr>
<td>User Set-up</td>
<td>DSMPro or TouchPad</td>
</tr>
</tbody>
</table>

Installation Manual for Models DSM 007, DSM 015 and DSM 030
### Software Controls (cont.)

| Diagnostics                             | Motor or Auxiliary Encoder Checks  
|                                         | Digital Output Override  
|                                         | Analog Output Override  
| Serial Protocol                         | 7-bit ASCII, Checksum, Active Response  
| Power-Up Faults                         | EPROM Checksum  
|                                         | EEPROM Checksum  
|                                         | SRAM Write/Read  
|                                         | Watchdog Reset  
|                                         | A/D Conversion  
|                                         | D/A Conversion  
| Run-Time Faults                         | Motor Overtemperature  
|                                         | Bus Overvoltage  
|                                         | IPM Fault  
|                                         | Overspeed  
|                                         | Excess Error  
|                                         | Encoder State Change  
|                                         | Illegal Hall State  
| Selectable Digital Inputs               | Drive Mode Select  
|                                         | Integrator Inhibit  
|                                         | Follower Enable  
|                                         | Forward Enable  
|                                         | Reverse Enable  
|                                         | Operation Mode Override  
|                                         | Preset Selects  
|                                         | Start Index  
|                                         | Define Home  
|                                         | Remove Command Offset  
|                                         | Start Homing  
|                                         | Sensor  

## Software Controls (cont.)

<table>
<thead>
<tr>
<th>Selectable Digital Outputs</th>
<th>In-Position</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Within Window</td>
</tr>
<tr>
<td></td>
<td>Zero Speed</td>
</tr>
<tr>
<td></td>
<td>Speed Window</td>
</tr>
<tr>
<td></td>
<td>± Current Limit</td>
</tr>
<tr>
<td></td>
<td>Up To Speed</td>
</tr>
<tr>
<td></td>
<td>Drive Enabled</td>
</tr>
<tr>
<td></td>
<td>Bus Charged</td>
</tr>
<tr>
<td></td>
<td>Disabling Motion</td>
</tr>
<tr>
<td></td>
<td>In Motion</td>
</tr>
<tr>
<td></td>
<td>In Dwell</td>
</tr>
<tr>
<td></td>
<td>Sequence Complete</td>
</tr>
<tr>
<td></td>
<td>Registered</td>
</tr>
<tr>
<td></td>
<td>At Home</td>
</tr>
<tr>
<td></td>
<td>Axis Homed</td>
</tr>
</tbody>
</table>

## Speed Control Command

<table>
<thead>
<tr>
<th>Range</th>
<th>0 to ±32,767 RPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>(actual maximum speed depends on the motor/drive combination)</td>
<td></td>
</tr>
</tbody>
</table>
## Power

<table>
<thead>
<tr>
<th></th>
<th>DSM 007 &amp; DSM 007P</th>
<th>DSM 015 &amp; DSM 015P</th>
<th>DSM 030 &amp; DSM 030P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AC Input Voltage and Frequency</strong></td>
<td>100-240 Vac_{rms} nominal Single Phase 47 - 63 Hz</td>
<td>100-240 Vac_{rms} nominal Single Phase 47 - 63 Hz</td>
<td>100-240 Vac_{rms} nominal Single Phase 47 - 63 Hz</td>
</tr>
<tr>
<td><strong>AC Input Current</strong></td>
<td>5 A_{rms}</td>
<td>9 A_{rms}</td>
<td>18 A_{rms}</td>
</tr>
<tr>
<td><strong>Bus Voltage</strong></td>
<td>141-339 Vdc</td>
<td>141-339 Vdc</td>
<td>141-339 Vdc</td>
</tr>
<tr>
<td><strong>Output Peak Current</strong></td>
<td>7.5 Amps</td>
<td>15 Amps</td>
<td>30 Amps</td>
</tr>
<tr>
<td><strong>Continuous Output Current (peak)</strong></td>
<td>2.5 Amps</td>
<td>5 Amps</td>
<td>10 Amps</td>
</tr>
<tr>
<td>**Bus Capacitance Energy Absorption (from 325-400 Vdc Bus)**a</td>
<td>38 Joules C=1410uF</td>
<td>51 Joules C=1880uF</td>
<td>51 Joules C=1880uF</td>
</tr>
<tr>
<td><strong>Peak Power Output</strong>b</td>
<td>120 Vac 0.9 kWatts 240 Vac 1.8 kWatts</td>
<td>120 Vac 1.3 kWatts 240 Vac 2.7 kWatts</td>
<td>120 Vac 2.7 kWatts 240 Vac 5.5 kWatts</td>
</tr>
<tr>
<td><strong>Continuous Power Output</strong>b</td>
<td>120 Vac 0.3 kWatts 240 Vac 0.6 kWatts</td>
<td>120 Vac 0.6 kWatts 240 Vac 1.2 kWatts</td>
<td>120 Vac 1.2 kWatts 240 Vac 2.5 kWatts</td>
</tr>
</tbody>
</table>

