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# Table of Contents

## 1 Safety

1.1 Introduction .................................................. 23
   How to use This Manual ........................................ 23
   Definition of Manipulating Industrial Robot ................. 24

1.2 Notes, Cautions, and Warnings .............................. 24

1.3 Precautions and Required Safeguards ......................... 25
   AdeptModules Static Forces ..................................... 25
   Safety Barriers .................................................. 25
   Additional Safety Information ................................. 26

1.4 Intended Use of the AdeptModules ......................... 26

1.5 AdeptModules Modifications ................................. 27
   Acceptable Modifications ...................................... 27
   Unacceptable Modifications ................................. 28

1.6 Endangerment Through Additional Equipment ............. 28

1.7 Working Areas ................................................ 28

1.8 Qualification of Personnel .................................. 29

1.9 Transport .................................................... 29

1.10 Safety Equipment for Operators ............................ 29

1.11 Protection Against Unauthorized Operation ............... 30

1.12 Operating Modes of AdeptModules ......................... 30
   Adept MV Controller ......................................... 30
   Automatic Mode ............................................... 30
   Manual Mode .................................................. 30
   EXC/EXA Controller ......................................... 30
   External Operations .......................................... 30
   Teach Box Operation .......................................... 31

1.13 Safety Aspects While Performing Maintenance .......... 31

1.14 What to Do in an Emergency Situation ................... 31

## 2 AdeptModules Overview ...................................... 33

2.1 Introduction .................................................. 35
   Module Types .................................................. 35
   H-Module ....................................................... 35
   M-Module ....................................................... 35
   S-Module ....................................................... 35
   Sz-Module ...................................................... 36
   Gantry Support Modules ...................................... 36
Class 10 Cleanroom Modules ................................................. 36

2.2 Modules Specifications .................................................. 37
  Module Moment Capacity .................................................. 38

2.3 AdeptModule Life and Yawing Moment Calculations ............... 40
  Life Calculations .......................................................... 40
  Moment Calculations ....................................................... 40
  G-Style Configuration ..................................................... 41
    Module 2 ................................................................. 41
    Module 1 ................................................................. 41
  D-Style Configuration ..................................................... 42
    Module 2 ................................................................. 42
    Module 1 ................................................................. 42
  X-Style Configuration ..................................................... 43
    Module 2 ................................................................. 43
    Module 1 ................................................................. 43
  K-Style Configuration ..................................................... 44
    Module 2 ................................................................. 44
    Module 1 ................................................................. 44
  Z-Style Configuration ..................................................... 45
    Module 2 ................................................................. 45
    Module 1 ................................................................. 45
  P-Style Configuration ..................................................... 46
    Module 3 ................................................................. 46
    Module 2 ................................................................. 46
    Module 1 ................................................................. 47
  J-Style Configuration ..................................................... 47
    Module 3 ................................................................. 47
    Module 2 ................................................................. 48
    Module 1 ................................................................. 48

3 Mechanical Assembly, Getting Started .................................. 49
  3.1 Introduction ............................................................ 51
  3.2 Transporting a Single Axis ........................................... 52
  3.3 Warranty Requirements .............................................. 52
  3.4 Mounting the Main Unit to a Base .................................. 53
    Direct Attachment Using the Tap Holes on the Bottom of the Main Unit. 54
    Attaching Using the Optional Mounting Brackets ..................... 55
  3.5 Single-Axis Electrical Connections ................................. 56
    EXA and EXC Electrical Connections ................................ 56
    Adept MV Controller Connections .................................... 56
  3.6 Mounting Components to the Main Unit ............................ 57
# Table of Contents

## 4 Mechanical Assembly, Adding Axis Two

### 4.1 Introduction

- Precautions

### 4.2 Combining Methods

### 4.3 Robot Cables

- Changing the Angle of the Cable End
- Mounting the Cable Holder
- Inserting the Chamfered and Straight Pin Into a Bracket

### 4.4 Assembling G-Type Combinations

### 4.5 G-1 Type Installation Procedure

- G-1 Type Electrical Connections
  - EXA and EXC Electrical Connections
  - Adept MV Controller Connections

### 4.6 G-2 Type Installation Procedure

- G-2 Type Electrical Connections
  - EXA and EXC Electrical Connections
  - Adept MV Controller Connections

### 4.7 G-3 Type Installation Procedure

- G-3 Type Electrical Connections
  - EXA and EXC Electrical Connections
  - Adept MV Controller Connections

### 4.8 Assembling D-Type Combinations

### 4.9 D-1 and D-2 Type Installation Procedure

- D-1 and D-2 Type Electrical Connections
  - EXA and EXC Electrical Connections
  - Adept MV Controller Connections

### 4.10 D1 and D2 Configuration Extended Stroke Cable Track Installation

- Adding User Cables to the Cable Track

### 4.11 D-3 Type Installation Procedure

- D-3 Type Electrical Connections
  - EXA and EXC Electrical Connections
  - Adept MV Controller Connections

### 4.12 D-4 Type Installation Procedure

- D-4 Type Electrical Connections
  - EXA and EXC Electrical Connections
  - Adept MV Controller Connections

### 4.13 Assembling K-Type Combinations

### 4.14 K-2 Type Installation Procedure

- K-2 Type Electrical Connections
  - EXA and EXC Electrical Connections
  - Adept MV Controller Connections
4.15 K-3 Type Installation Procedure ................................................. 100
   K-3 Type Electrical Connections ............................................... 100
   EXA and EXC Electrical Connections ...................................... 101
   Adept MV Controller Connections ........................................... 102

4.16 K-4 Type Installation Procedure ............................................. 104
   K-4 Type Electrical Connections ............................................... 104
   EXA and EXC Electrical Connections ...................................... 105
   Adept MV Controller Connections ........................................... 106

4.17 Assembling Z-Type Combinations ........................................... 108

4.18 Z-2 Type Installation Procedure ............................................. 109
   Z-2 Type Electrical Connections ............................................... 109
   EXA and EXC Electrical Connections ...................................... 110
   Adept MV Controller Connections ........................................... 111

4.19 Z-3 Type Installation Procedure ............................................. 113
   Z-3 Type Electrical Connections ............................................... 113
   EXA and EXC Electrical Connections ...................................... 114
   Adept MV Controller Connections ........................................... 115

4.20 Z-4 Type Installation Procedure ............................................. 117
   Z-4 Type Electrical Connections ............................................... 117
   EXA and EXC Electrical Connections ...................................... 118
   Adept MV Controller Connections ........................................... 119

4.21 Assembling T-Type Combinations ........................................... 121

4.22 T-Type Installation Procedure .............................................. 122
   T-Type Electrical Connections .................................................. 123
   EXA and EXC Electrical Connections ...................................... 123
   Adept MV Controller Connections ........................................... 124

4.23 Assembling X-Type Combinations ........................................... 126

4.24 X-1 Type Installation Procedure ............................................. 127
   X-1 Type Electrical Connections ............................................... 127
   EXA and EXC Electrical Connections ...................................... 128
   Adept MV Controller Connections ........................................... 129

4.25 X-2 Type Installation Procedure ............................................. 130
   X-2 Type Electrical Connections ............................................... 131
   EXA and EXC Electrical Connections ...................................... 132
   Adept MV Controller Connections ........................................... 133

4.26 X1 and X2 Extended Stroke Cable Track Installation ..................... 134
   Adding User Cables to the Cable Track ..................................... 136

4.27 X-3 Type Installation Procedure ............................................. 136
   X-3 Type Electrical Connections ............................................... 137
   EXA and EXC Electrical Connections ...................................... 138
   Adept MV Controller Connections ........................................... 139
Table of Contents

5 Mechanical Installation, Adding Axis Three ........................................... 141

5.1 Introduction ............................................................................................ 143

5.2 Assembling P-Type Combinations .......................................................... 144

5.3 P-1 Type Installation Procedure ............................................................. 145

  P-1 Type Electrical Connections ................................................................. 146
  EXA and EXC Electrical Connections ......................................................... 147
  Adept MV Controller Connections ............................................................... 148

5.4 P1 Extended Stroke Cable Track Installation ............................................. 151

  Adding User Cables to the Cable Track ......................................................... 152

5.5 P-2 Type Installation Procedure ............................................................. 153

  P-2 Type Electrical Connections ................................................................. 155
  EXA and EXC Electrical Connections ......................................................... 155
  Adept MV Controller Connections ............................................................... 156

5.6 Assembling J-Type Combinations ........................................................... 159

5.7 J Type Installation Procedure ............................................................... 160

  J Type Electrical Connections ................................................................. 161
  EXA and EXC Electrical Connections ......................................................... 162
  Adept MV Controller Connections ............................................................... 163

5.8 J Type Extended Stroke Cable Track Installation ..................................... 166

  Adding User Cables to the Cable Track ......................................................... 167

5.9 Mounting Tooling to an AdeptModule ..................................................... 168

  Mounting Attachments on Slider ................................................................. 168
  Mounting Attachments on Main Unit End Face ............................................. 169

5.10 Assembling a Gantry Support Module .................................................. 169

6 Mechanical Installation, Adept Cartesian .................................................. 171

6.1 Assembling an Adept Cartesian Robot ..................................................... 173

6.2 Installing the Z-Theta Module ............................................................... 176

  Removal of the Z-Theta Top Cover .............................................................. 176
  Attaching the Adept Z-Theta Module ........................................................... 176

6.3 Installing the Cable Covers ..................................................................... 178

6.4 Adept Cartesian Electrical Connections ................................................ 180

7 Maintenance ............................................................................................. 183

7.1 Initial Confirmation .................................................................................. 185

7.2 Maintenance .......................................................................................... 185

  Daily Maintenance ................................................................................. 186

7.3 Modules Lubrication .............................................................................. 187

  Lubrication Schedule .............................................................................. 187
# Table of Contents

1. **Lubrication Grease** .................................................. 188
2. **Grease Adaptor Nozzle** ............................................. 188
3. **Lubrication Procedures** .............................................. 188

7.4 **Pins, Connectors, and Screws.** ................................. 189
   - **Connector Pins and Inserter/Extractor Tools** .............. 189
   - **DDK Compatible Connectors** ...................................... 190
   - **JAE Connectors and DDK Connector Cross Reference List** 191
   - **Robot Cable Mounting Screws** ................................ 191
   - **Periodic Maintenance** ............................................ 191
     - **Grease Refill** .................................................. 191
     - **EXC/EXA Controller Back-up Batteries** .................... 194

8. **Technical Specifications** ........................................... 195
   8.1 **Specifications** ................................................... 197
      - **Specifications** .................................................. 197
      - **Transportable Load of Moving Axes** ....................... 198
   8.2 **Module Dimensions** .............................................. 199
      - **H Module** ..................................................... 199
      - **M Module** ..................................................... 200
      - **S Module** ..................................................... 201
      - **Sz Module** .................................................... 202
      - **Ztheta Module** ................................................ 203
   8.3 **Bracket Dimensions** .............................................. 204
      - **H-Module Mounting Bracket** ................................. 204
      - **M-Module Mounting Bracket** ................................ 205
      - **S/Sz-Module Mounting Bracket** ............................. 206
      - **Gantry Support Bracket** ..................................... 207
      - **CMS Bracket** ................................................ 208
      - **DHM Bracket** ................................................ 209
      - **DMM Bracket** ................................................ 210
      - **DSS Bracket** ................................................ 211
      - **D-Type Combination End Plate** ............................. 212
      - **DMS Bracket** ................................................ 213
      - **GHM Bracket** ................................................ 214
      - **GMS Bracket** ................................................ 215
      - **GSS Bracket** ................................................ 216
      - **XHH Bracket** ................................................ 217
      - **XHM Bracket** ................................................ 218
      - **XMM Bracket** ................................................ 219
      - **TMS Bracket** ................................................ 220
   8.4 **Work Envelopes and Payload Capacities.** .................. 221
      - **G1 Configuration** ............................................. 221
      - **G2 Configuration** ............................................. 222
      - **G3 Configuration** ............................................. 223
# Table of Contents