a. Bus capacitance energy absorption is based on the following equations:

\[ \varepsilon = \frac{1}{2} C(V_f^2) - \frac{1}{2} C(V_i^2) \]

\[ \varepsilon = \frac{1}{2} C((420)^2 - (325)^2) \]

\[ \frac{1}{2} C \cdot (420^2 - 325^2) = C(35387) \]

If \( C = 17 \times 470uF \), then \( E = 282 \)

b. Power outputs are based on the following equation:

\[ kWatts = \left( \frac{VAC \times I_{R_{max}}}{\sqrt{2}} \times \sqrt{3} \right) \times 0.85 \]
Power Dissipation

Centurion DSM Drives dissipate power that results in cabinet heating. The following table lists power dissipation values. Calculate the cabinet cooling requirements using the power dissipation information and formulas below.

<table>
<thead>
<tr>
<th>Current as % of Rated Continuous Current</th>
<th>DSM 007 &amp; DSM 007P</th>
<th>DSM 015 &amp; DSM 015P</th>
<th>DSM 030 &amp; DSM 030P</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>48 W</td>
<td>48 W</td>
<td>50 W</td>
</tr>
</tbody>
</table>

NOTE: These values do not include external shunt regulator power (regenerated power).

Maximum power losses are shown to help size a NEMA 12 or equivalent enclosure and to ensure the required ventilation. Typical power losses are about one-half maximum power losses.

When sizing an enclosure with no active method of heat dissipation, the following equation approximates the size of enclosure necessary:

\[ T = 4.08 \times \left( \frac{Q}{A} \right) + 1.1 \]

where:
- \( T \) = Temperature difference between inside air and outside ambient (°F)
- \( Q \) = Heat generated in enclosure (watts)
- \( A \) = Enclosure surface area in ft\(^2\) = \( \frac{(2d + 2h + 2w) \times 144}{144} \)
- \( d \) = Depth in inches
- \( h \) = Height in inches
- \( w \) = Width in inches
A
ABS Input 301
Absolute Indexing 189
AC
Current
   input 138, 306
   inrush 138
Frequency, input 306
Line Filters 74, 76
Power
   TB-1 137
   Terminals 131
Voltage, input 306
Accessories 235
Addressing 302
Agency Approvals 301
Altitude 301
Analog Controller
   Configuration Example 142
Analog Inputs 57
   Troubleshooting 232
Analog Outputs 302
   Troubleshooting 231
Application Examples
   Absolute Indexing 189
   Analog Controller 142
   Incremental Indexing 173
   Modifying User Units 197
Position Follower
   Master Encoder 155
   Step Up/Down 167
   Step/Direction 161
Preset Controller 147
Registration Indexing 181
Auto Tune
   Overspeed Parameter 204
   Selecting 202
Auxiliary Encoder Error,
   see Troubleshooting
Auxiliary Encoder Signal Inputs 302

B
Backlash
   Tuning 202
Bandwidth
   -3dB 303
   -45dB 303
BRAKE 302
Braking
   Dynamic Resistor Sizing 297
Breakout Board
   J1 (50 pin) 116
   J2 (26 pin) 120
Bus
   Capacitance 306
   Overvoltage 222
   Undervoltage 222
   Voltage 306

C
Cables
   European Union Directives 74
   Schematics and Diagrams 246
Cabling Examples 265
COMMAND 302
Command Sources
   Analog 55
   Types Accepted 303
Command Summary 270
Common Mode Choke 291
Compatible Components
   Motors 61

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Configuration Examples
Absolute Indexing 189
Analog Controller 142
Incremental Indexing 173
Modifying User Units 197
Position Follower
  Master Encoder 155
  Step Up/Down 167
  Step/Direction 161
Preset Controller 147
Registration Indexing 181

Connection Diagram
Absolute Indexing 191
Analog Controller 143
Incremental Indexing 175
Position Follower
  Master Encoder 156
  Step Up/Down 168
  Step/Direction 162
Preset Controller 149
Registration Indexing 183
Current Limit 57, 98

D
DAC, see Digital to Analog Converter
Data
  Collection 303
  Retention 303
DC Bus
  LED 213
  Terminals 131
Default Set Up Parameters
  Drive/Motor 307
Digital Inputs
  ENABLE 57
  Troubleshooting 230
Digital Outputs
  Troubleshooting 228
Digital Signal 57
Digital to Analog Converter 56
Display User Units, see User Units
Drive
  Addressing
    Serial Communications 123
    Specifications 302
    TouchPad Defaults 269
  Installation
    Interface Connections 72
    Mechanical Requirements 69
  Storage 49
  Drive/Motor Default
    Set Up Parameters 307
  Dynamic Braking Resistors 297

E
Electromagnetic Compatibility (EMC)
  AC Line Filters 289
  European Union Directives 74
  Filtering 289
  Grounding 291
  Guidelines
    Designing for EMC 293
    General 73
    System 287
    Shielding and Segregation 292
  Electromagnetic Interference (EMI) 287
  EMI Source-Victim Model 288
  EMC, see Electromagnetic Compatibility
  ENABLE Signal 57, 302
  Encoder
    Cabling 253
Connections 117
Troubleshooting 233
Error Codes and Messages 213, 220
  Power-Up 215
  Run Time 213
Error Displays
  TouchPad 277, 278
European Union Directives
  AC Line Filters 74
  Electromagnetic Compatibility 74
Excess Error, see Troubleshooting
Excessive Average Current, see Troubleshooting

F
Filters 76
Firmware 67
  Displaying Revision Level 67
  Hexadecimal Files 67
  Upgrading 67, 219
Fuse, see Power Supply Protection

G
Gains
  Effect on Tuning 206
  I-gain Defined 206
  Kd-gain, defined 206
  Kff-gain, defined 207
  Ki-gain, defined 207
  Kp-gain, defined 206
  P-gain Defined 206
Gear Ratios
  Selecting via TouchPad 277
Gravitational Effects
  Tuning 202

Grounding Types
  Single Point 291

H
Hall Inputs 301
Hardware Requirements 63
Host Commands 26, 29
Humidity 301

I
I LIMIT, see Current Limit
I/O Connections
  Analog Command Signal 99
  Analog Inputs 98
  Analog Outputs 99
  Auxiliary Encoder Inputs 105
  Circuit Examples 88
  Dedicated Relay Outputs 90
  Digital Inputs 83
  Digital Outputs 90
  Drive 72
  European Union Directives 74
  J1 81
  J2 117
  J4 and J5 121
  Motor Encoder Signal 101
  Output Circuit Examples 95
  Overview 57
  Power 83
  Selectable Outputs 90
  Wiring 73
I/O Connectors
  Controller 81
  Encoder 117
  Interface Cable Examples 108