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1 Configuration</td>
<td>224</td>
</tr>
<tr>
<td>D2 Configuration</td>
<td>225</td>
</tr>
<tr>
<td>D1 and D2 Extended Stroke Configurations</td>
<td>226</td>
</tr>
<tr>
<td>D3 Configuration</td>
<td>227</td>
</tr>
<tr>
<td>D4 Configuration</td>
<td>228</td>
</tr>
<tr>
<td>X1 Configuration</td>
<td>229</td>
</tr>
<tr>
<td>X2 Configuration</td>
<td>230</td>
</tr>
<tr>
<td>X1 and X2 Extended Stroke Configuration</td>
<td>231</td>
</tr>
<tr>
<td>X3 Configuration</td>
<td>232</td>
</tr>
<tr>
<td>K2 Configuration</td>
<td>233</td>
</tr>
<tr>
<td>K3 Configuration</td>
<td>234</td>
</tr>
<tr>
<td>K4 Configuration</td>
<td>235</td>
</tr>
<tr>
<td>Z2 Configuration</td>
<td>236</td>
</tr>
<tr>
<td>Z3 Configuration</td>
<td>237</td>
</tr>
<tr>
<td>Z4 Configuration</td>
<td>238</td>
</tr>
<tr>
<td>P1 Unit Stroke Configuration</td>
<td>239</td>
</tr>
<tr>
<td>P1 Slider Stroke Configuration</td>
<td>240</td>
</tr>
<tr>
<td>P1 Extended Stroke Configuration</td>
<td>241</td>
</tr>
<tr>
<td>P2 Unit Stroke Configuration</td>
<td>242</td>
</tr>
<tr>
<td>P2 Configuration</td>
<td>243</td>
</tr>
<tr>
<td>J Configuration</td>
<td>244</td>
</tr>
<tr>
<td>J Extended Stroke Configuration</td>
<td>245</td>
</tr>
<tr>
<td>T Configuration</td>
<td>246</td>
</tr>
<tr>
<td>Adept Cartesian Robot</td>
<td>247</td>
</tr>
<tr>
<td>CleanRoom Modules</td>
<td>249</td>
</tr>
<tr>
<td>Introduction</td>
<td>251</td>
</tr>
<tr>
<td>Difference</td>
<td>251</td>
</tr>
<tr>
<td>Maintenance of Cleanroom Models</td>
<td>251</td>
</tr>
<tr>
<td>Reversing Motor Mounts</td>
<td>253</td>
</tr>
<tr>
<td>Introduction</td>
<td>255</td>
</tr>
<tr>
<td>Procedure</td>
<td>255</td>
</tr>
<tr>
<td>Reversing Electrical Connections</td>
<td>265</td>
</tr>
<tr>
<td>Introduction</td>
<td>267</td>
</tr>
<tr>
<td>Procedure</td>
<td>267</td>
</tr>
<tr>
<td>Index</td>
<td>271</td>
</tr>
<tr>
<td>Figure</td>
<td>Description</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>1-1</td>
<td>AdeptModules</td>
</tr>
<tr>
<td>1-2</td>
<td>AdeptModules Joint Locations</td>
</tr>
<tr>
<td>2-1</td>
<td>Motor Mount</td>
</tr>
<tr>
<td>2-2</td>
<td>Yaw, Pitch, and Roll Examples</td>
</tr>
<tr>
<td>3-1</td>
<td>Transporting Modules</td>
</tr>
<tr>
<td>3-2</td>
<td>Typical Single-Axis Module</td>
</tr>
<tr>
<td>3-3</td>
<td>Attaching Main Unit Directly to the Base</td>
</tr>
<tr>
<td>3-4</td>
<td>Connecting to an EXA or EXC Controller</td>
</tr>
<tr>
<td>3-5</td>
<td>Connecting to an Adept MV Controller</td>
</tr>
<tr>
<td>4-1</td>
<td>Robot Cables</td>
</tr>
<tr>
<td>4-2</td>
<td>Driving the Chamfered Positioning Pins</td>
</tr>
<tr>
<td>4-3</td>
<td>G-Type Combination</td>
</tr>
<tr>
<td>4-4</td>
<td>G-1 Type Mechanical Assembly</td>
</tr>
<tr>
<td>4-5</td>
<td>Connecting to an EXA or EXC Controller</td>
</tr>
<tr>
<td>4-6</td>
<td>Connecting to an Adept MV Controller</td>
</tr>
<tr>
<td>4-7</td>
<td>G-2 Type Mechanical Assembly</td>
</tr>
<tr>
<td>4-8</td>
<td>Connecting to an EXA or EXC Controller</td>
</tr>
<tr>
<td>4-9</td>
<td>Connecting to an Adept MV Controller</td>
</tr>
<tr>
<td>4-10</td>
<td>G-3 Type Mechanical Assembly</td>
</tr>
<tr>
<td>4-11</td>
<td>Connecting to an EXA or EXC Controller</td>
</tr>
<tr>
<td>4-12</td>
<td>Connecting to an Adept MV Controller</td>
</tr>
<tr>
<td>4-13</td>
<td>D-Type Combination</td>
</tr>
<tr>
<td>4-14</td>
<td>D-1 Type Mechanical Assembly</td>
</tr>
<tr>
<td>4-15</td>
<td>D-2 Type Mechanical Assembly</td>
</tr>
<tr>
<td>4-16</td>
<td>Connecting to an EXA or EXC Controller</td>
</tr>
<tr>
<td>4-17</td>
<td>Connecting to an Adept MV Controller</td>
</tr>
<tr>
<td>4-18</td>
<td>Cable Tracks</td>
</tr>
<tr>
<td>4-19</td>
<td>Cable Track User Cable Installation</td>
</tr>
<tr>
<td>4-20</td>
<td>D-3 Type Mechanical Assembly</td>
</tr>
<tr>
<td>4-21</td>
<td>Connecting to an EXA or EXC Controller</td>
</tr>
<tr>
<td>4-22</td>
<td>Connecting to an Adept MV Controller</td>
</tr>
<tr>
<td>4-23</td>
<td>D-4 Type Mechanical Assembly</td>
</tr>
<tr>
<td>4-24</td>
<td>Connecting to an EXA or EXC Controller</td>
</tr>
<tr>
<td>4-25</td>
<td>Connecting to an Adept MV Controller</td>
</tr>
<tr>
<td>4-26</td>
<td>K-Type Combination</td>
</tr>
<tr>
<td>4-27</td>
<td>K-2 Type Mechanical Assembly</td>
</tr>
</tbody>
</table>
Figure 4-28 Connecting to an EXA or EXC Controller .................................................. 98
Figure 4-29 Connecting to an Adept MV Controller ...................................................... 99
Figure 4-30 K-3 Type Mechanical Assembly ................................................................. 100
Figure 4-31 Connecting to an EXA or EXC Controller .................................................. 102
Figure 4-32 Connecting to an Adept MV Controller ...................................................... 103
Figure 4-33 K-4 Type Mechanical Assembly ................................................................. 104
Figure 4-34 Connecting to an EXA or EXC Controller .................................................. 106
Figure 4-35 Connecting to an Adept MV Controller ...................................................... 107
Figure 4-36 Z-Type Combination .................................................................................. 108
Figure 4-37 Z-2 Type Mechanical Assembly ................................................................. 109
Figure 4-38 Connecting to an EXA or EXC Controller .................................................. 111
Figure 4-39 Connecting to an Adept MV Controller ...................................................... 112
Figure 4-40 Z-3 Type Mechanical Assembly ................................................................. 113
Figure 4-41 Connecting to an EXA or EXC Controller .................................................. 115
Figure 4-42 Connecting to an Adept MV Controller ...................................................... 116
Figure 4-43 Z-4 Type Mechanical Assembly ................................................................. 117
Figure 4-44 Connecting to an EXA or EXC Controller .................................................. 119
Figure 4-45 Connecting to an Adept MV Controller ...................................................... 120
Figure 4-46 T-Type Combination .................................................................................. 121
Figure 4-47 T-Type Mechanical Assembly .................................................................. 122
Figure 4-48 Connecting to an EXA or EXC Controller .................................................. 124
Figure 4-49 Connecting to an Adept MV Controller ...................................................... 125
Figure 4-50 X-Type Combination .................................................................................. 126
Figure 4-51 X-1 Type Mechanical Assembly ............................................................... 127
Figure 4-52 Connecting to an EXA or EXC Controller .................................................. 129
Figure 4-53 Connecting to an Adept MV Controller ...................................................... 130
Figure 4-54 X-2 Type Mechanical Assembly ............................................................... 131
Figure 4-55 Connecting to an EXA or EXC Controller .................................................. 132
Figure 4-56 Connecting to an Adept MV Controller ...................................................... 134
Figure 4-57 Cable Tracks ............................................................................................... 135
Figure 4-58 Cable Track User Cable Installation ........................................................... 136
Figure 4-59 X-3 Type Mechanical Assembly ............................................................... 137
Figure 4-60 Connecting to an EXA or EXC Controller .................................................. 139
Figure 4-61 Connecting to an Adept MV Controller ...................................................... 140
Figure 5-1 Typical Three-Axis Configuration ............................................................... 143
Figure 5-2 P-Type Combination with Z-axis Slider Stroke .......................................... 144
Figure 5-3 P-1 Type Mechanical Assembly ................................................................. 146
Figure 5-4 Connecting to an EXA or EXC Controller .................................................. 148
Figure 5-5 Connecting to an Adept MV Controller ...................................................... 150
Figure 5-6 Cable Tracks ............................................................................................... 152
<p>| Figure 5-7 | Cable Track User Cable Installation | 153 |
| Figure 5-8 | P-2 Type Mechanical Assembly | 154 |
| Figure 5-9 | Connecting to an EXA or EXC Controller | 156 |
| Figure 5-10 | Connecting to an Adept MV Controller | 158 |
| Figure 5-11 | J-Type Combination with Z-axis Slider Stroke | 159 |
| Figure 5-12 | J-Type Mechanical Assembly with Z-axis Slider Stroke | 161 |
| Figure 5-13 | Connecting to an EXA or EXC Controller | 163 |
| Figure 5-14 | Connecting to an Adept MV Controller | 165 |
| Figure 5-15 | Cable Tracks | 167 |
| Figure 5-16 | Cable Track User Cable Installation | 168 |
| Figure 5-17 | Gantry Module | 170 |
| Figure 5-18 | Exploded View of the Gantry Module Assembly | 170 |
| Figure 6-1 | Adept Cartesian Robot System | 173 |
| Figure 6-2 | Screw Guides | 174 |
| Figure 6-3 | Cable Track Supports | 174 |
| Figure 6-4 | Cable Track Bracket Mounting | 175 |
| Figure 6-5 | Mounting Cable Track to the Y-Axis | 175 |
| Figure 6-6 | Y-Axis Cable Track Support Bracket Mounting Keys | 176 |
| Figure 6-7 | Z-Theta Mounting, Top Left, and Right Screws with Top Cover Removed | 177 |
| Figure 6-8 | Attaching the Z-Theta to the Y-Axis | 177 |
| Figure 6-9 | Attaching the Y-axis Cable Track to the Z-Theta Module | 178 |
| Figure 6-10 | Y-axis Cable Track Screw Removal | 178 |
| Figure 6-11 | Bottom Cover Y-axis Cable Track | 179 |
| Figure 6-12 | Alignment of the Cover Plates | 179 |
| Figure 6-13 | Securing the Cover Plates | 180 |
| Figure 6-14 | System Cable Layout | 181 |
| Figure 6-15 | Cable Track Connector Plate | 182 |
| Figure 7-1 | Robot Cable Maintenance Checks | 186 |
| Figure 7-2 | Greasing an H-Type Module | 192 |
| Figure 7-3 | Greasing an M-Type Module | 193 |
| Figure 7-4 | Greasing an S-Type Module | 194 |
| Figure 8-1 | H Module | 199 |
| Figure 8-2 | M Module | 200 |
| Figure 8-3 | S Module | 201 |
| Figure 8-4 | Sz Module | 202 |
| Figure 8-5 | ZTheta Module | 203 |
| Figure 8-6 | H-Module Mounting Bracket | 204 |
| Figure 8-7 | M-Module Mounting Bracket | 205 |
| Figure 8-8 | S/Sz-Module Mounting Bracket | 206 |
| Figure 8-9 | Gantry Support Bracket | 207 |</p>
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-10</td>
<td>CMS Type Bracket</td>
<td>208</td>
</tr>
<tr>
<td>8-11</td>
<td>DMM Type Bracket</td>
<td>209</td>
</tr>
<tr>
<td>8-12</td>
<td>DSS Type Bracket</td>
<td>210</td>
</tr>
<tr>
<td>8-13</td>
<td>D-Type End Plate</td>
<td>211</td>
</tr>
<tr>
<td>8-14</td>
<td>GHM Bracket</td>
<td>212</td>
</tr>
<tr>
<td>8-15</td>
<td>GM Type Bracket</td>
<td>213</td>
</tr>
<tr>
<td>8-16</td>
<td>SS Type Bracket</td>
<td>214</td>
</tr>
<tr>
<td>8-17</td>
<td>XHH Bracket</td>
<td>215</td>
</tr>
<tr>
<td>8-18</td>
<td>XHM Bracket</td>
<td>216</td>
</tr>
<tr>
<td>8-19</td>
<td>XMM Bracket</td>
<td>217</td>
</tr>
<tr>
<td>8-20</td>
<td>D1 and D2 Extended Stroke Configurations</td>
<td>218</td>
</tr>
<tr>
<td>8-21</td>
<td>D1 Type Configuration</td>
<td>219</td>
</tr>
<tr>
<td>8-22</td>
<td>TMS Bracket</td>
<td>220</td>
</tr>
<tr>
<td>8-23</td>
<td>G1 Type Configuration</td>
<td>221</td>
</tr>
<tr>
<td>8-24</td>
<td>G2 and G3 Type Configuration</td>
<td>222</td>
</tr>
<tr>
<td>8-25</td>
<td>D Type Configuration</td>
<td>223</td>
</tr>
<tr>
<td>8-26</td>
<td>D1 and D2 Extended Stroke Configurations</td>
<td>224</td>
</tr>
<tr>
<td>8-27</td>
<td>D2 Type Configuration</td>
<td>225</td>
</tr>
<tr>
<td>8-28</td>
<td>D1 and D2 Extended Stroke Configurations</td>
<td>226</td>
</tr>
<tr>
<td>8-29</td>
<td>D3 Type Configuration</td>
<td>227</td>
</tr>
<tr>
<td>8-30</td>
<td>D4 Type Configuration</td>
<td>228</td>
</tr>
<tr>
<td>8-31</td>
<td>X1 and X2 Extended Stroke Configurations</td>
<td>229</td>
</tr>
<tr>
<td>8-32</td>
<td>X2 Type Configuration</td>
<td>230</td>
</tr>
<tr>
<td>8-33</td>
<td>X1 and X2 Extended Stroke Configurations</td>
<td>231</td>
</tr>
<tr>
<td>8-34</td>
<td>X3 Type Configuration</td>
<td>232</td>
</tr>
<tr>
<td>8-35</td>
<td>X4 Type Configuration</td>
<td>233</td>
</tr>
<tr>
<td>8-36</td>
<td>X5 Type Configuration</td>
<td>234</td>
</tr>
<tr>
<td>8-37</td>
<td>X6 Type Configuration</td>
<td>235</td>
</tr>
<tr>
<td>8-38</td>
<td>X7 Type Configuration</td>
<td>236</td>
</tr>
<tr>
<td>8-39</td>
<td>X8 Type Configuration</td>
<td>237</td>
</tr>
<tr>
<td>8-40</td>
<td>X9 Type Configuration</td>
<td>238</td>
</tr>
<tr>
<td>8-41</td>
<td>X10 Unit Stroke Configuration</td>
<td>239</td>
</tr>
<tr>
<td>8-42</td>
<td>P1 Slider Stroke Configuration</td>
<td>240</td>
</tr>
<tr>
<td>8-43</td>
<td>P1 Extended Stroke Configuration</td>
<td>241</td>
</tr>
<tr>
<td>8-44</td>
<td>P2 Unit Stroke Configuration</td>
<td>242</td>
</tr>
<tr>
<td>8-45</td>
<td>P2 Slider Stroke Configuration</td>
<td>243</td>
</tr>
<tr>
<td>8-46</td>
<td>P3 Slider Stroke Configuration</td>
<td>244</td>
</tr>
<tr>
<td>8-47</td>
<td>P3 Extended Stroke Configuration</td>
<td>245</td>
</tr>
<tr>
<td>8-48</td>
<td>P4 Type Configuration</td>
<td>246</td>
</tr>
<tr>
<td>8-49</td>
<td>P5 Type Configuration</td>
<td>247</td>
</tr>
</tbody>
</table>
Figure B-1  Motor Cover Removal ......................................................... 255
Figure B-2  Connector Base Removal .................................................. 256
Figure B-3  Seal Belt and End Cap Removal ............................................ 256
Figure B-4  Separating Motor From Base ............................................... 257
Figure B-5  Removal of Set Bolts .......................................................... 258
Figure B-6  Motor Mount Plate Flipping ................................................. 258
Figure B-7  Re-mounting Motor Base Plate ............................................ 259
Figure B-8  Installation of the Pulley ....................................................... 259
Figure B-9  Motor Installation ............................................................... 260
Figure B-10  Belt Cover Installation ....................................................... 260
Figure B-11  Stand-off Installation ......................................................... 261
Figure B-12  Tie Wrapping Wires ........................................................... 261
Figure B-13  Reinstalling Connector Base Plate ....................................... 262
Figure B-14  End Cap Reinstallation ....................................................... 263
Figure B-15  Fixing Seal Belt ............................................................... 263
Figure B-16  Motor Cover Insertion ....................................................... 264
Figure C-1  Cover Screw Removal .......................................................... 267
Figure C-2  Removing the Motor Cover ................................................... 268
Figure C-3  Motor Cover Flipping ............................................................ 268
Figure C-4  Re-inserting Connector Cover Panel ...................................... 269
Figure C-5  Attaching Motor Cover and Connector Cover Panel ................. 269
List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1</td>
<td>Sources for International Standards and Directives</td>
<td>26</td>
</tr>
<tr>
<td>2-1</td>
<td>Standard and Cleanroom Modules</td>
<td>37</td>
</tr>
<tr>
<td>2-2</td>
<td>Extended Stroke Modules</td>
<td>38</td>
</tr>
<tr>
<td>2-3</td>
<td>Maximum Payload and Moment Capacities</td>
<td>40</td>
</tr>
<tr>
<td>3-1</td>
<td>Mounting Screw Recommendations</td>
<td>53</td>
</tr>
<tr>
<td>3-2</td>
<td>Mounting Screw Specifications</td>
<td>55</td>
</tr>
<tr>
<td>3-3</td>
<td>Mounting Bracket Bolt Specifications</td>
<td>56</td>
</tr>
<tr>
<td>4-1</td>
<td>G-Type Configuration Components</td>
<td>66</td>
</tr>
<tr>
<td>4-2</td>
<td>G-1 Type Cable Options</td>
<td>67</td>
</tr>
<tr>
<td>4-3</td>
<td>G-2 Type Cable Options</td>
<td>71</td>
</tr>
<tr>
<td>4-4</td>
<td>G-3 Type Cable Options</td>
<td>75</td>
</tr>
<tr>
<td>4-5</td>
<td>D-Type Configuration Components</td>
<td>78</td>
</tr>
<tr>
<td>4-6</td>
<td>D-1 Type Cable Options</td>
<td>80</td>
</tr>
<tr>
<td>4-7</td>
<td>D-3 Type Cable Options</td>
<td>87</td>
</tr>
<tr>
<td>4-8</td>
<td>D-4 Type Cable Options</td>
<td>91</td>
</tr>
<tr>
<td>4-9</td>
<td>K-Type Configuration Components</td>
<td>95</td>
</tr>
<tr>
<td>4-10</td>
<td>K-2 Type Cable Options</td>
<td>97</td>
</tr>
<tr>
<td>4-11</td>
<td>K-3 Type Cable Options</td>
<td>101</td>
</tr>
<tr>
<td>4-12</td>
<td>K-4 Type Cable Options</td>
<td>105</td>
</tr>
<tr>
<td>4-13</td>
<td>Z-Type Configuration Components</td>
<td>108</td>
</tr>
<tr>
<td>4-14</td>
<td>Z-2 Type Cable Options</td>
<td>110</td>
</tr>
<tr>
<td>4-15</td>
<td>Z-3 Type Cable Options</td>
<td>114</td>
</tr>
<tr>
<td>4-16</td>
<td>Z-4 Type Cable Options</td>
<td>118</td>
</tr>
<tr>
<td>4-17</td>
<td>T-Type Configuration Components</td>
<td>121</td>
</tr>
<tr>
<td>4-18</td>
<td>T-Type Cable Options</td>
<td>123</td>
</tr>
<tr>
<td>4-19</td>
<td>X-Type Configuration Components</td>
<td>126</td>
</tr>
<tr>
<td>4-20</td>
<td>X-1 Type Cable Options</td>
<td>128</td>
</tr>
<tr>
<td>4-21</td>
<td>X-2 Type Cable Options</td>
<td>131</td>
</tr>
<tr>
<td>4-22</td>
<td>X-3 Type Cable Options</td>
<td>137</td>
</tr>
<tr>
<td>5-1</td>
<td>P-Type Configuration X- and Y-axis Components</td>
<td>144</td>
</tr>
<tr>
<td>5-2</td>
<td>P-Type Configuration Z-axis Components</td>
<td>145</td>
</tr>
<tr>
<td>5-3</td>
<td>P-1 Type Cable Options</td>
<td>146</td>
</tr>
<tr>
<td>5-4</td>
<td>P-2 Type Cable Options</td>
<td>155</td>
</tr>
<tr>
<td>5-5</td>
<td>J-Type Configuration X- and Y-Axis Components</td>
<td>159</td>
</tr>
<tr>
<td>5-6</td>
<td>J-Type Configuration ZAxis Components</td>
<td>160</td>
</tr>
<tr>
<td>5-7</td>
<td>J-Type Cable Options</td>
<td>161</td>
</tr>
</tbody>
</table>
List of Tables

Table 5-8  End-Effector Bolt Specifications ............................................ 169
Table 5-9  Fixing Bolt Specification .......................................................... 169
Table 6-1  AdeptCartesian Robot Required Components ............................. 173
Table 6-2  AdeptCartesian Cable Options .................................................... 180
Table 7-1  Module Power Output ............................................................... 185
Table 7-2  Daily Maintenance Checks .......................................................... 186
Table 7-3  Lubrication Schedule ................................................................. 187
Table 7-4  DDK Connectors ....................................................................... 191
Table 8-1  Horizontal Axis Transportable Load .......................................... 198
Table 8-2  Vertical Axis Transportable Load ............................................... 198
Table B-1  Cable Color to Pin Number Connections ................................... 257
1.1 Introduction ................................................................. 23
  How to use This Manual ............................................... 23
  Definition of Manipulating Industrial Robot ..................... 24
1.2 Notes, Cautions, and Warnings ..................................... 24
1.3 Precautions and Required Safeguards ............................. 25
  AdeptModules Static Forces ........................................... 25
  Safety Barriers ......................................................... 25
  Additional Safety Information ....................................... 26
1.4 Intended Use of the AdeptModules ................................. 26
1.5 AdeptModules Modifications ........................................ 27
  Acceptable Modifications ............................................. 27
  Unacceptable Modifications ......................................... 28
1.6 Endangement Through Additional Equipment .................... 28
1.7 Working Areas ........................................................... 28
1.8 Qualification of Personnel .......................................... 29
1.9 Transport ................................................................ 29
1.10 Safety Equipment for Operators .................................. 29
1.11 Protection Against Unauthorized Operation .................... 30
1.12 Operating Modes of AdeptModules ................................. 30
  Adept MV Controller .................................................... 30
  Automatic Mode ......................................................... 30
  Manual Mode ............................................................. 30
  EXC/EXA Controller ..................................................... 30
  External Operations ...................................................... 30
  Teach Box Operation .................................................... 31
1.13 Safety Aspects While Performing Maintenance ............... 31
1.14 What to Do in an Emergency Situation ......................... 31
1.1 Introduction

AdeptModules are a family of linear motion modules which can be used separately or combined into 15 unique 2- to 3-axis configurations. AdeptModules consist of a precision ground, ball-screw drive mechanism, high capacity linear guides, and AC servo motors. AdeptModules also include fully sealed belt covers to protect the module from contaminants.

The AdeptModules are designed to interface with the Adept MV controller and PA-4 power chassis. The interface is done through the Signal Interface Box (SIB). The control and operation of the Modules is programmed and performed through the controller. AdeptModules can also be controlled by NSK’s EXC or EXA controller.

![Figure 1-1. AdeptModules](image)

**Figure 1-1. AdeptModules**

**How to use This Manual**

This manual is intended to be used with the AdeptModules Volume 1 MV or EXC / EXA Controller Interface manual. This manual is used for the assembly of particular configurations of the AdeptModules system. To operate the AdeptModules from installation of the system to commissioning the system refer to the *AdeptModules, Vol. 1 MV Controller Interface Instruction Handbook* for the type of controller used.
Definition of Manipulating Industrial Robot

A manipulating robot is automatically controlled, reprogrammable, multi-purpose, manipulative machine with several degrees of freedom (see Figure 1-2) which may be either fixed in a place or mobile for use in industrial automation applications. (ISO 10218:1992(E))

1.2 Notes, Cautions, and Warnings

There are four levels of special notation used in this instruction handbook. In descending order of importance, they are:

**WARNING:** If the actions indicated in a “WARNING” are not complied with, injury or major equipment damage could result. A Warning statement will typically describe the potential hazard, its possible effect, and the measures that must be taken to reduce the hazard.