Installation Manual for Models DSM 007, DSM 015 and DSM 030
J1 116
J2 117, 120
J4 and J5 121
RS-232 and RS-485 121
I/O Power
   External 83
I-gain
   Defined 206
Illegal Hall State 222
Incremental Indexing 173
Indexing
   Absolute 189
   Incremental 173
   Registration 181
Indicators
   DC Bus 213
Inertia
   Possible Effects 200
Initial Inspection 43
Input
   Frequency 137
   Power 138
   Troubleshooting 232
Inrush Current 138
Inspecting the Drive 44
Inspection Procedures
   Checkout Test 47
   Communications Verification 47
   Hardware Set Up 45
   Initial Drive Operation 48
   Initial Power-up 47
   Shipping Damage 43
Installing
   Software 64
   TouchPad 269
Interconnect Cables
   European Union Directives 74
Schematics and Diagrams 246
   Interface
      Connections 72
      Signals 81
IPM Short, see Troubleshooting
IPM Thermal Protection Fault, see Troubleshooting

J

J1
   Analog Command Signal 99
   Analog Inputs 98
   Analog Outputs 99
   Auxiliary Encoder Inputs 105
   Circuit Examples 88
   Dedicated Relay Outputs 90
   Digital Inputs 83
   Digital Outputs 90
   Interface Cable Examples 108
   Motor Encoder Signal 101
   Output Circuit Examples 95
   Pin-Outs 81
   Power 83
   Selectable Outputs 90
J2
   Pin-outs 117
J4
   Pin-outs 121
J5
   Pin-outs 121

K

Kd-gain 206
Kff-gain 207
Ki-gain 207
Kp-gain 206

L
LED
DC Bus 213
Line Drivers 56
Line Filters 76
Low Pass Filter 303

M
Maintenance 217
Cleaning 217
Manual Tuning 205
Filter Adjustment 207
Position Loop Procedure 209
Procedures 208
Velocity Loop Examples 211
Velocity Loop Procedure 208
Mechanical Installation 69
Mechanical Resonance
Possible Causes 200
Tuning 200
Modifying User Units, see User Units
Motor
Encoder
Input 301
Interface 301
Output 302
Power Output 301
Identification Table 279
Overload Protection 135, 303
Overview 61
Phase Connections 132
Power
Cabling 132

Schematics and Diagrams 259
Troubleshooting
Encoder Error 224
Motor Information Missing 225
Overspeed 223
Overtemperature 221
Thermal Protection Fault 224
Mounting Requirements 69

O
Operating Temperature 301
Options 235
Output Current
Continuous (peak) 306
Peak 306

P
Part Numbers 235
AC Line Filters 237
Cables 246
Encoder Cables 239, 253
Fuses 236
Interface Cables 238
Manuals 237
Mating Connectors 243
Motor Power Cables 241, 259
Serial Interface Cables 238, 251
Shunt Resistor 237
Terminal Strip 237
TouchPad 237
PC Display Units Dialog 197
P-gain
Defined 206
Position Follower
Master Encoder 155

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Step Up/Down 167
Step/Direction 161
Position Regulation 303
Power
   Input Frequency 137
   Output
      Continuous 306
      Peak 306
   Protection 135
   Ratings 306
   Source Separation 138
   Supply 135
Preset Binary Inputs
   Programmable Speed Inputs 147
Preset Controller
   Configuration Example 147
Product Notice v
Product Support 323
Protection Circuitry 135
Motor Overload 135

RS-232
   Multiple Axes Set-up 128
   Single Axis Set-up 123
   Troubleshooting 226
RS-485
   Multiple Axes Set-up 127
Run Time
   Error Codes 213
   Faults 304

Safety
   Guidelines 37
Safety Notes v
   Damaged Cables v
   Flying Leads v
   Generation of Power v
   Installation and Maintenance v
   Logic Signals v
   Loose Cables v
   Loose Drives v
   Mechanical Connection v
   Motors v
   Product Disposal v
   Requirements v
   Supply v
   User Responsibilities 37
   Weight v
Sample Applications
   Absolute Indexing 189
   Analog Controller 142
   Incremental Indexing 173
   Modifying User Units 197
   Position Follower
      Master Encoder 155
      Step Up/Down 167

R
Readme File 67
READY 302
Registration Indexing 181
Requirements
   AC Input Current 138
   I/O Power
      External 83
   Input Power 138
   Transformer 138
   Wire Size 138
Revision Level
   Software 67
Ripple
   Speed Regulation 303
Step/Direction 161
Preset Controller 147
Registration Indexing 181
Selectable I/O 302
   Digital Inputs 304
   Digital Outputs 305
Self-Test 270
Separation of Power Sources 138
Serial Communications
   Drive Addressing 123
      RS-232 Multiple Axes 128
      RS-232 Single Axis 123
      RS-485 Multiple Axes 127
   Hardware Addressing 123
   Overview 55
   Port (J5) 121
Serial Interface Cables
   Schematics and Diagrams 251
Serial Ports 302
Serial Protocol 304
Shipping Damage 44
Shock 301
Signal Extension Kits 81
Single Point Ground Example 291
Software
   Installation 64
   Instructions 25
   Readme File 67
   Requirements 63
   Starting and Quitting 65
   Version Level 67
Space Requirements 69
Specifications 301, 306
   ABS Input 301
   AC Input
      Current 306
      Frequency 306
   AC Voltage 306
   Addressing 302
   Agency Approvals 301
   Altitude 301
   Analog Outputs 302
   Auxiliary Encoder Signal Inputs 302
   BRAKE 302
   Bus Capacitance 306
   Bus Voltage 306
   COMMAND 302
   Command Sources 303
   Data Collection 303
   Data Retention 303
   ENABLE 302
   Hall Inputs 301
   Humidity 301
   Low Pass Filter 303
   Motor Encoder
      Input 301
      Interface 301
      Output 302
      Signal Output Power 301
   Operating Temperature 301
   Output Current
      Continuous (peak) 306
      Peak 306
   Position Regulation 303
   Power Output
      Continuous 306
      Peak 306
   Power-Up Faults 304
   READY 302
   Ripple
      Speed Regulation 303
   Run-Time Faults 304
   Selectable Digital Inputs 304
   Selectable Digital Outputs 302, 305
Selectable Inputs 302
Serial Ports 302
Serial Protocol 304
Shock 301
Speed Control Command 305
Speed Regulation 303
-3dB Bandwidth 303
-45dB Bandwidth 303
Status Display 302
Storage Temperature 301
Thermostat Inputs 301
Vibration 301
Weight 301
Speed Control Command 305
Speed Regulation 303
Starting and Quitting Software 65
Status Display 302
Storage 32
Storage Temperature 301
Storing the Drive 49
Support 323
Local Product 35
Technical Product Assistance 35
Symbols and Conventions 30

T

TB-1
AC Power Terminals 131
Bus Terminals
AC Power 137
DC Bus Terminals 131
Motor Power Terminals 132
Technical Assistance 323
Terminal Strip
J1 (50 pin) 116

J2 (26 pin) 120
see also TB-1
Testing the Drive 44
Thermostat Inputs 301
Timing Diagram
Absolute Indexing 189
Incremental Indexing 173
Registration Indexing 181
Torque (Current) Loop Diagram 201
TouchPad 270
Character Selection 273
Cursor Movements 273
Default Settings 269
Drive Addressing Defaults 269
Error Display 278
Error Displays 277
Gear Ratios 277
Installation and Operation 269
Instructions 26
Lists
Baud Rate 280
Drive Communications 280
Motor Table 279
Selections 276
Modes of Operation 271
Motor Selection 272
Motor Table Identification 279
Revision Level 67
Text Selection 273
Version Display 270
Warnings 277
Transformer Sizing 138
Troubleshooting 217
Analog Outputs 231
Auxiliary Encoder Error 224
Bus Overvoltage 222
Bus Undervoltage 222
Current Limit 232
Digital Inputs 230
Digital Outputs 228
Encoder Inputs 233
Excess Error 223
Excessive Average Current 223
Gain Adjustments 200
IPM Short 221
IPM Thermal Protection Fault 224
Motor Buzz or Squeal 200
Motor Encoder Error 224
Motor Overspeed 223
Motor Overtemperature 221
Motor Thermal Protection Fault 224
RS-232 Communications 226
TouchPad 277
Tuning 199
   Auto Tune 202
   Backlash 202
   Gain Settings, Effect on 206
   General 199
   Gravitational Effects 202
   High Inertia Loads 200
   Manual Tune 205
   Mechanical Resonance 200
Tuning Procedures
   Manual Mode 208
      Position Loop 209
      Velocity Loop 208
      Velocity Loop Examples 211
   Velocity Loop
      Filter 207
      Overspeed Parameter 204
   Typographical Conventions 30