**WARNING:** If in a “WARNING” the actions are indicated with a lightning bolt instead of an exclamation mark, an electrical danger or shock is possible for personnel working with the system.

**CAUTION:** If the action specified in the “CAUTION” is not complied with, damage to your equipment could result.
NOTE: A “NOTE” provides supplementary information, emphasizes a point or procedure, or gives a tip for easier operation.

1.3 Precautions and Required Safeguards

This manual must be read by all personnel who install, operate, or maintain Adept systems, or who work within or near the workcell.

WARNING: Adept Technology strictly prohibits installation, commissioning, or operation of an installation with an AdeptModule without adequate safeguards according to the standards EN 775/ISO 10218, sections 5,6; EN 292-1, and EN 60204, section 13, or national equivalent.

AdeptModules Static Forces

AdeptModule systems include computer-controlled mechanisms that are capable of exerting considerable force. Like all robot and motion systems, and most industrial equipment, they must be treated with respect by the user and the operator.

Safety Barriers

Safety barriers must be an integral part of AdeptModules workcell design, installation, Operator training, and operating procedures. Adept systems are computer-controlled, and may activate remote devices under program control at times or along paths not anticipated by personnel. It is critical that safeguards be in place to prevent personnel from entering the workcell whenever equipment power is present.

The AdeptModules are not safe on their own. The AdeptModules System Integrator (or end user) must ensure that adequate safeguards, safety barriers, light curtains, safety gates, safety floor mats, etc., will be installed. The AdeptModules workcell must be designed according to EN 775/ISO 10218, sections 5,6; EN 292-1, 3.71, and EN 60204, section 13, or national equivalent.

The safety distance to the AdeptModules depends, relating to the standard EN 294, on the height of the safety fence. The height and the distance of the safety fence must ensure that nobody can reach the danger zone of the AdeptModules. See EN 294.

Adept controller systems for AdeptModules have various control features which can aid the integrator or user in constructing system safeguards, including Customer Emergency stop circuitry and digital input and output lines. The emergency power-off circuitry is capable of switching external power systems. See Chapter 3 for information on safe and effective use of the AdeptModules.

AdeptModules are capable of moving at high speeds. If a person is struck by an AdeptModules (impacted), serious injury could occur. AdeptModules configuration, joint speed, joint orientation, and attached payload all contribute to the total amount of energy available to cause injury.
Additional Safety Information

The standards and regulations listed in this handbook contain additional guidelines for AdeptModules system installation, safeguarding, maintenance, testing, start up, and operator training. Table 1-1 below lists sources for the various standards.

Table 1-1. Sources for International Standards and Directives

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<tr>
<th>Source</th>
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<tbody>
<tr>
<td>BSI, British Standards Institute</td>
<td>Sales Department, Linford Wood, Milton Keynes</td>
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<td>Beuth Verlag GmbH</td>
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<tr>
<td>American National Standards Institute</td>
<td>11 West 42nd Street, 13th Floor, New York, NY</td>
<td>212-642-4900</td>
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<tr>
<td>Document Center, Inc.</td>
<td>1504 Industrial Way, Unit 9, Belmont, CA</td>
<td>415-591-7600</td>
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1.4 Intended Use of the AdeptModules

The installation and usage of Adept products must comply with all safety instructions and warnings in this manual. Installation and usage must also comply with all applicable European, international, or local requirements and safety standards.

The AdeptModules are intended for use in parts assembly and material handling for payloads less than 60kg (132 lbs). Refer to specific sections in this manual for configuration and related payloads.

**WARNING:** For safety reasons it is prohibited to make certain modifications to AdeptModules. See Section 1.5.

The Adept MV controller, Adept PA-4 power chassis and the EXC/EXA controllers are intended for use as component subassemblies of a complete industrial automation system. The controllers and power chassis subassemblies must be installed inside a suitable enclosure. The controllers and power chassis subassemblies must not come into contact with liquids.
Adept equipment is not intended for use in any of the following situations:

- In hazardous (explosive) atmospheres.
- In mobile, portable, marine, or aircraft systems.
- In life-support systems.
- In residential installations.
- In situations where the Adept equipment will be subject to extremes of heat or humidity. See specifications for allowable temperature and humidity ranges.

**WARNING:**
The given instructions about operation, installation, and maintenance in this Instruction Handbook must be strictly observed.

Non-intended use of an AdeptModules can:

- cause injury to personnel.
- damage the AdeptModules or other equipment.
- reduce the system reliability and the performance of the system.
- All persons that install, commission, operate, or maintain the AdeptModules must:
  - have the necessary qualifications.
  - read and follow exactly the instructions in this Instruction Handbook.

If there is any doubt concerning the application, ask Adept to determine if it is an intended use or not.

### 1.5 AdeptModules Modifications

It is sometimes necessary to modify the AdeptModules in order to successfully integrate it into a workcell. Unfortunately, many seemingly simple modifications can either cause an AdeptModules failure or reduce the AdeptModules performance, reliability, or lifetime. The following information is provided as a guideline to modifications.

**Acceptable Modifications**

In general, the following AdeptModules modifications will not cause problems but may affect AdeptModules performance:

- Attaching tooling, utility boxes, solenoid packs, vacuum pumps, screwdrivers, cameras, lighting, etc., to the AdeptModule mounting plates, combining brackets, or cable brackets.
- Attaching hoses, pneumatic lines, or cables to the AdeptModules. These should be designed so they do not restrict joint motion or cause AdeptModules motion errors.
Unacceptable Modifications

If not done properly, the modifications listed below will damage the AdeptModules, reduce system safety and reliability, or shorten the life of the AdeptModules.

CAUTION: Making any of the modifications outlined below will void the warranty of any components that Adept determines were damaged due to the modification. You must contact Adept Customer Service if you are considering any of the following modifications.

- Modifying any of the AdeptModules harnesses or Modules-to-controller cables.
- Modifying any AdeptModule covers or drive system components.
- Modifying, including drilling or cutting, any AdeptModules casting or extrusions.
- Routing additional hoses, air lines, or wires through the modules or modules cable tracks.

1.6 Endangerment Through Additional Equipment

Additional equipment—for instance grippers, conveyor belts, etc.—may not be used if it would reduce the safeguarding of the workcell.

All Emergency Stop Switches must be always accessible.

In other countries, Adept strongly recommends a similar level of safety be obtained, in addition to complying with the applicable local and national regulations.

1.7 Working Areas

AdeptModules have both a Manual and an Automatic operating mode. While AdeptModules is in Automatic Mode, no personnel are allowed to stay in the workcell.

Operators with additional safety equipment (see section 1.10 on page 29) are allowed to work in the workcell when AdeptModules is in manual mode. For safety reasons the operator should, whenever possible, stay outside of the working envelope of the AdeptModules to prevent injury. The maximum speed and power of the AdeptModules is reduced, but it could still cause injury to the operator.

Before performing maintenance in the working envelope of the AdeptModules, personel must switch off High Power and disconnect the power to the PA4 power chassis. After these precautions, a skilled person is allowed to maintain the AdeptModules. See section 1.8 on page 29 for the specifications of the personnel.

WARNING:

Electrical Hazard!
Impact Hazard!
Never remove any safeguarding, and never make changes in the system that will decommission a safeguard.
1.8 Qualification of Personnel

This manual assumes that personnel have attended proper training courses and have a working knowledge of the system. The user must provide the necessary additional training for all personnel who will be working with the system.

As noted in this handbook, certain procedures should be performed only by skilled or instructed persons. For a description of the level of qualification Adept uses the standard terms:

- **Skilled persons** have technical knowledge or sufficient experience to enable them to avoid the dangers which electricity may create (engineers and technicians).
- **Instructed persons** are adequately advised or supervised by skilled persons to enable them to avoid the dangers which electricity may create (operating and maintenance staff).

All personnel must observe sound safety practices during the installation, operation, and testing of all electrically powered equipment. To avoid injury or damage to equipment, always remove power by disconnecting the AC power cord from the source before attempting any repair or upgrade activity.

**WARNING:** The user is obligated to get confirmation from every entrusted person before they start working with the AdeptModules about the following subjects:
1) The person has received the Instruction Handbook, has read it, and has understood it.
2) The person will work in the described manner.

1.9 Transport

Always use adequate equipment to transport and lift Adept devices. See Chapter 3 for more information on transporting, lifting, and installing.

**WARNING:** Do not stay under the AdeptModule while it is transported.

1.10 Safety Equipment for Operators

Adept advises operators to wear extra safety equipment in the workcell. For safety reasons the operators must wear

- safety glasses
- protective headgear
- and safety shoes

Install warning signs around the workcell to make sure anyone working around the AdeptModules system knows they must wear safety equipment.
1.11 Protection Against Unauthorized Operation

The system must be protected against unauthorized use. Restrict access to the keyboard and the Manual Control Pendant by locking them in a cabinet or use another adequate method to prevent access to them.

1.12 Operating Modes of AdeptModules

AdeptModules can be controlled via an Adept MV Controller or an EXC/EXA controller.

Adept MV Controller

Automatic Mode

AdeptModules systems are computer-controlled, and the program that is currently running the AdeptModules may cause it to move at times or along paths you may not anticipate. When the key switch for the operating mode is in the AUTO position and the HIGH POWER light or the PROGRAM RUNNING light on the external Front Panel (VFP) are illuminated, do not enter the workcell because the AdeptModules or motion device might move unexpectedly. (The LAMP TEST button on the VFP allows these lights to be periodically checked.)

WARNING: During Automatic Mode operations no person is allowed to stay in the guarded space of the AdeptModules, because serious injury can occur if a person is struck by the AdeptModules.

Manual Mode

AdeptModules can also be controlled manually when the operating mode key switch is in the MANUAL position and the HIGH POWER light on the VFP is illuminated. When Manual mode is selected, motion can be only initiated from the Manual Control Pendant (MCP). Per EN 775/ISO 10218, the maximum speed of the AdeptModules is limited to less than 250 mm per second (10 ips) in Manual mode. In this mode, work that requires close approach to the installation or AdeptModules can be performed, such as teaching points, program verification, or troubleshooting operations.

NOTE: The MCP has two operating modes. In MAN (Manual) mode the MCP can initiate an AdeptModules motion. In COMP (Automatic) mode the MCP works like a terminal.

EXC/EXA Controller

External Operations

AdeptModules systems are computer-controlled, and the program that is currently running the AdeptModules may cause it to move at times or along paths you may not anticipate. This mode of operation is automatically established after the main power is enabled. When in External Operation the AdeptModules are controlled by external I/O signals. Do not enter the workcell because the AdeptModules or motion device might move unexpectedly.
**WARNING:** During Automatic Mode operations no person is allowed to stay in the guarded space of the AdeptModules, because serious injury can occur if a person is struck by the AdeptModules.

**Teach Box Operation**

The AdeptModules can also be controlled manually by the teach box. Three operations can be performed with the teach box: Home return, Jogging, and Programming. In this mode, work that requires close approach to the installation or AdeptModules can be performed, such as teaching points, program verification, or troubleshooting operation.

### 1.13 Safety Aspects While Performing Maintenance

Only skilled persons with the necessary knowledge about the safety and operating equipment are allowed to maintain the AdeptModules, controller, and power chassis.

**WARNING:** During maintenance and repair, the power of the Adept PA-4 power chassis and the Adept MV controller must be turned off. Unauthorized third parties must be prevented from turning on power through the use of fail-safe lockout measures. (Turn off the circuit breakers, lock the cabinet, and remove the key!)

### 1.14 What to Do in an Emergency Situation

Press any Emergency-Stop button (a red push-button on a yellow field) and then follow the internal procedures of your company or organization for an emergency situation. If a fire occurs, use CO₂ to extinguish the fire.
2.1 Introduction .................................................. 35
   Module Types ............................................... 35
       H-Module .............................................. 35
       M-Module .............................................. 35
       S-Module .............................................. 35
       Sz-Module ............................................ 36
   Gantry Support Modules ................................. 36
   Class 10 Cleanroom Modules ......................... 36

2.2 Modules Specifications ................................. 37
   Module Moment Capacity .............................. 38

2.3 AdeptModule Life and Yawing Moment Calculations .... 40
   Life Calculations ........................................ 40
   Moment Calculations .................................... 40
   G-Style Configuration .................................. 41
       Module 2 ........................................... 41
       Module 1 ........................................... 41
   D-Style Configuration .................................. 42
       Module 2 ........................................... 42
       Module 1 ........................................... 42
   X-Style Configuration .................................. 43
       Module 2 ........................................... 43
       Module 1 ........................................... 43
   K-Style Configuration .................................. 44
       Module 2 ........................................... 44
       Module 1 ........................................... 44
   Z-Style Configuration .................................. 45
       Module 2 ........................................... 45
       Module 1 ........................................... 45
   P-Style Configuration .................................. 46
       Module 3 ........................................... 46
       Module 2 ........................................... 46
       Module 1 ........................................... 47
   J-Style Configuration .................................. 47
       Module 3 ........................................... 47
       Module 2 ........................................... 48
       Module 1 ........................................... 48
2.1 Introduction

AdeptModules are a family of linear motion actuators which can be used separately or combined into 15 unique 2- and 3-axis configurations. AdeptModules consist of a precision-ground ball-screw drive mechanism, high-capacity linear guides, and AC servo motors. AdeptModules also include fully sealed belt covers to protect the module from contaminants.

Module Types

AdeptModules are offered in the four module types described in the following sections.

H-Module

The H-module is the largest module with the highest payload and moment capacity. The H-module is offered in standard stroke lengths between 300 mm (12 inches) and 1000 mm (40 inches) and special-order stroke lengths from 1200 mm (47 inches) to 2000 mm (80 inches).

The H-module consists of a 20 mm pitch ball screw, two 25 mm linear guides, and a 300 watt motor without a holding brake.

The H-module is 180 mm (7 inches) wide and 90 mm (3.5 inches) in height. The overall length of the H-module depends on the stroke length. The standard H-modules are supplied with direct-mount motors. Extended stroke H-modules are supplied with side-mount motors.

M-Module

The M-Module is the midsize module with the midrange payload and moment capacity. The M-Module is offered in standard stroke lengths between 250 mm (10 inches) and 950 mm (37 inches) and special-order stroke lengths from 1,150 mm (inches) to 1,550 mm (inches).

The M-module consists of a 20 mm pitch ball screw, a single 50 mm linear guide, and the same 300 watt motor without a holding brake.

The M-module is 116 mm (4.6 inches) wide and 85 mm (3.4 inches) in height. The overall length of the M-module depends on the stroke length. The standard M-modules are supplied with direct-mount motors. Extended stroke M-modules are supplied with side-mount motors.

S-Module

The S-Module is the smallest profile module intended for horizontal applications. The S-Module is offered in standard stroke lengths between 130 mm (5 inches) and 530 mm (21 inches) and special-order stroke lengths of 630 mm (24.8 inches).

The S-module consists of a 10 mm pitch ball screw for 130 mm and 230 mm stroke lengths and a 20 mm pitch ball screw for stroke lengths from 330 mm to 630 mm. The S-module has a single 25 mm linear guide and a 100 watt motor without a holding brake.

The S-module is 66 mm (2.6 inches) wide and 66 mm (2.6 inches) in height. The overall length of the S-module depends on the stroke length. The standard S-modules are supplied with right side-mount motors.
**Sz-Module**

The Sz-module has the same profile and design as the S-module, but has a left side-mount motor and a 100 watt motor with a holding brake for use in vertical applications.

**Gantry Support Modules**

Gantry Support Modules consist of a single 25 mm linear guide in a cross-section similar to the S/Sz-module. The gantry support is intended to be used with a G-1 or P-1 configuration and therefore is available in stroke lengths to match the stroke length of an H-Module. The gantry support module is provided with a bracket that mounts to the end of the M-module and mates with a bracket affixed to the linear guide on the gantry support bracket.

**Class 10 Cleanroom Modules**

All standard modules are offered in a Class 10 compatible cleanroom version. The cleanroom modules have three differences from standard modules:

- cleanroom modules are assembled with a different belt material to greatly reduce the generation of particles.
- cleanroom modules contain a special cleanroom grease.
- cleanroom modules have two air fittings to connect a vacuum supply for removing particles from the internal cavity of the module.
## 2.2 Modules Specifications

### Table 2-1. Standard and Cleanroom Modules

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Part Number</th>
<th>Stroke (mm)</th>
<th>Max. Speed (mm/sec)</th>
<th>Repeatability (± mm/±in)</th>
<th>Ball Screw Pitch (mm)</th>
<th>Max. Payload (kg/lb)</th>
<th>Motor Mount</th>
<th>Rated Thrust Force (n/lb)</th>
<th>Moment Capacity (n-m/lb-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-Module</td>
<td></td>
<td>10030</td>
<td>300</td>
<td>1200</td>
<td>0.01/0.0004</td>
<td>20</td>
<td>60/132</td>
<td>Direct</td>
<td>300/67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10040</td>
<td>400</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10050</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10060</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10080</td>
<td>800</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>10100</td>
<td>1000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>17120</td>
<td>1200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-Module</td>
<td></td>
<td>20025</td>
<td>250</td>
<td>1200</td>
<td>0.01/0.0004</td>
<td>20</td>
<td>60/132</td>
<td>Direct</td>
<td>300/67</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20035</td>
<td>350</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20045</td>
<td>450</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20055</td>
<td>550</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20075</td>
<td>750</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>20095</td>
<td>950</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-Module</td>
<td></td>
<td>30013</td>
<td>130</td>
<td>600</td>
<td>0.01/0.0004</td>
<td>10</td>
<td>20/44</td>
<td>Right</td>
<td>240/54</td>
</tr>
<tr>
<td>(horizontal)</td>
<td></td>
<td>30023</td>
<td>230</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30033</td>
<td>330</td>
<td>1200</td>
<td>0.01/0.0004</td>
<td>20</td>
<td>20/44</td>
<td>Right</td>
<td>120/27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30043</td>
<td>430</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>30053</td>
<td>530</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sz-Module</td>
<td></td>
<td>40013</td>
<td>130</td>
<td>600</td>
<td>0.01/0.0004</td>
<td>10</td>
<td>15/33</td>
<td>Left</td>
<td>240/54</td>
</tr>
<tr>
<td>(vertical)</td>
<td></td>
<td>40023</td>
<td>230</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a Where x = 0 for Standard modules and x = 1 for Cleanroom modules.
b See Figure 2-1.
c See Figure 2-2.
Module Moment Capacity

Figure 2-2 shows the rolling, pitching, and yawing moments of a module. Rolling, pitching and yawing moment capacities are specified for each module in Table 2-1.