U
ULTRA Master Instructions 25
Unpacking the Drive 43
User Units 197

V
Velocity Loop Diagram 201
Version Level
   Firmware 67
   Software 67
   TouchPad 270
   Vibration 301

W
Warnings
   TouchPad 277
   Weight 301
   Wire Size 138
   Wiring I/O 73
   Wording Conventions 30
### J5 - Serial Port

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RCV +</td>
</tr>
<tr>
<td>2</td>
<td>RCV</td>
</tr>
<tr>
<td>3</td>
<td>XMT</td>
</tr>
<tr>
<td>4</td>
<td>XMT +</td>
</tr>
<tr>
<td>5</td>
<td>Com</td>
</tr>
<tr>
<td>6</td>
<td>Reserved</td>
</tr>
<tr>
<td>7</td>
<td>RCV -</td>
</tr>
<tr>
<td>8</td>
<td>XMT -</td>
</tr>
<tr>
<td>9</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

### J2 - Encoder

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Encoder +5V Pwr</td>
</tr>
<tr>
<td>2</td>
<td>Encoder 5V Com</td>
</tr>
<tr>
<td>3</td>
<td>Encoder +5V Pwr</td>
</tr>
<tr>
<td>4</td>
<td>Encoder 5V Com</td>
</tr>
<tr>
<td>5</td>
<td>Encoder +5V Pwr</td>
</tr>
<tr>
<td>6</td>
<td>Encoder 5V Com</td>
</tr>
<tr>
<td>7</td>
<td>Mtr Encdr Input Chnl A+</td>
</tr>
<tr>
<td>8</td>
<td>Mtr Encdr Input Chnl A-</td>
</tr>
<tr>
<td>9</td>
<td>Mtr Encdr Input Chnl B+</td>
</tr>
<tr>
<td>10</td>
<td>Mtr Encdr Input Chnl B-</td>
</tr>
<tr>
<td>11</td>
<td>Mtr Encdr Input Chnl i+</td>
</tr>
<tr>
<td>12</td>
<td>Mtr Encdr Input Chnl i-</td>
</tr>
<tr>
<td>13</td>
<td>Hall A</td>
</tr>
<tr>
<td>14</td>
<td>Hall B</td>
</tr>
<tr>
<td>15</td>
<td>Hall C</td>
</tr>
<tr>
<td>16</td>
<td>Absolute Position</td>
</tr>
<tr>
<td>17</td>
<td>Reserved</td>
</tr>
<tr>
<td>18</td>
<td>Reserved</td>
</tr>
<tr>
<td>19</td>
<td>Thermal Switch +</td>
</tr>
<tr>
<td>20</td>
<td>Thermal Switch -</td>
</tr>
</tbody>
</table>