The rolling moment capacity is the torque capacity of the module around the x-axis. The x-axis runs through the centerline of the ball screw.

Table 2-2. Extended Stroke Modules

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Part Number (90400-)</th>
<th>Stroke (mm)</th>
<th>Extended Strokes</th>
<th>Speed (mm/sec)</th>
<th>Ball Screw Pitch (mm)</th>
<th>Motor Mounta</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-Module</td>
<td>11120</td>
<td>1200</td>
<td>1200</td>
<td>40b</td>
<td>Right</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11140</td>
<td>1400</td>
<td>1080</td>
<td>840</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11160</td>
<td>1600</td>
<td>840</td>
<td>680</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11180</td>
<td>1800</td>
<td></td>
<td>560</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-Module</td>
<td>21115</td>
<td>1150</td>
<td>1200</td>
<td>40b</td>
<td>Right</td>
<td></td>
</tr>
<tr>
<td></td>
<td>21135</td>
<td>1350</td>
<td>1080</td>
<td>840</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>21155</td>
<td>1550</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-Module</td>
<td>31063</td>
<td>630</td>
<td>1200</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Sz-Module</td>
<td>41033</td>
<td>330</td>
<td>600</td>
<td>10</td>
<td>Left (Standard)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>41043</td>
<td>430</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>41053</td>
<td>530</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>41063</td>
<td>630</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a See Figure 2-1.
b 50% reduction due to timing belt.
The pitching moment capacity is the torque capacity of the module around the y-axis of the module. The y-axis is the axis perpendicular to the x-axis and in the same plane as the module top surface.

The yawing moment capacity is the torque capacity of the module around the z-axis of the module. The z-axis is the axis perpendicular to both the x-axis and y-axis and perpendicular to the top surface of the module.

Figure 2-2. Yaw, Pitch, and Roll Examples
2.3 AdeptModule Life and Yawing Moment Calculations

Some calculations can be done to estimate the life of an AdeptModule under particular loading conditions. The two primary factors that affect the module life are the applied payloads and moments (yaw, pitch, and roll) about the flange.

The following table lists the maximum payload and moment capacities of each module type. These values will be used in the life calculations.

### Table 2-3. Maximum Payload and Moment Capacities

<table>
<thead>
<tr>
<th>Module Type</th>
<th>Maximum Payload Capacity (kg)</th>
<th>Maximum Moment Capacity (Roll N-m, Pitch N-m, Yaw N-m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-Module</td>
<td>60</td>
<td>600 400 350</td>
</tr>
<tr>
<td>M-Module</td>
<td>40</td>
<td>70 120 120</td>
</tr>
<tr>
<td>S-Module</td>
<td>20</td>
<td>27 10 10</td>
</tr>
<tr>
<td>Sz-Module</td>
<td>15</td>
<td>27 10 10</td>
</tr>
</tbody>
</table>

**Life Calculations**

There are two formulas for estimating the module life; one is based upon the payload, and the other upon the applied moments:

\[
\text{lifePayload}(\text{km}) = 5000(\text{km}) \times \left( \frac{\text{PayloadCapacity}}{\text{MaxAppliedPayload}} \right)^3
\]

\[
\text{lifeMoment}(\text{km}) = 5000(\text{km}) \times \left( \frac{\text{MomentCapacity}}{\text{MaxAppliedMoment}} \right)^3
\]

**NOTE:** Calculating the maximum applied moment consists of three separate calculations (Roll, Pitch, and Yaw).

For the above calculations, take the minimum value as the final solution of the estimated module life.

**Moment Calculations**

When configuring AdeptModule systems, it is very important that the moment capacities of the modules are not exceeded. Exceeding the moment capacity will result in a premature failure of the linear guide within the module. In each case, the mounting of the module, the mass of the payload, and the accelerations of the modules determine the total applied moments.
The following equations include the static and dynamic loading conditions for each module configuration. These equations assume “worst case” loading conditions. Some of the mathematical terms have been approximated.

**G-Style Configuration**

$$L_2 = \text{length of Module 2 (m)}$$
$$w_2 = \text{width of Module 2 (m)}$$
$$M_2 = \text{mass of Module 2 (kg)}$$
$$m = \text{mass of applied payload (kg)}$$
$$a_1 = \text{max acceleration of Module 1 (m/s}^2\text{)}$$
$$a_2 = \text{max acceleration of Module 2 (m/s}^2\text{)}$$
$$g = \text{gravitational acceleration (9.8m/s}^2\text{)}$$
$$l_1, l_2, l_3 = \text{distances from flange to center of mass of applied payload (m)}$$

\[ \text{RollingMoment} = 2mg l_1 a_1 + \frac{L_2}{4} \]

\[ \text{YawingMoment} = 2m g l_2 a_2 + \frac{L_2}{4} \]

\[ \text{PitchingMoment} = 2ma_1 l_1 + ma_2 l_2 + \frac{w_2}{2} \]

**Module 2**

\[ (\text{RollingMoment})_2 = m(g l_1 + a_1 l_3) \]

\[ (\text{YawingMoment})_2 = m(g l_2 + a_2 l_3) \]

\[ (\text{PitchingMoment})_2 = m(a_2 l_1 + a_1 l_2) \]

**Module 1**

\[ (\text{RollingMoment})_1 = (\text{YawingMoment})_2 + M_2 a_1 \frac{L_2}{4} \]

\[ (\text{YawingMoment})_1 = (\text{PitchingMoment})_2 + M_2 a_1 \frac{L_2}{4} \]

\[ (\text{PitchingMoment})_1 = (\text{RollingMoment})_2 + m_2 a_1 \frac{w_2}{2} \]
D-Style Configuration

- \( L_2 \) = total length of Module 2 (m)
- \( w_2 \) = width of Module 2 (m)
- \( M_2 \) = mass of Module 2 (kg)
- \( m \) = mass of applied payload (kg)
- \( a_1 \) = max acceleration of Module 1 \((m/s^2)\)
- \( a_2 \) = max acceleration of Module 2 \((m/s^2)\)
- \( g \) = gravitational acceleration \((9.8 \text{ m/s}^2)\)
- \( l_1, l_2, l_3 \) = distances from flange to center of mass of applied payload (m)

\[
\begin{align*}
\text{Rolling Moment} \ (2) & = m(g l_3 + a_1 l_1) \\
\text{Yawing Moment} \ (2) & = m a_2 l_3 \\
\text{Pitching Moment} \ (2) & = m(g l_2 + a_2 l_1)
\end{align*}
\]

Module 1

\[
\begin{align*}
\text{Rolling Moment} \ (1) & = (\text{Pitching Moment} \ (2) + M_2 g \frac{L_2}{4}) \\
\text{Yawing Moment} \ (1) & = (\text{Yawing Moment} \ (2) + M_2 a_1 \frac{L_2}{4}) \\
\text{Pitching Moment} \ (1) & = (\text{Rolling Moment} \ (2) + M_2 a_1 \frac{w_2}{2})
\end{align*}
\]
X-Style Configuration

L₂ = total length of Module 2 (m)

h₂ = height of Module 2 (m)

w₂ = width of Module 2 (m)

M₂ = mass of Module 2 (kg)

m = mass of applied payload (kg)

a₁ = max acceleration of Module 1 (m/s²)

a₂ = max acceleration of Module 2 (m/s²)

g = gravitational acceleration (9.8 m/s²)

l₁, l₂, l₃, = distances from flange to center of mass at applied payload (m)

Module 2

\[
(RollingMoment)_2 = m(l₁ + a₁l₃) + \frac{M₂g h₂}{2}
\]

\[
(YawingMoment)_2 = m(g(l₁ + L₂) + a₂l₃) + \frac{M₂g L₂}{4}
\]

\[
(PitchingMoment)_2 = m(a₁(l₁ + L₂) + a₂l₂) + \frac{M₂a₁ L₂}{4}
\]

Module 1

\[
(RollingMoment)_1 = (YawingMoment)_2
\]

\[
(YawingMoment)_1 = (PitchingMoment)_2
\]

\[
(PitchingMoment)_1 = (RollingMoment)_2 + \frac{M₂a₁ w₂}{2}
\]
K-Style Configuration

\[ H_2 = \text{height of Module 2 (m)} \]
\[ L_1 = \text{length of Module 1 (m)} \]
\[ L_2 = \text{length of Module 2 (m)} \]
\[ M_2 = \text{mass of Module 2 (kg)} \]
\[ m = \text{mass of payload (kg)} \]
\[ a_1 = \text{max acceleration of Module 1 (m/s}^2) \]
\[ a_2 = \text{max acceleration of Module 2 (m/s}^2) \]
\[ g = \text{gravitational acceleration (9.8 m/s}^2) \]
\[ l_1, l_2, l_3 = \text{distances from flange to center of mass of applied payload (m)} \]

\[ (\text{Rolling Moment})_2 = ma_1l_1 \]
\[ (\text{Yawing Moment})_2 = m(gl_2 + a_2l_2 + a_1l_3) \]
\[ (\text{Pitching Moment})_2 = ml_1(g + a_2) \]

\[ (\text{Rolling Moment})_1 = (\text{Pitching Moment})_2 + M_2g\frac{H_2}{2} \]
\[ (\text{Yawing Moment})_1 = (\text{Yawing Moment})_2 + M_2a_1\frac{L_2}{4} \]
\[ (\text{Pitching Moment})_1 = (\text{Rolling Moment})_2 + M_2a_1\frac{H_2}{2} \]
Z-Style Configuration

\[ \text{Rolling Moment}_2 = m a_1 l_2 + M_2 a_1 \frac{H_2}{2} \]

\[ \text{Pitching Moment}_2 = m l_3 (g + a_2) + a_1 \left( M_2 \frac{L_2}{4} + m(l_1 + L_2) \right) \]

\[ \text{Yawing Moment}_2 = \left( m l_2 + M_2 \frac{H_2}{2} \right) (g + a_2) \]

Module 1

\[ \text{Rolling Moment}_1 = \text{Pitching Moment}_2 \]

\[ \text{Pitching Moment}_1 = \text{Pitching Moment}_2 \]

\[ \text{Yawing Moment}_1 = \text{Yawing Moment}_2 \]

\[ \text{Rolling Moment}_1 = \text{Rolling Moment}_2 \]
P-Style Configuration

Module 3

\[
(RollingMoment)_3 = m(a_2 l_1 + a_1 l_2)
\]

\[
(YawingMoment)_3 = m[a_2 l_3 + l_2(g + a_3)]
\]

\[
(PitchingMoment)_3 = m[a_1 l_3 + l_2(g + a_3)]
\]

Module 2

\[
(RollingMoment)_2 = (PitchingMoment)_3 + M_3 a_1 \frac{L_3}{4}
\]

\[
(PitchingMoment)_2 = (RollingMoment)_3 + M_3 \left( a_2 \frac{H_3}{2} + a_1 L_2 \right)
\]

\[
(YawingMoment)_2 = (YawingMoment)_3 + M_3 a_2 \frac{L_3}{4}
\]

\[L_2 = \text{length of Module 2 (m)}\]
\[M_2 = \text{mass of Module 2 (kg)}\]
\[L_3 = \text{length of Module 3 (m)}\]
\[M_3 = \text{mass of Module 3 (kg)}\]
\[H_3 = \text{height of Module 3 (m)}\]
\[w_2 = \text{width of Module 2 (m)}\]
\[m = \text{mass of applied payload (kg)}\]
\[a_1 = \text{max acceleration of Module 1 (m/s^2)}\]
\[a_2 = \text{max acceleration of Module 2 (m/s^2)}\]
\[a_3 = \text{max acceleration of Module 3 (m/s^2)}\]
\[g = \text{gravitational acceleration (9.8 m/s^2)}\]
\[l_1, l_2, l_3 = \text{distances from flange to center of mass of applied payload (m)}\]
Module 1

\[ (\text{Rolling Moment})_1 = (\text{Yawing Moment})_2 + \left( M_2 \frac{L_2}{4} + M_3 L_2 \right) a_1 \]

\[ (\text{Yawing Moment})_1 = (\text{Pitching Moment})_2 + \left( M_2 \frac{L_2}{4} + M_3 L_2 \right) a_1 \]

\[ (\text{Pitching Moment})_1 = (\text{Rolling Moment})_2 + \left( M_2 \frac{L_2}{2} + M_3 \frac{w_2}{2} \right) a_1 \]

J-Style Configuration

Module 3

\[ (\text{Rolling Moment})_3 = m(a_2 l_2 + a_1 l_1) \]

\[ (\text{Yawing Moment})_3 = m[a_1 l_3 + l_2(g + a_3)] \]

\[ (\text{Pitching Moment})_3 = m[a_2 l_3 + l_1(g + a_3)] \]
Module 2

\[(Rolling\text{Moment})_2 = (Yawing\text{Moment})_3\]

\[(Pitching\text{Moment})_2 = (Rolling\text{Moment})_3 + \left(\frac{M_2 L_2}{4} + M_3 L_2^2\right) a_1\]

\[(Yawing\text{Moment})_2 = (Pitching\text{Moment})_3 + \left(\frac{M_2 L_2}{4} + M_3 L_2^2\right) g\]

Module 1

\[(Rolling\text{Moment})_1 = (Yawing\text{Moment})_2 + (M_2 + M_3)a_2 \frac{w_2}{2}\]

\[(Yawing\text{Moment})_1 = (Pitching\text{Moment})_2\]

\[(Pitching\text{Moment})_1 = (Rolling\text{Moment})_2\]
3.1 Introduction ................................................................. 51
3.2 Transporting a Single Axis. ............................................. 52
3.3 Warranty Requirements ................................................... 52
3.4 Mounting the Main Unit to a Base ........................................ 53
  Direct Attachment Using the Tap Holes on the Bottom of the Main Unit . . . 54
  Attaching Using the Optional Mounting Brackets ............................. 55
3.5 Single-Axis Electrical Connections ......................................... 56
  EXA and EXC Electrical Connections ...................................... 56
  Adept MV Controller Connections ........................................ 56
3.6 Mounting Components to the Main Unit. ................................. 57
3.1 Introduction

This chapter provides an overview of the AdeptModules mechanical assembly process.

All AdeptModules systems start with a main module unit. The main unit is considered axis one and is generally referred to as the X-axis. Installation of the main unit for all configurations is covered in this chapter. Begin your installation by following the procedures in this chapter regardless of the total number of axes in your system.

If your system includes a second axis, see “Mechanical Assembly, Adding Axis Two” starting on page 59 for details on adding the second axis. If your system includes a third or fourth axis, see “Mechanical Installation, Adding Axis Three” starting on page 141 for details on adding the third and fourth axes.

There are many possible combinations of AdeptModules. In most cases the assembly instructions will apply to a range of modules. The applicable range for a given assembly process is provided in tables that look similar to:

<table>
<thead>
<tr>
<th>X-Axis Main Unit</th>
<th>Y-Axis Main Unit</th>
<th>Combining Bracket</th>
</tr>
</thead>
<tbody>
<tr>
<td>90400-10**0</td>
<td>90400-200*5</td>
<td>90400-05002</td>
</tr>
</tbody>
</table>

This table indicates that any X-axis unit with a serial number between 90400-10000 and 90400-10990 may be used in the installation, any Y-axis unit with a serial number between 90400-20005 and 90400-20095 may be used, and combining bracket 90400-05002 must be used.

Transporting AdeptModules
### 3.2 Transporting a Single Axis

The main unit must be transported using a sling as shown in (Figure 3-1).

![Figure 3-1. Transporting Modules](image)

**WARNING:** Do not stand under a module during transportation. Personal injury can occur.

**WARNING:** The robot module is a precision machine. Be careful to avoid impacts or excessive jarring of the module during handling.

### 3.3 Warranty Requirements

The following precautions must be observed or the AdeptModules warranty may be void. Read these precautions before beginning installation and observe them during installation and operation.

**NOTE:** Install the main unit on a smooth, finished surface (recommended flatness: 0.1 mm or less)
1. When installing the main unit on the base, or installing equipment on the main unit or slider, the mounting bolts must be mounted to the screw-in depths specified in Table 3-1 through Table 3-3.

2. Do not disassemble any part other than those mentioned in the “Maintenance” section.

3. The robot module connectors are similar for all modules. When connecting modules to the controller, check for proper connection before applying power. Improper connection may result in motor damage.

4. Do not attempt to restrict the motion of the main unit with an external restraint. When pushing or pulling the work, the moment applied to the main unit must be equal to, or less than, the transportable moment. See “Chapter 8” for details.

5. The main unit is protected against contamination by sealing belts. However, the unit should be kept away from water or oil splash.

6. Use the main unit at an ambient temperature between 0° and 40° C (non-condensing). The motors within the main unit, in particular, release heat. Consequently, no heat source should be placed near the unit.

7. The drive pin of the combining bracket and the pin hole on the main unit are high-precision mating surfaces. Thus, you may experience some resistance in positioning the pin in the hole. In these cases, press the bracket and main unit together firmly, using care to avoid damaging the hole in the process.

### 3.4 Mounting the Main Unit to a Base

All AdeptModules installations, regardless of the number of axes, begin by mounting the main unit (axis one) to the base.

Adept recommends the use of socket head cap screws for installation, as specified in Table 3-1. Other specifications are listed in individual tables throughout the manual.

<table>
<thead>
<tr>
<th>Bolt Diameter</th>
<th>M8</th>
<th>M6</th>
<th>M5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pitch</td>
<td>1.25 mm</td>
<td>1.0 mm</td>
<td>0.8 mm</td>
</tr>
</tbody>
</table>
Figure 3-2. Typical Single-Axis Module

The main unit may be attached in two ways: bolting the main unit directly to the work surface using the tap holes on the bottom of the main unit or attaching a bracket(s) to the bottom of the main unit and then attaching the bracket to the work surface.

**NOTE:** The mounting surface should be a finished surface with a flatness of approximately 0.1 mm and be free from harmful projections. When the bolt fixing portions are lifted, use shims to adjust the flatness.

See Chapter 8, “Technical Specifications” for dimensions on specific AdeptModule types.

**Direct Attachment Using the Tap Holes on the Bottom of the Main Unit**

1. In Chapter 8 locate the dimension drawing for the module you are attaching.
2. Using the layout and screw size information on the dimension drawing, mark and drill twelve holes through the mounting base.
3. Select the correct size bolts based on the specifications in Table 3-1 and Table 3-2 and attach the main unit to the base as shown in Figure 3-3.
Figure 3-3. Attaching Main Unit Directly to the Base

NOTE: The mounting bolts should meet the specifications given in Table 3-1 and Table 3-2.

Table 3-2. Mounting Screw Specifications

<table>
<thead>
<tr>
<th></th>
<th>H-Module</th>
<th>M-Module</th>
<th>S-Module</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bolt Diameter</strong></td>
<td>M8</td>
<td>M6</td>
<td>M5</td>
</tr>
<tr>
<td><strong>Screw-In Depth</strong></td>
<td>12-16 mm</td>
<td>9-12 mm</td>
<td>7-9 mm</td>
</tr>
<tr>
<td><strong>Tightening Torque</strong></td>
<td>33.3 N•m</td>
<td>14.7 N•m</td>
<td>5.9 N•m</td>
</tr>
<tr>
<td></td>
<td>340 kgf•cm</td>
<td>150 kgf•cm</td>
<td>60 kgf•cm</td>
</tr>
<tr>
<td></td>
<td>294.7 in•lb</td>
<td>130.1 in•lb</td>
<td>52.2 in•lb</td>
</tr>
</tbody>
</table>

Attaching Using the Optional Mounting Brackets

1. In Chapter 8 locate the dimension drawings for the module and the mounting bracket that you are installing.

2. Using the layout and screw size information on the dimension drawing, mark and drill four holes through the mounting base for each bracket used. Two brackets are recommended for 600mm or smaller units and three brackets are recommended for larger units.

3. Attach the mounting brackets to the main unit with the bolts supplied in the kit (the required screw sizes are listed in Table 3-3).

4. Bolt the mounting brackets to the work surface using the screw specifications shown in Table 3-2.
### 3.5 Single-Axis Electrical Connections

If this is the only axis in the system, see the instructions below for connecting the module to an EXA, EXC, or Adept MV controller.

If you are installing a two-axis system, see “Mechanical Assembly, Adding Axis Two” starting on page 59. If you are installing a three- or four-axis system, see “Mechanical Installation, Adding Axis Three” on page 141.

**EXA and EXC Electrical Connections**

Connect the two barrel ends of the cable to the X-axis module as shown in Figure 3-4. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

**Adept MV Controller Connections**

Connect the two barrel ends of the cable to the X-axis module as shown in Figure 3-5. These connectors have different pin sizes and cannot be installed incorrectly. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B Amp break-out cable.
3.6 Mounting Components to the Main Unit

If this is the only axis in the system, you are ready to mount your end-effector or other tooling to the module. Go to “Mounting Tooling to an AdeptModule” on page 168.

If you are installing a two-axis system, see “Mechanical Assembly, Adding Axis Two” starting on page 59. If you are installing a three- or four-axis system, see “Mechanical Installation, Adding Axis Three” starting on page 141.
Mechanical Assembly,
Adding Axis Two

4.1 Introduction ......................................................... 63
   Precautions ....................................................... 63
4.2 Combining Methods ............................................... 63
4.3 Robot Cables ...................................................... 63
   Changing the Angle of the Cable End .......................... 64
   Mounting the Cable Holder .................................... 64
   Inserting the Chamfered and Straight Pin Into a Bracket 64
4.4 Assembling G-Type Combinations ............................... 65
4.5 G-1 Type Installation Procedure ............................... 66
   G-1 Type Electrical Connections ............................... 67
   EXA and EXC Electrical Connections ......................... 67
   Adept MV Controller Connections ............................ 68
4.6 G-2 Type Installation Procedure ............................... 70
   G-2 Type Electrical Connections ............................... 71
   EXA and EXC Electrical Connections ......................... 71
   Adept MV Controller Connections ............................ 72
4.7 G-3 Type Installation Procedure ............................... 74
   G-3 Type Electrical Connections ............................... 75
   EXA and EXC Electrical Connections ......................... 75
   Adept MV Controller Connections ............................ 76
4.8 Assembling D-Type Combinations ............................... 78
4.9 D-1 and D-2 Type Installation Procedure ..................... 79
   D-1 and D-2 Type Electrical Connections ..................... 80
   EXA and EXC Electrical Connections ......................... 80
   Adept MV Controller Connections ............................ 81
4.10 D1 and D2 Configuration Extended Stroke Cable Track Installation ............... 84
   Adding User Cables to the Cable Track ...................... 85
4.11 D-3 Type Installation Procedure ............................. 86
   D-3 Type Electrical Connections ............................. 87
   EXA and EXC Electrical Connections ......................... 87
   Adept MV Controller Connections ............................ 88
4.12 D-4 Type Installation Procedure ............................. 90
4.13 Assembling K-Type Combinations ........................................ 95
4.14 K-2 Type Installation Procedure ........................................ 96
  K-2 Type Electrical Connections ........................................ 96
  EXA and EXC Electrical Connections ................................ 97
  Adept MV Controller Connections ..................................... 98
4.15 K-3 Type Installation Procedure ........................................ 100
  K-3 Type Electrical Connections ........................................ 100
  EXA and EXC Electrical Connections ................................ 101
  Adept MV Controller Connections ..................................... 102
4.16 K-4 Type Installation Procedure ........................................ 104
  K-4 Type Electrical Connections ........................................ 104
  EXA and EXC Electrical Connections ................................ 105
  Adept MV Controller Connections ..................................... 106
4.17 Assembling Z-Type Combinations ........................................ 108
4.18 Z-2 Type Installation Procedure ........................................ 109
  Z-2 Type Electrical Connections ........................................ 109
  EXA and EXC Electrical Connections ................................ 110
  Adept MV Controller Connections ..................................... 111
4.19 Z-3 Type Installation Procedure ........................................ 113
  Z-3 Type Electrical Connections ........................................ 113
  EXA and EXC Electrical Connections ................................ 114
  Adept MV Controller Connections ..................................... 115
4.20 Z-4 Type Installation Procedure ........................................ 117
  Z-4 Type Electrical Connections ........................................ 117
  EXA and EXC Electrical Connections ................................ 118
  Adept MV Controller Connections ..................................... 119
4.21 Assembling T-Type Combinations ........................................ 121
4.22 T-Type Installation Procedure ........................................ 122
  T-Type Electrical Connections ........................................ 123
  EXA and EXC Electrical Connections ................................ 123
  Adept MV Controller Connections ..................................... 124
4.23 Assembling X-Type Combinations ........................................ 126
4.24 X-1 Type Installation Procedure ........................................ 127
  X-1 Type Electrical Connections ........................................ 127
  EXA and EXC Electrical Connections ................................ 128
  Adept MV Controller Connections ..................................... 129
4.25 X-2 Type Installation Procedure ........................................ 130
  X-2 Type Electrical Connections ........................................ 131
  EXA and EXC Electrical Connections ................................ 132
Adept MV Controller Connections ................. 133

4.26 X1 and X2 Extended Stroke Cable Track Installation .......... 134
  Adding User Cables to the Cable Track .......... 136

4.27 X-3 Type Installation Procedure .................... 136
  X-3 Type Electrical Connections ................. 137
    EXA and EXC Electrical Connections .......... 138
    Adept MV Controller Connections .......... 139
4.1 Introduction

This chapter details adding a second axis (Y-axis) to an AdeptModules system. Before beginning any procedures in this chapter you should have completed installation of the main unit as described in Chapter 3.

Precautions

Observe the following precautions when configuring modules in multi-axis combinations:

1. The mounting bracket used to connect axis two to axis one must use the mounting holes shown for that module in Chapter 8. Do not use other holes for the mounting bracket.

2. The chamfered pin of the combining bracket and the pin hole on the main unit are high-precision mating surfaces and you may experience some resistance in positioning the pin in the hole. Carefully press the bracket and main unit together firmly, using care to avoid damaging the hole in the process.

3. When assembling cables, avoid applying unreasonable force to cables.

   **NOTE:** Combinations other than those illustrated are possible.

4. Before applying power, check for correct cable connections.

   **WARNING:** Improper connection may result in damage to the controller or module motor.

4.2 Combining Methods

The following instructions describe the various two-axis combination assembly procedures. There are several types of two-axis combinations, so be sure to follow the proper set of procedures. There are six ways to combine the X-axis and Y-axis units: G, D, K, T, X, and Z. For installation procedures on your specific two-axis configuration, see the section that relates to that combination.

The combining brackets are complex components that are machined for use in several different combinations. Before installing the locator pins in the bracket, carefully compare the holes in the bracket with the holes in each module to ensure that you use the proper pin and bolt holes. The bracket dimension drawings in Chapter 8 show the proper pin and bolt holes combinations.

4.3 Robot Cables

There are two types of robot cables. One is the “straight” type and the other is the “elbow-on-one-end” type. Figure 4-1 shows the two types of cables.
Changing the Angle of the Cable End

In some AdeptModule configurations the angle of the cable holder will need to be rotated. Follow these directions to change the angle of the holder:

1. Loosen the two cable fixing screws using a M5 hex wrench.
2. Pull the elbow out approximately 5 mm (.2 inches).
3. Rotate the elbow to the desired position (do not exceed 90 degrees of rotation in either direction).
4. Push the elbow back into the socket and tighten the cable fixing screws to 1.47 N•m (13.0 in•lb).

Mounting the Cable Holder

Attach the cable holders to their respective axes using four M3 x 57 screws provided with the cable (see the following directions and Chapter 8 for holder locations), torque to 1.47 N•m (13.0 in•lb).

Inserting the Chamfered and Straight Pin Into a Bracket

Locating pins can be very helpful in positioning the Modules on the mounting surface or together. There are two types, chamfered and straight.

To insert the pins into the bracket or the module use a rubber mallet. The pins must not project more than 8 mm. For locating the position of the pins on the different types of brackets refer to “Module Dimensions” starting on page 199 of the “Technical Specifications” chapter and Figure 4-2.
4.4 Assembling G-Type Combinations

In a G-type configuration, the combining bracket mounts to the slider of the X-axis unit and to the body of the Y-axis unit as shown in Figure 4-3. In this configuration the sliders are perpendicular to the X-axis.

Figure 4-3. G-Type Combination
The applicable ranges of modules and their combining brackets are shown in Table 4-1. Verify that you have compatible X-axis, Y-axis, and combining bracket components before beginning assembly.

### Table 4-1. G-Type Configuration Components.

<table>
<thead>
<tr>
<th>Combination Type</th>
<th>X-Axis Module Type and Part Numbers</th>
<th>Y-Axis Module Type and Part Numbers</th>
<th>Combining Bracket Type and Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>G-1</td>
<td>H 90400-10*0</td>
<td>M 90400-200*5</td>
<td>GHM 90400-05002</td>
</tr>
<tr>
<td>G-2</td>
<td>M 90400-200*5</td>
<td>S 90400-300*3</td>
<td>GMS 90400-05001</td>
</tr>
<tr>
<td>G-3</td>
<td>S 90400-300*3</td>
<td>S 90400-300*3</td>
<td>GSS 90400-05003</td>
</tr>
</tbody>
</table>

#### 4.5 G-1 Type Installation Procedure

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

3. Mate the combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).

4. Mate the Y-axis to combining bracket by aligning the motor-side pin holes on the Y-axis module to the pins on the side of the bracket (these holes are on the side opposite the sliders). Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 4-4, and refer to Table 3-3 for the mounting bolt specifications).
The applicable range of robot and controller cables is shown in Table 4-2. Verify that you have compatible cables before beginning assembly.

### Table 4-2. G-1 Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
</tbody>
</table>

**EXA and EXC Electrical Connections**

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-5. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

Figure 4-4. G-1 Type Mechanical Assembly
2. Connect the Y-axis cables:
   
a. Connect the C holder end of the robot cable to the motor end of the S module (see Section 4.3 for holder mounting).

b. Attach the A holder end of the robot cable to the side of the M module as shown in Figure 4-6 (refer to Section 4.3 for holder mounting).

c. Connect the two barrel ends of the cable to the Y-axis module as shown in Figure 4-5. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

![Figure 4-5. Connecting to an EXA or EXC Controller](image)

**Adept MV Controller Connections**

1. Connect the X-axis cables:
   
a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-6. These connectors have different pin sizes and cannot be installed incorrectly.
b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the Dual B+ Amp break-out cable.

2. Connect the Y-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the M module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the side of the H module as shown in Figure 4-6 (refer to Section 4.3 for holder mounting).
   c. Connect the two barrel ends of the cable to the A holder as shown in Figure 4-6. These connectors have different pin sizes and cannot be installed incorrectly.
   d. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.
   e. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable# 10400-00600).
4.6 **G-2 Type Installation Procedure**

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Mate the combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts.

4. Mate the Y-axis to combining bracket by aligning the motor-side pin holes on the Y-axis module to the pins on the side of the bracket (these holes are on the side opposite the sliders). Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 4-7).
G-2 Type Electrical Connections

The applicable range of robot and controller cables is shown in Table 4-3. Verify that you have compatible cables before beginning assembly.

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
</tbody>
</table>

**EXA and EXC Electrical Connections**

1. Connect the X-axis cables:

   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-8. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.
2. Connect the Y-axis cables:
   a. Rotate the C holder 90 degrees (refer to Section 4.3 for holder rotation).
   b. Connect the C holder end of the robot cable to the motor end of the S module (see Section 4.3 for holder mounting).
   c. Attach the A holder end of the robot cable to the side of the M module as shown in Figure 4-8 (refer to Section 4.3 for holder mounting).
   d. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   e. Connect the two barrel ends of the cable to the Y-axis module as shown in Figure 4-8. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

---

A Holder

Robot cable to Y-axis module

X-axis

Cable #90400-03003

To: "1-CN5 SENSOR 1"

To: "1-CN6 MOTOR 1"

To: "2-CN5 SENSOR 2"

To: "2-CN6 MOTOR 2"

---

Figure 4-8. Connecting to an EXA or EXC Controller

Adept MV Controller Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-9. These connectors have different pin sizes and cannot be installed incorrectly.
b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B⁺ Amp break-out cable.

2. Connect the Y-axis cables:
   a. Rotate the C holder 90 degrees (refer to Section 4.3 for holder rotation).
   b. Connect the C holder end of the robot cable to the motor end of the S module (refer to Section 4.3 for holder rotation and mounting).
   c. Attach the A holder end of the robot cable to the side of the M module as shown in Figure 4-9 (refer to Section 4.3 for holder rotation and mounting).
   d. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   e. Connect the two barrel ends of the cable to the A holder as shown in Figure 4-9. These connectors have different pin sizes and cannot be installed incorrectly.
   f. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.
   g. The final connector connects to the Axis 1 end of the B⁺ Amp break-out cable (cable #10400-00600).

![Figure 4-9. Connecting to an Adept MV Controller](image-url)
4.7 G-3 Type Installation Procedure

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Mate the combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for mounting bolt specifications).

4. Mate the Y-axis to combining bracket by aligning the motor-side pin holes on the Y-axis module to the pins on the side of the bracket (these holes are on the side opposite the sliders). Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 4-10).

Figure 4-10. G-3 Type Mechanical Assembly
G-3 Type Electrical Connections

The applicable range of robot and controller cables is shown in Table 4-4. Verify that you have compatible cables before beginning assembly.

**Table 4-4. G-3 Type Cable Options**

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
</tbody>
</table>

EXA and EXC Electrical Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-11. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.
2. Connect the Y-axis cables:
   a. Rotate the C holder 90 degrees (refer to Section 4.3 for holder rotation).
   b. Connect the C holder end of the robot cable to the motor end of the Y-axis module (refer Section 4.3 for holder mounting).
   c. Attach the A holder end of the robot cable to the side of the X-axis module as shown in Figure 4-11 (refer to Section 4.3 for holder mounting).
   d. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   e. Connect the two barrel ends of the cable to the Y-axis module as shown in Figure 4-11. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

---

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Figure 4-11. Connecting to an EXA or EXC Controller

**Adept MV Controller Connections**

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-12. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B” Amp break-out cable.

2. Connect the Y-axis cables:
   a. Rotate the C holder 90 degrees (refer to Section 4.3 for holder rotation).
   b. Connect the C holder end of the robot cable to the motor end of the Y-axis module (refer to Section 4.3 for holder rotation and mounting).
   c. Attach the A holder end of the robot cable to the side of the X-axis module as shown in Figure 4-12 (refer to Section 4.3 for holder rotation and mounting).
   d. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   e. Connect the two barrel ends of the cable to the A holder as shown in Figure 4-12. These connectors have different pin sizes and cannot be installed incorrectly.
f. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

g. The final connector connects to the Axis 1 end of the B⁺ Amp break-out cable (cable# 10400-00600).

Figure 4-12. Connecting to an Adept MV Controller
4.8 Assembling D-Type Combinations

In a D-type configuration the combining bracket mounts to the slider of the X-axis unit and to the body of the Y-axis unit as shown in Figure 4-13. In this configuration the sliders are parallel to the X-axis.

Figure 4-13. D-Type Combination

The applicable ranges of modules and their combining brackets are shown in Table 4-5. Verify that you have compatible X-axis, Y-axis, and combining bracket components before beginning assembly.

Table 4-5. D-Type Configuration Components

<table>
<thead>
<tr>
<th>Combination Type</th>
<th>X-Axis Module Type and Part Numbers</th>
<th>Y-Axis Module Type and Part Numbers</th>
<th>Combining Bracket Type and Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-1</td>
<td>H 90400-10**0</td>
<td>M 90400-200*5</td>
<td>DHM 90400-05004</td>
</tr>
<tr>
<td>D-2</td>
<td>M 90400-200*5</td>
<td>M 90400-200*5</td>
<td>DMM 90400-05005</td>
</tr>
<tr>
<td>D-1 Extended Stroke</td>
<td>H 90400-11**0</td>
<td>M 90400-211*5</td>
<td>DHM 90400-05004</td>
</tr>
<tr>
<td>D-2 Extended Stroke</td>
<td>M 90400-211*5</td>
<td>M 90400-211*5</td>
<td>DMM 90400-05005</td>
</tr>
<tr>
<td>D-3</td>
<td>M 90400-200*5</td>
<td>S 90400-300*3</td>
<td>DMS 90400-05006</td>
</tr>
<tr>
<td>D-4</td>
<td>S 90400-300*3</td>
<td>S 90400-300*3</td>
<td>DSS 90400-05007</td>
</tr>
</tbody>
</table>

NOTE: Gantry modules (pt# 90400-041**) are recommended by Adept when stroke lengths exceed 950 mm in the Y-axis.
4.9 D-1 and D-2 Type Installation Procedure

The D-1 combination type connects an H module with an M module. The D-2 type combination connects two M modules.