### J1 - Controller

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Encoder +5VDC</td>
</tr>
<tr>
<td>2</td>
<td>Encoder 5V Com</td>
</tr>
<tr>
<td>3</td>
<td>Encoder +6VDC</td>
</tr>
<tr>
<td>4</td>
<td>Encoder 5V Com</td>
</tr>
<tr>
<td>5</td>
<td>External I/O Power</td>
</tr>
<tr>
<td>6</td>
<td>External I/O Com</td>
</tr>
<tr>
<td>7</td>
<td>Mtr Output Chnl A+</td>
</tr>
<tr>
<td>8</td>
<td>Mtr Output Chnl A-</td>
</tr>
<tr>
<td>9</td>
<td>Mtr Output Chnl B+</td>
</tr>
<tr>
<td>10</td>
<td>Mtr Output Chnl B-</td>
</tr>
<tr>
<td>11</td>
<td>Mtr Output Chnl i+</td>
</tr>
<tr>
<td>12</td>
<td>Mtr Output Chnl i-</td>
</tr>
<tr>
<td>13</td>
<td>External I/O Com</td>
</tr>
<tr>
<td>14</td>
<td>Auxiliary Chnl A+</td>
</tr>
<tr>
<td>15</td>
<td>Auxiliary Chnl A-</td>
</tr>
<tr>
<td>16</td>
<td>Auxiliary Chnl B+</td>
</tr>
<tr>
<td>17</td>
<td>Auxiliary Chnl B-</td>
</tr>
<tr>
<td>18</td>
<td>Auxiliary Chnl i+</td>
</tr>
<tr>
<td>19</td>
<td>Auxiliary Chnl i-</td>
</tr>
<tr>
<td>20</td>
<td>Drive Enable</td>
</tr>
<tr>
<td>21</td>
<td>Fault Reset</td>
</tr>
<tr>
<td>22</td>
<td>Analog Cmd +</td>
</tr>
<tr>
<td>23</td>
<td>Analog Cmd -</td>
</tr>
<tr>
<td>24</td>
<td>Drive Ready +</td>
</tr>
<tr>
<td>25</td>
<td>Drive Ready -</td>
</tr>
<tr>
<td>26</td>
<td>External I/O Power</td>
</tr>
<tr>
<td>27</td>
<td>I Limit</td>
</tr>
<tr>
<td>28</td>
<td>Analog Com</td>
</tr>
<tr>
<td>29</td>
<td>Reserved</td>
</tr>
<tr>
<td>30</td>
<td>Reserved</td>
</tr>
<tr>
<td>31</td>
<td>Analog Output 1</td>
</tr>
<tr>
<td>32</td>
<td>Selectable Input 1</td>
</tr>
<tr>
<td>33</td>
<td>Selectable Input</td>
</tr>
<tr>
<td>34</td>
<td>Selectable Input 2</td>
</tr>
<tr>
<td>35</td>
<td>Reserved</td>
</tr>
<tr>
<td>36</td>
<td>Reserved</td>
</tr>
<tr>
<td>37</td>
<td>Reserved</td>
</tr>
<tr>
<td>38</td>
<td>Reserved</td>
</tr>
<tr>
<td>39</td>
<td>Reserved</td>
</tr>
<tr>
<td>40</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Interface Connections

This section illustrates the components and connections typical for a Centurion DSM100 Drive DSM 007, 007P, 015, 015P, 030 and 030P drive.

DSM Interface Connection Diagram - J2 and J5
DSM Interface Connection Diagram - J1

Installation Manual for Models DSM 007, DSM 015 and DSM 030
Product Support

Giddings & Lewis product support is available over the phone. When you call, you should be at your computer and have the hardware and software manuals at hand. Be prepared to give the following information:

- The version numbers of the hardware and software products.
- The type of hardware that you are using.
- The fault indicators and the exact wording of any messages that appears on your screen.
- How you have tried to solve the problem.

Distributor & Representative Network

The Giddings & Lewis has a wide network of distributors that are trained to support our products. If you encounter problems, call the distributor or representative where you purchased the product before contacting the factory.

Applications Engineers and Field Service

In the United States you can reach the Giddings & Lewis factory based support staff by phone between 7:00 AM and 5:00 PM (CST) Monday through Friday at 1-800-558-4808. The applications engineers can assist you with programming difficulties as well as ideas for how to approach your automation task. Should your problem require on-site assistance, field service is available.

The applications engineers can also be reached via fax at 1-920-929-4669. The fax machine is open 24 hours 7 days a week. Faxes will be answered during regular business hours only.

In Europe, support can be obtained through Giddings & Lewis. The support staff may be reached by telephone between 8:30 and 17:30 local time, Monday through Friday at 011-44-15154-62010, or via fax at 011-44-15154-72801.

Bulletin Board Service (BBS)

If you have a modem, you can reach the Giddings & Lewis BBS 24 hours a day, 7 days a week at 1-920-929-4682. The following services are available through the BBS:

- Example application programs.
- Technical bulletins.
- Leave messages and files for the application engineers.
- Help with your application.