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

3. Mate the combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).

4. Mate the Y-axis to combining bracket by aligning the motor-side pin holes on the Y-axis module to the pins on the side of the bracket (these holes are on the side opposite the sliders). Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 4-14 or Figure 4-15, and refer to Table 3-3 for the mounting bolt specifications).

Figure 4-14. D-1 Type Mechanical Assembly
The applicable ranges of robot and controller cables are shown in Table 4-6. Verify that you have compatible cables before beginning assembly.

**Table 4-6. D-1 Type Cable Options**

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-061*5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Y-Axis Robot Cable tracks (extended stroke types)</td>
<td>90400-08008</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
<tr>
<td>Cable track assemble for Extended stroke models</td>
<td>900400-08008</td>
<td></td>
</tr>
</tbody>
</table>
NOTE: Adept recommends using cable tracks for extended stroke configurations. See Section 4.3 for cable track installation.

**EXA and EXC Electrical Connections**

1. Connect the X-axis cables:
   
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-16. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Y-axis cables:
   
   a. Connect the B holder end of the robot cable to the motor end of the Y-axis module (see Section 4.3 for holder mounting).
   
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-16 (refer to Section 4.3 for holder mounting).
   
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   
   d. Connect the two barrel ends of the controller cable to the Y-axis module as shown in Figure 4-16. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.
Figure 4-16. Connecting to an EXA or EXC Controller

Adept MV Controller Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-17. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Y-axis cables:
   a. Connect the B holder end of the robot cable to the motor end of the Y-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-17 (refer to Section 4.3 for holder mounting).
c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N\(\cdot\)m (66.4 to 79.6 in\(\cdot\)lb).

d. Connect the two barrel ends of the cable to the A holder as shown in Figure 4-17. These connectors have different pin sizes and cannot be installed incorrectly.

e. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

f. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable# 10400-00600).

Figure 4-17. Connecting to an Adept MV Controller
4.10 D1 and D2 Configuration Extended Stroke Cable Track Installation

When using the D1 and D2 extended stroke configurations, Adept recommends the use of cable tracks.

Follow these directions to install the cable tracks (see Figure 4-18).

1. Slide the module rail keys into the X-axis. The cable track supports mount to these keys.

2. Mount the cable track supports using M3 x 6 screws. Start with the cable track support away from the motor side of the module, torque to 1.47 N•m (13.0 in•lb).

3. Mount the remaining cable track supports and cable track support bracket (nonmoving side) to the X-axis in the same manner as steps 1 and 2.

   **NOTE:** In some configurations the cable track supports must be mounted to the systems base vice the X-axis. In this case Drill M6-25.4 mm tapped holes and mount supports to the base with M6 screws, 10mm long, torque to 1.47 N•m (13.0 in•lb).

   **NOTE:** Before mounting the cable track, insure that the cables are not twisted within the cable track.

4. Mount the cable track support bracket (moving side) with M3-6 screws to the Y-axis motor cover, torque to 1.47 N•m (13.0 in•lb).

5. Position the cable track along the X-axis cable track supports with the cable support fixture on the cable track support bracket (nonmoving side).

6. Using 4 nuts, mount the cable support fixture to the cable track support bracket (nonmoving side), torque to 1.47 N•m (13.0 in•lb).

7. Mount the other support fixture of the cable track to the cable track support bracket (moving side) with 4 screws and tapped securing plate. The securing plate is placed under the cable track support bracket, torque to 1.47 N•m (13.0 in•lb).
8. Connect all cable connectors to the controller and axis as describe in the above electrical connection procedures.

**NOTE:** Adept recommends labeling the cables at the connectors to avoid misconnection and damage to the AdeptModules system.

**Adding User Cables to the Cable Track**

When adding user cables to the cable track, open the top of the cable track using a standard screw driver (see Figure 4-19). Be aware of the cross-sectional area of the cable track for the amount of space for user cables and air hoses.
4.11 D-3 Type Installation Procedure

The D-3 type combination connects an M module and an S module.

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Carefully mate the combining bracket to the Y-axis. Do not secure with mounting bolts at this time.
4. Mate the Y-axis with combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for mounting bolt specifications).

5. Mount the Y-axis to combining bracket. Install the mounting bolts (see Figure 4-20 and refer to Table 3-3 for mounting bolt specifications).

---

**Figure 4-20. D-3 Type Mechanical Assembly**

**D-3 Type Electrical Connections**

The applicable ranges of robot and controller cables are shown in Table 4-7. Verify that you have compatible cables before beginning assembly.

---

**Table 4-7. D-3 Type Cable Options**

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
</tbody>
</table>

**EXA and EXC Electrical Connections**

1. Connect the X-axis cables:
a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-21. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Y-axis cables:
   a. Connect the B holder end of the robot cable to the connectors of the Y-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-21 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of it movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   d. Connect the two barrel ends of the controller cable to the Y-axis module as shown in Figure 4-21. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

![Figure 4-21. Connecting to an EXA or EXC Controller](image)

**Figure 4-21. Connecting to an EXA or EXC Controller**

**Adept MV Controller Connections**

1. Connect the X-axis cables:
a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-22. These connectors have different pin sizes and cannot be installed incorrectly.

b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Y-axis cables:

a. Connect the B holder end of the robot cable to the motor end of the Y-axis module (see Section 4.3 for holder mounting).

b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-22 (refer to Section 4.3 for holder mounting).

c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).

d. Connect the two barrel ends of the controller cable to the Y-axis module as shown in Figure 4-22. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

e. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

f. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable# 10400-00600).
Figure 4-22. Connecting to an Adept MV Controller

4.12 D-4 Type Installation Procedure

The D-4 type connects two S modules.

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).
3. Mate the combining bracket to the Y-axis rear surface. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).

4. Mount the Y-axis with combining bracket by aligning the pin holes on the X-axis module slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 4-23, and refer to Table 3-3 for the mounting bolt specifications).

![Figure 4-23. D-4 Type Mechanical Assembly](image)

**D-4 Type Electrical Connections**

The applicable ranges of robot and controller cables are shown in Table 4-8. Verify that you have compatible cables before beginning assembly.

**Table 4-8. D-4 Type Cable Options**

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td>10400-070**</td>
<td></td>
</tr>
</tbody>
</table>
EXA and EXC Electrical Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-5. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Y-axis cables:
   a. Attach a small mounting plate to the X-axis motor end face plate with mounting bolts.
   a. Connect the B holder end of the robot cable to the motor end of the Y-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the small mounting plate of the X-axis module as shown in Figure 4-24 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   d. Connect the two barrel ends of the cable to the Y-axis module as shown in Figure 4-24. These connectors have different pins sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.
Figure 4-24. Connecting to an EXA or EXC Controller

Adept MV Controller Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-25. These connectors have different pins sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B⁺ Amp break-out cable.

2. Connect the Y-axis cables:
   a. Attach a small mounting plate to the X-axis motor end face plate with mounting bolts.
   a. Connect the B holder end of the robot cable to the motor end of the Y-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the small mounting plate of the X-axis module as shown in Figure 4-25 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
d. Connect the two barrel ends of the cable to the A holder as shown in Figure 4-25. These connectors have different pins sizes and cannot be installed incorrectly.

e. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

f. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable# 10400-00600).

Figure 4-25. Connecting to an Adept MV Controller
4.13 Assembling K-Type Combinations

In a K-type configuration the combining bracket mounts to the slider of the X-axis unit and to the body of the Z-axis unit as shown in Figure 4-26. In this configuration the sliders are parallel to the X-axis.

![Figure 4-26. K-Type Combination](image)

The applicable ranges of modules and their combining brackets are shown in Table 4-9. Verify that you have compatible X-axis, Z-axis, and combining bracket components before beginning assembly.

<table>
<thead>
<tr>
<th>Combination Type</th>
<th>X-Axis Module Type and Part Numbers</th>
<th>Y-Axis Module Type and Part Numbers</th>
<th>Combining Bracket Type and Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-2</td>
<td>H 90400-10**0</td>
<td>Mz 90400-240*5</td>
<td>DHM 90400-05004</td>
</tr>
<tr>
<td>K-3</td>
<td>M 90400-10**0</td>
<td>Mz 90400-240*5</td>
<td>DMM 90400-05005</td>
</tr>
<tr>
<td>K-4</td>
<td>M 90400-10**0</td>
<td>Sz 90400-400*3</td>
<td>DMS 90400-05007</td>
</tr>
</tbody>
</table>
4.14 K-2 Type Installation Procedure

The K-2 type combination connects an H module and an Mz module.

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Z-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Carefully mate the combining bracket to the Z-axis. Do not secure with mounting bolts at this time.

4. Mate the Z-axis with combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for mounting bolt specifications).

5. Mount the Z-axis to combining bracket. Install the mounting bolts (see Figure 4-27 and refer to Table 3-3 for mounting bolt specifications).

![Figure 4-27. K-2 Type Mechanical Assembly](image)

K-2 Type Electrical Connections

The applicable ranges of robot and controller cables are shown in Table 4-10. Verify that you have compatible cables before beginning assembly.

DHM Bracket (90400-05004)

X-axis
H-Module (90400-100*0)

Hex. Socket Cap Screw M6 x 20 mm (4 pcs)

Z-axis
Mz-Module (90400-240*5)

Hex. Socket Cap Screw M8 x 25 mm (4 pcs)
### EXA and EXC Electrical Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-21. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the connectors of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-28 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-28. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

#### Table 4-10. K-2 Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
</tbody>
</table>
Figure 4-28. Connecting to an EXA or EXC Controller

Adept MV Controller Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-29. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the motor end of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-29 (refer to Section 4.3 for holder mounting).
c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).

d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-29. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

e. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

f. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable# 10400-00600).

Figure 4-29. Connecting to an Adept MV Controller
4.15 K-3 Type Installation Procedure

The K-3 type combination connects an M module and an Mz module.

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Z-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Carefully mate the combining bracket to the Z-axis. Do not secure with mounting bolts at this time.

4. Mate the Z-axis with combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for mounting bolt specifications).

5. Mount the Z-axis to combining bracket. Install the mounting bolts (see Figure 4-30 and refer to Table 3-3 for mounting bolt specifications).

---

**Figure 4-30. K-3 Type Mechanical Assembly**

**K-3 Type Electrical Connections**

The applicable ranges of robot and controller cables are shown in Table 4-11. Verify that you have compatible cables before beginning assembly.
EXA and EXC Electrical Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-31. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the connectors of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-31 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-31. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

Table 4-11. K-3 Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable</td>
<td>10400-070**</td>
<td></td>
</tr>
</tbody>
</table>
Figure 4-31. Connecting to an EXA or EXC Controller

Adept MV Controller Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-32. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the motor end of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-32 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-32. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

e. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

f. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable # 10400-00600).

Figure 4-32. Connecting to an Adept MV Controller
4.16 K-4 Type Installation Procedure

The K-4 type combination connects an M module and an Sz module.

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Z-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Carefully mate the combining bracket to the Z-axis. Do not secure with mounting bolts at this time.

4. Mate the Z-axis with combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for mounting bolt specifications).

5. Mount the Z-axis to combining bracket. Install the mounting bolts (see Figure 4-33 and refer to Table 3-3 for mounting bolt specifications).

Figure 4-33. K-4 Type Mechanical Assembly

K-4 Type Electrical Connections

The applicable ranges of robot and controller cables are shown in Table 4-12. Verify that you have compatible cables before beginning assembly.
**Table 4-12. K-4 Type Cable Options**

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
</tbody>
</table>

**EXA and EXC Electrical Connections**

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-34. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the connectors of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-34 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-34. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.
Figure 4-34. Connecting to an EXA or EXC Controller

Adept MV Controller Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-35. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the motor end of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-35 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-35. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

e. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

f. The final connector connects to the Axis 1 end of the B⁺ Amp break-out cable (cable# 10400-00600).
4.17 **Assembling Z-Type Combinations**

In a Z-type configuration the combining bracket mounts to the slider of the X-axis unit and to the slider of the Z-axis unit as shown in Figure 4-36. In this configuration the Z-axis sliders is perpendicular to the X-axis.

![Figure 4-36. Z-Type Combination](image)

The applicable ranges of modules and their combining brackets are shown in Table 4-13. Verify that you have compatible X-axis, Z-axis, and combining bracket components before beginning assembly.

**Table 4-13. Z-Type Configuration Components.**

<table>
<thead>
<tr>
<th>Combination Type</th>
<th>X-Axis Module Type and Part Numbers</th>
<th>Z-Axis Module Type and Part Numbers</th>
<th>Combining Bracket Type and Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-2</td>
<td>H 90400-10**0 Mz 90400-240*5 XHM 90400-05008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-3</td>
<td>M 90400-10**0 Mz 90400-240*5 XMM 90400-05010</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Z-4</td>
<td>M 90400-10**0 Sz 90400-400*3 DMS 90400-05007</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.18 Z-2 Type Installation Procedure

The Z-2 type combination connects an H module and an Mz module.

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Z-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Carefully mate the combining bracket to the Z-axis. Do not secure with mounting bolts at this time.

4. Mate the Z-axis with combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for mounting bolt specifications).

5. Mount the Z-axis to combining bracket. Install the mounting bolts (see Figure 4-37 and refer to Table 3-3 for mounting bolt specifications).

Figure 4-37. Z-2 Type Mechanical Assembly

Z-2 Type Electrical Connections

The applicable ranges of robot and controller cables are shown in Table 4-14. Verify that you have compatible cables before beginning assembly.
1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-38. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the connectors of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-38 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-38. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

### Table 4-14. Z-2 Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
</tbody>
</table>

**EXA and EXC Electrical Connections**

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-38. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the connectors of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-38 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-38. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

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**Figure 4-38. Connecting to an EXA or EXC Controller**

**Adept MV Controller Connections**

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-39. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the motor end of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-39 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-39. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

e. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

f. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable# 10400-00600).

Figure 4-39. Connecting to an Adept MV Controller
4.19 Z-3 Type Installation Procedure

The K-3 type combination connects an M module and an Mz module.

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Z-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Carefully mate the combining bracket to the Z-axis. Do not secure with mounting bolts at this time.

4. Mate the Z-axis with combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for mounting bolt specifications).

5. Mount the Z-axis to combining bracket. Install the mounting bolts (see Figure 4-40 and refer to Table 3-3 for mounting bolt specifications).

Figure 4-40. Z-3 Type Mechanical Assembly

Z-3 Type Electrical Connections

The applicable ranges of robot and controller cables are shown in Table 4-15. Verify that you have compatible cables before beginning assembly.
1. Connect the X-axis cables:
   
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-41. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Z-axis cables:

   a. Connect the B holder end of the robot cable to the connectors of the Z-axis module (see Section 4.3 for holder mounting).

   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-41 (refer to Section 4.3 for holder mounting).

   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).

   d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-41. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

### Table 4-15. Z-3 Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>(1 per axis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interface Cable</td>
<td></td>
<td>10400-070**</td>
</tr>
<tr>
<td>(1 per axis)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### EXA and EXC Electrical Connections

1. Connect the X-axis cables:

   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-41. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Z-axis cables:

   a. Connect the B holder end of the robot cable to the connectors of the Z-axis module (see Section 4.3 for holder mounting).

   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-41 (refer to Section 4.3 for holder mounting).

   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).

   d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-41. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

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Figure 4-41. Connecting to an EXA or EXC Controller

**Adept MV Controller Connections**

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-42. These connectors have different pin sizes and cannot be installed incorrectly.

   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the motor end of the Z-axis module (see Section 4.3 for holder mounting).

   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-42 (refer to Section 4.3 for holder mounting).

   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-42. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

e. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

f. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable# 10400-00600).

Figure 4-42. Connecting to an Adept MV Controller
4.20 Z-4 Type Installation Procedure

The K-4 type combination connects an M module and an Sz module.

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Z-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Carefully mate the combining bracket to the Z-axis. Do not secure with mounting bolts at this time.

4. Mate the Z-axis with combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for mounting bolt specifications).

5. Mount the Z-axis to combining bracket. Install the mounting bolts (see Figure 4-43 and refer to Table 3-3 for mounting bolt specifications).

Figure 4-43. Z-4 Type Mechanical Assembly

Z-4 Type Electrical Connections

The applicable ranges of robot and controller cables are shown in Table 4-16. Verify that you have compatible cables before beginning assembly.
EXA and EXC Electrical Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-44. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the connectors of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-44 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-44. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
</tbody>
</table>
Figure 4-44. Connecting to an EXA or EXC Controller

Adept MV Controller Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-45. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Z-axis cables:
   a. Connect the B holder end of the robot cable to the motor end of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the motor end face of the X-axis module as shown in Figure 4-45 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
d. Connect the two barrel ends of the controller cable to the Z-axis robot cable holder on the X-axis module as shown in Figure 4-45. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

e. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

f. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable# 10400-00600).
4.21 Assembling T-Type Combinations

In a T-type configuration the combining bracket mounts to the slider of the X-axis unit and to the Body of the Z-axis unit as shown in Figure 4-46.

![Figure 4-46. T-Type Combination](image)

The applicable ranges of modules and their combining brackets are shown in Table 4-17. Verify that you have compatible X-axis, Z-axis, and combining bracket components before beginning assembly.

<table>
<thead>
<tr>
<th>Combination Type</th>
<th>X-Axis Module Type and Part Numbers</th>
<th>Z-Axis Module Type and Part Numbers</th>
<th>Combining Bracket Type and Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>T</td>
<td>M 90400-20**5</td>
<td>Sz 90400-400*3</td>
<td>TMS 90400-05011</td>
</tr>
</tbody>
</table>
4.22 T-Type Installation Procedure

The T-type connects a M module and a Sz modules.

1. Insert the X-axis chamfered and straight pins into the L-shaped bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Z-axis chamfered and straight pins into the L-shaped bracket and seat with a rubber mallet.

3. Mate the L-shaped combining bracket to the X-axis modules slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).

4. Mate the plate bracket to the mounting holes on the Z-axis counter motor side with mounting bolts (refer to Table 4-3 for the mounting bolt specifications).

5. Mount the Z-axis with plate bracket by aligning the pins on the L shaped combining bracket through the holes on the plate bracket. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 4-47, and refer to Table 3-3 for the mounting bolt specifications).

![Figure 4-47. T-Type Mechanical Assembly]
T-Type Electrical Connections

The applicable ranges of robot and controller cables are shown in Table 4-18. Verify that you have compatible cables before beginning assembly.

### Table 4-18. T-Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-Axis Robot Cable</td>
<td>90400-071*5</td>
<td>90400-071*5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
</tbody>
</table>

**EXA and EXC Electrical Connections**

1. Connect the X-axis cables:
   
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-48. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Z-axis cables:
   
   a. Connect the C holder end of the robot cable to the motor end of the Z-axis module (see Section 4.3 for holder mounting).

   b. Attach the A holder end of the robot cable to the mounting holes on the motor cover of the X-axis module as shown in Figure 4-48 (refer to Section 4.3 for holder mounting).

   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).

   d. Connect the two barrel ends of the cable to the Z-axis module as shown in Figure 4-48. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

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*AdeptModules Instruction Handbook, Volume 2: Mechanical Assembly, Rev A*
Figure 4-48. Connecting to an EXA or EXC Controller

Adept MV Controller Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-49. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Z-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Z-axis module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the mounting holes on the motor cover of the X-axis module as shown in Figure 4-49 (refer to Section 4.3 for holder mounting).
   c. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
d. Connect the two barrel ends of the cable to the A holder as shown in Figure 4-49. These connectors have different pin sizes and cannot be installed incorrectly.

e. The D-sub connector connects to the Signal Interface Box connector marked “Axis 2”.

f. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable# 10400-00600).

Figure 4-49. Connecting to an Adept MV Controller
4.23 Assembling X-Type Combinations

In a X-type configuration the combining bracket mounts to the slider of the X-axis unit and to the slider of the Y-axis unit as shown in Figure 4-50.

![Figure 4-50. X-Type Combination](image)

The applicable range of modules and their combining brackets is shown in Table 4-19. Verify that you have compatible X-axis, Y-axis, and combining bracket components before beginning assembly.

### Table 4-19. X-Type Configuration Components.

<table>
<thead>
<tr>
<th>Combination Type</th>
<th>X-Axis Module Type and Part Numbers</th>
<th>Y-Axis Module Type and Part Numbers</th>
<th>Combining Bracket Type and Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-1</td>
<td>H 90400-10**0</td>
<td>H 90400-100*0</td>
<td>XHH 90400-05008</td>
</tr>
<tr>
<td>X-2</td>
<td>H 90400-100*0</td>
<td>M 90400-200*5</td>
<td>XHM 90400-05009</td>
</tr>
<tr>
<td>X-3</td>
<td>M 90400-200*5</td>
<td>M 90400-200*5</td>
<td>XMM 90400-05010</td>
</tr>
<tr>
<td>X-1 Extended Stroke</td>
<td>H 90400-11**0</td>
<td>H 90400-11**0</td>
<td>XHH 90400-05008</td>
</tr>
<tr>
<td>X-2 Extended Stroke</td>
<td>H 90400-11**0</td>
<td>M 90400-211*5</td>
<td>XHM 90400-05009</td>
</tr>
</tbody>
</table>

**NOTE:** Gantry modules (pt# 90400-041**) are recommended by Adept when stroke lengths exceed 950 mm in the Y-axis.
4.24 X-1 Type Installation Procedure

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

3. Mate the combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).

4. Mate the Y-axis to combining bracket by aligning the pin holes on the Y-axis module slider to the pins on the side of the bracket. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 4-51, and refer to Table 3-3 for the mounting bolt specifications).

![Figure 4-51. X-1 Type Mechanical Assembly](image)

X-1 Type Electrical Connections

The applicable ranges of robot and controller cables are shown in Table 4-20. Verify that you have compatible cables before beginning assembly.
### Table 4-20. X-1 Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-071*5</td>
<td>90400-071*5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
<tr>
<td>Cable track assembly for</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extended stroke models</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>90400-08009</td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:** Adept recommends using cable tracks for extended stroke configurations. See Section 4.3 for cable track installation.

**EXA and EXC Electrical Connections**

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-52. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Y-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Y-axis H module (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the side of the X-axis H module as shown in Figure 4-52 (refer to Section 4.3 for holder mounting).
   c. Connect the two barrel ends of the cable to the Y-axis module as shown in Figure 4-52. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.
**Figure 4-52. Connecting to an EXA or EXC Controller**

**Adept MV Controller Connections**

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-53. These connectors have different pin sizes and cannot be installed incorrectly.
   
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B⁺ Amp break-out cable.

2. Connect the Y-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Y-axis H module (see Section 4.3 for holder mounting).
   
   b. Attach the A holder end of the robot cable to the side of the X-axis H module as shown in Figure 4-53 (refer to Section 4.3 for holder mounting).
   
   c. Connect the two barrel ends of the cable to the A holder as shown in Figure 4-53. These connectors have different pin sizes and cannot be installed incorrectly.
d. The D-sub connector connects to the Signal Interface Box connector marked “Axis 2”.

e. The final connector connects to the Axis 1 end of the B\(^{+}\) Amp break-out cable (cable# 10400-00600).

**Figure 4-53. Connecting to an Adept MV Controller**

### 4.25 X-2 Type Installation Procedure

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Mate the combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts.

4. Mate the Y-axis to combining bracket by aligning the motor-side pin holes on the Y-axis module to the pins on the side of the bracket (these holes are on the side opposite the sliders). Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 4-54).
X-2 Type Installation Procedure

X-2 Type Electrical Connections

The applicable ranges of robot and controller cables are shown in Table 4-21. Verify that you have compatible cables before beginning assembly.

Table 4-21. X-2 Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
<tr>
<td>Cable track assembly for Extended stroke models</td>
<td>90400-08010</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: Adept recommends using cable tracks for extended stroke configurations. See Section 4.3 for cable track installation.
EXA and EXC Electrical Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-55. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Y-axis cables:
   b. Connect the C holder end of the robot cable to the motor end of the Y-axis M module (see Section 4.3 for holder mounting).
   c. Attach the A holder end of the robot cable to the side of the X-axis H module as shown in Figure 4-55 (refer to Section 4.3 for holder mounting).
   d. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) of the A holder and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   e. Connect the two barrel ends of the cable to the Y-axis module as shown in Figure 4-55. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

![Figure 4-55. Connecting to an EXA or EXC Controller](image-url)
Adept MV Controller Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-56. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Y-axis cables:
   c. Connect the C holder end of the robot cable to the motor end of the Y-axis M module (refer to Section 4.3 for holder rotation and mounting).
   d. Attach the A holder end of the robot cable to the side of the X-axis module as shown in Figure 4-56 (refer to Section 4.3 for holder rotation and mounting).
   e. Move the X-axis to the center of it movement stroke. Loosen the cap nut (see Figure 4-1) of the A holder and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).
   f. Connect the two barrel ends of the cable to the A holder as shown in Figure 4-56. These connectors have different pin sizes and cannot be installed incorrectly.
   g. The D-sub connector connects to the Signal Interface Box connector marked “Axis 2”.
   h. The final connector connects to the Axis 1 end of the B+ Amp break-out cable (cable# 10400-00600).
4.26 X1 and X2 Extended Stroke Cable Track Installation

When using extended stroke modules and certain other configurations, Adept recommends the use of cable tracks.

Follow these directions to install cable tracks (see Figure 4-18).

1. Slide the module rail keys into the X-axis. The cable track supports mount to these keys.

2. Mount the cable track supports using M3 x 6 screws. Start with the cable track support away from the motor side of the module and torque to 1.47 N•m (13.0 in•lb).

3. Mount the remaining cable track supports and cable track support bracket (nonmoving side) to the X-axis in the same manner as steps 1 and 2.

**NOTE:** In some configurations the cable track supports must be mounted to the systems base vice the X-axis. In this case Drill M6-25.4 mm tapped holes and mount supports to the base with M6 screws, 10mm long, and tighten to 1.47 N•m (13.0 lb•in).
4. Mount the cable track support bracket (moving side) with M4-6 screws to the axis combining bracket and tighten to 2.9 N\( \cdot \)m (25.6 in\( \cdot \)lb).

5. Mount the holder mounting plate to the X-axis cover plate with M5-6 screws and torque to 5.9 N\( \cdot \)m (52.2 in\( \cdot \)lb).

6. Position the cable track along the X-axis cable track supports with the cable support fixture on the cable track support bracket (non-moving side).

7. Using 4 nuts, mount the cable support fixture to the cable track support bracket (non-moving side) and tighten to 1.47 N\( \cdot \)m (13.0 in\( \cdot \)lb).

8. Mount the other support fixture of the cable track to the cable track support bracket (moving side) with 4 screws and tapped securing plate. Place the securing plate is placed under the cable track support bracket and tighten to 1.47 N\( \cdot \)m (13.0 in\( \cdot \)lb).

9. Mount the C-holder (elbow side) of the robot cable to the Y-axis connectors and the A-holder (straight side) to the holder mounting plate (step 5) with M3-57 screws and torque to 1.47 N\( \cdot \)m (13.0 in\( \cdot \)lb).

**NOTE:** Cable holders will have to be rotated so that the cable stands upright. Refer to page 64 for directions on changing the angle of the cable holders.

10. Connect all cable connectors to the controller and axis as described in the above electrical connection procedures.

**NOTE:** Adept recommends labeling the cables, with the enclosed lables, on the connectors to avoid misconnection and damage to the AdeptModules system.

**Figure 4-57. Cable Tracks**

9. Mount the C-holder (elbow side) of the robot cable to the Y-axis connectors and the A-holder (straight side) to the holder mounting plate (step 5) with M3-57 screws and torque to 1.47 N\( \cdot \)m (13.0 in\( \cdot \)lb).

**NOTE:** Cable holders will have to be rotated so that the cable stands upright. Refer to page 64 for directions on changing the angle of the cable holders.

10. Connect all cable connectors to the controller and axis as described in the above electrical connection procedures.

**NOTE:** Adept recommends labeling the cables, with the enclosed lables, on the connectors to avoid misconnection and damage to the AdeptModules system.
Adding User Cables to the Cable Track

When adding user cables to the cable tracks open the top of the cable track using a standard screw driver (see Figure 4-58). Be aware of the cross-sectional area of the cable track for the amount of space for user cables and air hoses.

Figure 4-58. Cable Track User Cable Installation

4.27 X-3 Type Installation Procedure

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).
2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet.

3. Mate the combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for mounting bolt specifications).

4. Mate the Y-axis to combining bracket by aligning the motor-side pin holes on the Y-axis module to the pins on the side of the bracket (these holes are on the side opposite the sliders). Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 4-59).

![Figure 4-59. X-3 Type Mechanical Assembly](image)

**X-3 Type Electrical Connections**

The applicable ranges of robot and controller cables are shown in Table 4-22. Verify that you have compatible cables before beginning assembly.

**Table 4-22. X-3 Type Cable Options**

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
</tbody>
</table>
### EXA and EXC Electrical Connections

1. Connect the X-axis cables:
   
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-60. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Y-axis cables:
   
   a. Rotate the C holder 90 degrees (refer to Section 4.3 for holder rotation).

   b. Connect the C holder end of the robot cable to the motor end of the S module (refer Section 4.3 for holder mounting).

   c. Attach the A holder end of the robot cable to the side of the M module as shown in Figure 4-60 (refer to Section 4.3 for holder mounting).

   d. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N•m (66.4 to 79.6 in•lb).

   e. Connect the two barrel ends of the cable to the Y-axis module as shown in Figure 4-60. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

---

**Table 4-22. X-3 Type Cable Options (Continued)**

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller Cable</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>(1 per axis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interface Cable</td>
<td></td>
<td>10400-070**</td>
</tr>
<tr>
<td>(1 per axis)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Adept MV Controller Connections

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 4-61. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Y-axis cables:
   a. Rotate the C holder 90 degrees (refer to Section 4.3 for holder rotation).
   b. Connect the C holder end of the robot cable to the motor end of the Y-axis module (refer to Section 4.3 for holder rotation and mounting).
   c. Attach the A holder end of the robot cable to the side of the X-axis module as shown in Figure 4-61 (refer to Section 4.3 for holder rotation and mounting).

Figure 4-60. Connecting to an EXA or EXC Controller
d. Move the X-axis to the center of its movement stroke. Loosen the cap nut (see Figure 4-1) and twist the cable to the upright position. Retighten the cap nut and torque to 7.5 to 9.0 N\textcdot m (66.4 to 79.6 in\textperiodcentered lb).

e. Connect the two barrel ends of the cable to the A holder as shown in Figure 4-61. These connectors have different pin sizes and cannot be installed incorrectly.

f. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”.

g. The final connector connects to the Axis 1 end of the B* Amp break-out cable (cable# 10400-00600).

Figure 4-61. Connecting to an Adept MV Controller
5 Mechanical Installation, Adding Axis Three

5.1 Introduction ......................................................... 143
5.2 Assembling P-Type Combinations ................................. 144
5.3 P-1 Type Installation Procedure ................................. 145
   P-1 Type Electrical Connections ................................. 146
   EXA and EXC Electrical Connections ............................ 147
   Adept MV Controller Connections ............................... 148
5.4 P1 Extended Stroke Cable Track Installation ................. 151
   Adding User Cables to the Cable Track ...................... 152
5.5 P-2 Type Installation Procedure ................................. 153
   P-2 Type Electrical Connections ................................. 155
   EXA and EXC Electrical Connections ............................ 155
   Adept MV Controller Connections ............................... 156
5.6 Assembling J-Type Combinations ................................. 159
5.7 J Type Installation Procedure ................................. 160
   J Type Electrical Connections ................................. 161
   EXA and EXC Electrical Connections ............................ 162
   Adept MV Controller Connections ............................... 163
5.8 J Type Extended Stroke Cable Track Installation ............ 166
   Adding User Cables to the Cable Track ...................... 167
5.9 Mounting Tooling to an AdeptModule ......................... 168
   Mounting Attachments on Slider ............................... 168
   Mounting Attachments on Main Unit End Face ........................ 169
5.10 Assembling a Gantry Support Module ....................... 169
5.1 Introduction

The robot modules are easily combined into a three-axis system using optional combining brackets.

This section describes the tasks required to configure a three-axis system in addition to gantry support installation. Refer to the section applicable for the specific combination types should a three or four axis configuration be required.

**NOTE:** To mount brackets, the screw holes shown in Chapter 8 should be used. Do not use other screw holes for this purpose.

Figure 5-1 depicts a typical three-axis configuration.

![Figure 5-1. Typical Three-Axis Configuration](image)

**NOTE:** When using long stroke combinations, a cable support and gantry module unit is recommended by Adept.
5.2 **Assembling P-Type Combinations**

In a P-type configuration the combining bracket mounts to the slider of the X- and Y-axis unit, and to the body or slider of the Z-axis unit. A Z-axis slider stroke is shown in Figure 5-2.

![Figure 5-2. P-Type Combination with Z-axis Slider Stroke](image)

The applicable ranges of modules and their combining brackets are shown in Table 5-1 and Table 5-2. Verify that you have compatible X-axis, Y-axis, Z-axis, and combining bracket components before beginning assembly.

**Table 5-1. P-Type Configuration X- and Y-axis Components.**

<table>
<thead>
<tr>
<th>Combination Type</th>
<th>X-Axis Module and Part Numbers</th>
<th>Y-Axis Module and Part Numbers</th>
<th>Combining Bracket Type and Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>H 90400-10**0</td>
<td>M 90400-200*5</td>
<td>GHM 90400-05002</td>
</tr>
<tr>
<td>P2</td>
<td>M 90400-200*5</td>
<td>S 90400-300*3</td>
<td>GMS 90400-05001</td>
</tr>
</tbody>
</table>
Table 5-2. P-Type Configuration Z-axis Components

<table>
<thead>
<tr>
<th>Combination Type</th>
<th>Z-Axis Module and Part Numbers</th>
<th>Combining Bracket Type and Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Sz 90400-400*3 DMS 90400-05006</td>
<td></td>
</tr>
<tr>
<td>P2</td>
<td>Sz 90400-400*3 DSS 90400-05007</td>
<td></td>
</tr>
</tbody>
</table>

5.3 P-1 Type Installation Procedure

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm). Refer to the section “Inserting the Chamfered and Straight Pin Into a Bracket” on page 64.

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm). Refer to the section “Inserting the Chamfered and Straight Pin Into a Bracket” on page 64.

3. Insert the Z-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm). Refer to the section “Inserting the Chamfered and Straight Pin Into a Bracket” on page 64.

4. Mate the L-shaped combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).

5. Mate the Y-axis to combining bracket by aligning the motor-side pin holes on the Y-axis module to the pins on the side of the bracket (these holes are on the side opposite the sliders). Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 5-3, and refer to Table 3-1 to Table 3-3 for the mounting bolt specifications).

6. Mate the Z-axis combining bracket to the Z-axis. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).
   a. Mounting the Z-axis for slider stroke: mount the combining bracket to the screw holes on the Z-axis rear surface.
   b. Mounting the Z-axis for unit stroke: mount the combining bracket to the Z-axis slider.

7. Mate the Z-axis with the combining bracket by aligning the pin holes on the Y-axis module slider to the pins on the side of the Z-axis bracket. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 5-3, and refer to Table 3-3 for the mounting bolt specifications).
P-1 Type Electrical Connections

The applicable ranges of robot and controller cables are shown in Table 5-3. Verify that you have compatible cables before beginning assembly.

Table 5-3. P-1 Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Z-Axis Robot Cable</td>
<td>90400-071*5</td>
<td>90400-071*5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
</tbody>
</table>
EXA and EXC Electrical Connections

1. Connect the X-axis controller cable:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 5-4. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Y-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Y-axis (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the side of the X-axis as shown in Figure 5-4 (refer to Section 4.3 for holder mounting).
   c. Connect the two barrel ends of the controller cable to the Y-axis cable (holder A) as shown in Figure 5-4. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

3. Connect the Z-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Z-axis (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the side of the X-axis as shown in Figure 5-4 (refer to Section 4.3 for holder mounting).
   c. Connect the two barrel ends of the controller cable to the Z-axis cable (holder A) as shown in Figure 5-4. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 3” and “2-CN5 SENSOR 3”.

4. Position the X and Y axes to the center of their stroke. Rotate the cable holders on the Y- and Z-axis so that the cables stand upright (refer to section Section 4.3 for cable holder rotation).

NOTE: Adept recommends using cable tracks for extended stroke configurations. See Section 4.3 for cable track installation.
Figure 5-4. Connecting to an EXA or EXC Controller

Adept MV Controller Connections

1. Connect the X-axis controller cable:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 5-5. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Y-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Y-axis (see Section 4.3 for holder mounting).
b. Attach the A holder end of the robot cable to the side of the X-axis as shown in Figure 5-5 (refer to Section 4.3 for holder mounting).

c. Connect the two barrel ends of the cable to the A holder as shown in Figure 5-5. These connectors have different pin sizes and cannot be installed incorrectly.

d. The D-sub connector connects to the Signal Interface Box connector marked “Axis 2”.

e. The final connector connects to the Axis 2 end of the B+ Amp break-out cable (cable# 10400-00600).

3. Connect the Z-axis cables:

a. Connect the C holder end of the robot cable to the motor end of the Z-axis (see Section 4.3 for holder mounting).

b. Attach the A holder end of the robot cable to the side of the X-axis as shown in Figure 5-5 (refer to Section 4.3 for holder mounting).

c. Connect the two barrel ends of the cable to the A holder as shown in Figure 5-5. These connectors have different pin sizes and cannot be installed incorrectly.

d. The D-sub connector connects to the Signal Interface Box connector marked “Axis 3”.

e. The final connector connects to the Axis 1 end of the second B+ Amp break-out cable (cable# 10400-00600).

4. Position the X- and Y-axes to the center of their stroke. Rotate the cable holders (holder A’s) on the Y- and Z-axis so that the cables stand upright (refer to section Section 4.3 for cable holder rotation).
Figure 5-5. Connecting to an Adept MV Controller
5.4 **P1 Extended Stroke Cable Track Installation**

When using extended stroke modules and certain other configurations, Adept recommends the use of cable tracks.

Follow these directions to install cable tracks (see Figure 4-18).

1. Slide the module rail keys into the X-axis. The cable rests mount to these keys.
2. Mount the cable rests using M3 x 6 screws. Start with the cable track support away from the motor side of the module and torque to 1.47 N•m (13.0 in•lb).
3. Mount the remaining cable track supports and cable track support bracket (nonmoving side) to the X-axis in the same manner as steps 1 and 2.

**NOTE:** In some configurations the cable track supports must be mounted to the systems base vice the X-axis. In this case Drill M6-25.4 mm tapped holes and mount supports to the base with M6 screws, 10mm long, tighten to 1.47 N•m (13.0 lb•in).

4. Mount the cable track support bracket (moving side) with M3-6 screws to the axis combining bracket and tighten to 1.47 N•m (13.0 in•lb).
5. Position the cable track along the X-axis cable track supports with the cable support fixture on the cable track support bracket (nonmoving side).
6. Using 4 nuts, mount the cable support fixture to the cable track support fixture (nonmoving side), tighten to 1.47 N•m (13.0 in•lb).
7. Mount the other support fixture of the cable track to the cable track support bracket (moving side) with 4 screws and tapped securing plate. Place the securing plate under the cable track support bracket and tighten to 1.47 N•m (13.0 in•lb).
8. Mount the C-holder of the Z-axis robot cable to the Y-axis and the other holder to the 
Z-axis connectors with M3-57 screws and torque to 1.47 N•m (13.0 in•lb).

**NOTE:** Cable holders will have to be rotated so that the cable stands 
upright. Refer to page 64 for directions on changing the angle of the cable 
holders.

9. Connect all cable connectors to the controller and axis as described in the above 
electrical connection procedures.

**NOTE:** Adept recommends labeling the cables, with the enclosed labels, 
on the connectors to avoid misconnection and damage to the 
AdeptModules system.

**Adding User Cables to the Cable Track**

When adding user cables to the cable tracks open the top of the cable track using a 
standard screw driver (see Figure 5-7). Be aware of the cross-sectional area of the cable 
track for the amount of space for user cables and air hoses.
5.5 P-2 Type Installation Procedure

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm). Refer to the section “Inserting the Chamfered and Straight Pin Into a Bracket” on page 64.

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm). Refer to the section “Inserting the Chamfered and Straight Pin Into a Bracket” on page 64.

3. Insert the Z-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm).
4. Mate the L-shaped combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).

5. Mate the Y-axis to combining bracket by aligning the motor-side pin holes on the Y-axis module to the pins on the side of the bracket (these holes are on the side opposite the sliders). Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 5-8, and refer to Table 3-3 for the mounting bolt specifications).

6. Mate the Z-axis combining bracket to the Z-axis. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).

   a. To mount Z-axis for slider stroke: Mount the combining bracket to the screw holes on the Z-axis rear surface.

   b. To mount the Z-axis for unit stroke: Mount the combining bracket to the Z-axis slider.

7. Mate the Z-axis and combining bracket by aligning the pin holes on the Y-axis module to the pins on the side of the Z-axis bracket. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 5-8, and refer to Table 3-3 for the mounting bolt specifications).

![Figure 5-8. P-2 Type Mechanical Assembly](image_url)
**P-2 Type Electrical Connections**

The applicable ranges of robot and controller cables are shown in Table 5-4. Verify that you have compatible cables before beginning assembly.

---

### Table 5-4. P-2 Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Z-Axis Robot Cable</td>
<td>90400-071*5</td>
<td>90400-071*5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
<tr>
<td>Cable track assemblies for Extended stroke models</td>
<td></td>
<td>90400-08012 90400-08007</td>
</tr>
</tbody>
</table>

**NOTE:** Adept recommends using cable tracks for extended stroke configurations. See Section 4.3 for cable track installation.

**EXA and EXC Electrical Connections**

1. Connect the X-axis cables:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 5-9. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Y-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Y-axis (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the side of the X-axis as shown in Figure 5-9 (refer to Section 4.3 for holder mounting).
   c. Connect the two barrel ends of the controller cable to the Y-axis cable (holder A) as shown in Figure 5-9. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

3. Connect the Z-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Z-axis (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the side of the X-axis as shown in Figure 5-9 (refer to Section 4.3 for holder mounting).
c. Connect the two barrel ends of the controller cable to the Z-axis cable (holder A) as shown in Figure 5-9. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 3” and “2-CN5 SENSOR 3”.

4. Position the X- and Y-axis to the center of their stroke. Rotate the cable holders (holder As) on the Y- and Z-axes so that the cables stand upright (refer to section Section 4.3 for cable holder rotation).

Adept MV Controller Connections

1. Connect the X-axis cables:

   - To: “1-CN5 SENSOR 1”
   - To: “1-CN6 MOTOR 1”
   - To: “2-CN5 SENSOR 3”
   - To: “2-CN6 MOTOR 3”
   - Robot cable to Z-axis module

   - Cable #90400-03003

   A Holder

   - To: “2-CN6 MOTOR 2”
   - To: “2-CN5 SENSOR 2”

   - Cable #90400-03003

   Robot cable to Y-axis module

   A Holder

   - To: “1-CN6 MOTOR 1”
   - To: “1-CN5 SENSOR 1”

Figure 5-9. Connecting to an EXA or EXC Controller
a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 5-10. These connectors have different pin sizes and cannot be installed incorrectly.

b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B⁺ Amp break-out cable.

2. Connect the Y-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Y-axis (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the side of the X-axis as shown in Figure 5-10 (refer to Section 4.3 for holder mounting).
   c. Connect the two barrel ends of the cable to the A holder as shown in Figure 5-10. These connectors have different pin sizes and cannot be installed incorrectly.
   d. The D-sub connector connects to the Signal Interface Box connector marked “Axis 2”.
   e. The final connector connects to the Axis 2 end of the B⁺ Amp break-out cable (cable# 10400-00600).

3. Connect the Z-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Z-axis (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the side of the X-axis as shown in Figure 5-10 (refer to Section 4.3 for holder mounting).
   c. Connect the two barrel ends of the cable to the A holder as shown in Figure 5-10. These connectors have different pin sizes and cannot be installed incorrectly.
   d. The D-sub connector connects to the Signal Interface Box connector marked “Axis 3”.
   e. The final connector connects to the Axis 1 end of the second B⁺ Amp break-out cable (cable# 10400-00600).

4. Position the X- and Y-axes to the center of their stroke. Rotate the cable holders on the Y- and Z-axis so that the cables stand upright (refer to section Section 4.3 for cable holder rotation).
Figure 5-10. Connecting to an Adept MV Controller
5.6 Assembling J-Type Combinations

In a J-type configuration the combining bracket mounts to the slider of the X and Y-axis unit, and to the body or slider of the Z-axis unit. A Z-axis slider stroke is shown in Figure 5-11.

![Image of J-Type Combination with Z-axis Slider Stroke](image)

**Figure 5-11. J-Type Combination with Z-axis Slider Stroke**

The applicable ranges of modules and their combining brackets are shown in Table 5-5 and Table 5-6. Verify that you have compatible X-axis, Y-axis, Z-axis, and combining bracket components before beginning assembly.

**Table 5-5. J-Type Configuration X- and Y-Axis Components**

<table>
<thead>
<tr>
<th>Combination Type</th>
<th>X-Axis Module and Part Numbers</th>
<th>Y-Axis Module and Part Numbers</th>
<th>Combining Bracket Type and Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>H 90400-10**0</td>
<td>M 90400-200*5</td>
<td>XHM 90400-05009</td>
</tr>
</tbody>
</table>
Table 5-6. J-Type Configuration Z-Axis Components

<table>
<thead>
<tr>
<th>Combination Type</th>
<th>Z-Axis Module and Part Numbers</th>
<th>Combining Bracket Type and Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>J</td>
<td>$S_z$</td>
<td>CMS 90400-05012</td>
</tr>
</tbody>
</table>

5.7 J Type Installation Procedure

1. Insert the X-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm). Refer to the section “Inserting the Chamfered and Straight Pin Into a Bracket” on page 64.

2. Insert the Y-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm). Refer to the section “Inserting the Chamfered and Straight Pin Into a Bracket” on page 64.

3. Insert the Z-axis chamfered and straight pins into the bracket and seat with a rubber mallet (the pins must not project more than 8 mm). Refer to the section “Inserting the Chamfered and Straight Pin Into a Bracket” on page 64.

4. Mate the L-shaped combining bracket to the X-axis slider. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).

5. Mate the Y-axis to combining bracket by aligning the slider pin holes on the Y-axis module to the pins on the side of the bracket. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 5-12, and refer to Table 3-3 for the mounting bolt specifications).

6. Mate the Z-axis combining bracket to the Z-axis. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (refer to Table 3-3 for the mounting bolt specifications).
   a. To mount Z-axis for slider stroke: Mount the combining bracket to the screw holes on the Z-axis rear surface.
   b. To mount the Z-axis for unit stroke: Mount the combining bracket to the Z-axis slider.

7. Mate the Z-axis and combining bracket by aligning the pin holes on the Y-axis module end plate to the pins on the side of the Z-axis bracket. Carefully mate the pins and pin holes to avoid damaging the pins. Install the mounting bolts (see Figure 5-12, and refer to Table 3-3 for the mounting bolt specifications).
Figure 5-12. J-Type Mechanical Assembly with Z-axis Slider Stroke

J-Type Electrical Connections

The applicable ranges of robot and controller cables are shown in Table 5-7. Verify that you have compatible cables before beginning assembly.

Table 5-7. J-Type Cable Options

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>EXC, EXA Controller Cable</th>
<th>Adept MV Interface Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y-Axis Robot Cable</td>
<td>90400-07**5</td>
<td>90400-07**5</td>
</tr>
<tr>
<td>Z-Axis Robot Cable</td>
<td>90400-071*5</td>
<td>90400-071*5</td>
</tr>
<tr>
<td>Controller Cable (1 per axis)</td>
<td>90400-03003</td>
<td></td>
</tr>
<tr>
<td>Interface Cable (1 per axis)</td>
<td></td>
<td>10400-070**</td>
</tr>
<tr>
<td>Cable track assemblies for Extended stroke models</td>
<td>90400-08012 90400-08007</td>
<td></td>
</tr>
</tbody>
</table>
**NOTE:** Adept recommends using cable tracks for extended stroke configurations. See Section 4.3 for cable track installation.

**EXA and EXC Electrical Connections**

1. Connect the X-axis controller cable:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 5-13. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “1-CN6 MOTOR 1” and “1-CN5 SENSOR 1”.

2. Connect the Y-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Y-axis (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the side of the X-axis as shown in Figure 5-13 (refer to Section 4.3 for holder mounting).
   c. Connect the two barrel ends of the controller cable to the Y-axis cable (holder A) as shown in Figure 5-13. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 2” and “2-CN5 SENSOR 2”.

3. Connect the Z-axis cables:
   a. Connect the C holder end of the robot cable to the motor end of the Z-axis (see Section 4.3 for holder mounting).
   b. Attach the A holder end of the robot cable to the end of the X-axis as shown in Figure 5-13 (refer to Section 4.3 for holder mounting).
   c. Connect the two barrel ends of the controller cable to the Z-axis cable (holder A) as shown in Figure 5-13. These connectors have different pin sizes and cannot be installed incorrectly. The other ends connect to the controller connections marked “2-CN6 MOTOR 3” and “2-CN5 SENSOR 3”.

4. Position the X- and Y-axes to the center of their stroke. Rotate the cable holders (holder As) on the Y- and Z-axis so that the cables stand upright (refer to section Section 4.3 for cable holder rotation).
Figure 5-13. Connecting to an EXA or EXC Controller

Adept MV Controller Connections

1. Connect the X-axis controller cable:
   a. Connect the two barrel ends of the cable to the X-axis module as shown in Figure 5-14. These connectors have different pin sizes and cannot be installed incorrectly.
   b. The D-sub connector connects to the Signal Interface Box connector marked “Axis 1”. The final connector connects to the Axis 1 end of the B+ Amp break-out cable.

2. Connect the Y-axis cables:
a. Connect the C holder end of the robot cable to the motor end of the Y-axis (see Section 4.3 for holder mounting).

b. Attach the A holder end of the robot cable to the side of the X-axis as shown in Figure 5-14 (refer to Section 4.3 for holder mounting).

c. Connect the two barrel ends of the cable to the A holder as shown in Figure 5-14. These connectors have different pin sizes and cannot be installed incorrectly.

d. The D-sub connector connects to the Signal Interface Box connector marked “Axis 2”.

e. The final connector connects to the Axis 2 end of the B+ Amp break-out cable (cable# 10400-00600).

3. Connect the Z-axis cables:

   a. Connect the C holder end of the robot cable to the motor end of the Z-axis (see Section 4.3 for holder mounting).

   b. Attach the A holder end of the robot cable to the end of the X-axis as shown in Figure 5-14 (refer to Section 4.3 for holder mounting).

   c. Connect the two barrel ends of the cable to the A holder as shown in Figure 5-14. These connectors have different pin sizes and cannot be installed incorrectly.

   d. The D-sub connector connects to the Signal Interface Box connector marked “Axis 3”.

   e. The final connector connects to the Axis 1 end of the second B+ Amp break-out cable (cable# 10400-00600).

4. Position the X- and Y-axes to the center of their stroke. Rotate the cable holders on the Y- and Z-axis so that the cables stand upright (refer to section Section 4.3 for cable holder rotation).
Figure 5-14. Connecting to an Adept MV Controller
5.8 J Type Extended Stroke Cable Track Installation

When using extended stroke modules and certain other configurations, Adept recommends the use of cable tracks.

Follow these directions to install cable tracks (see Figure 4-18).

1. Slide the module rail keys into the X-axis. The cable track supports mount to these keys.

2. Mount the cable track supports using M3 x 6 screws. Start with the cable track support away from the motor side of the module and torque to 1.47 N•m (13.0 in•lb).

3. Mount the remaining cable track supports and cable track support bracket (non-moving side) to the X-axis in the same manner as steps 1 and 2.

   NOTE: In some configurations the cable track supports must be mounted to the system base vice the X-axis. In this case drill M6-25.4 mm tapped holes and mount supports to the base with M6 screws, 10mm long, and tighten to 1.47 N•m (13.0 lb•in).

4. Mount the cable track support bracket (moving side) with M4-6 screws to the axis combining bracket and tighten to 2.9 N•m (25.6 in•lb).

5. Mount the holder mounting plate to the X-axis cover plate with M5-6 screws and torque to 5.9 N•m (52.2 in•lb).

6. Position the cable track along the X-axis cable track supports with the cable support fixture on the cable track support bracket (non-moving side).

7. Using 4 nuts, mount the cable support fixture to the cable track support bracket (non-moving side) and tighten to 1.47 N•m (13.0 in•lb).

8. Mount the other support fixture of the cable track to the cable track support bracket (moving side) with 4 screws and tapped securing plate. Place the securing plate under the cable track support bracket and tighten to 1.47 N•m (13.0 in•lb).
9. Mount the C-holders (elbow side) of the robot cable to the Y-axis and Z-axis connectors, and the A-holders (straight side) to the holder mounting plate (step 5) with M3-57 screws and torque to 1.47 N•m (13.0 in•lb).

**NOTE:** Cable holders will have to be rotated so that the cable stands upright. Refer to page 64 for directions on changing the angle of the cable holders.

10. Connect all cable connectors to the controller and axis as described in the above electrical connection procedures.

**NOTE:** Adept recommends labeling the cables, with the enclosed labels, on the connectors to avoid misconnection and damage to the AdeptModules system.

**Adding User Cables to the Cable Track**

When adding user cables to the cable track, open the top of the cable track using a standard screw driver (see Figure 5-16). Be aware of the cross-sectional area of the cable track for the amount of space for user cables and air hoses.
5.9 Mounting Tooling to an AdeptModule

Mounting Attachments on Slider

See the “Technical Specifications” section for specific dimensions of the slider for the individual AdeptModule types.

1. Use fixing bolts specified in Table 5-8 to mount any end-effector to the slider.
Table 5-8. End-Effector Bolt Specifications

<table>
<thead>
<tr>
<th></th>
<th>H-Module</th>
<th>M-Module</th>
<th>S-Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolt Diameter</td>
<td>M8</td>
<td>M6</td>
<td>M5</td>
</tr>
<tr>
<td>Screw-In Depth</td>
<td>12-16 mm</td>
<td>9-12 mm</td>
<td>6-8 mm</td>
</tr>
<tr>
<td>Tightening Torque</td>
<td>33.3 N•m</td>
<td>14.7 N•m</td>
<td>11.7 N•m</td>
</tr>
<tr>
<td></td>
<td>(340 kgf•cm)</td>
<td>(150 kgf•cm)</td>
<td>(120 kgf•cm)</td>
</tr>
</tbody>
</table>

Mounting Attachments on Main Unit End Face

NOTE: Attachment mounting tap holes are also provided on the counter-motor end face of the main unit (on both end faces of the S module).

1. Use fixing bolts specified in Table 5-9 to mount the end-effector or bracket to the slider.

Table 5-9. Fixing Bolt Specification

<table>
<thead>
<tr>
<th></th>
<th>H-Module</th>
<th>M-Module</th>
<th>S-Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolt Diameter</td>
<td>M8</td>
<td>M6</td>
<td>M5</td>
</tr>
<tr>
<td>Screw-In Depth</td>
<td>12-16 mm</td>
<td>9-12 mm</td>
<td>8-10 mm</td>
</tr>
<tr>
<td>Tightening Torque</td>
<td>33.3 N•m</td>
<td>14.7 N•m</td>
<td>5.9 N•m</td>
</tr>
<tr>
<td></td>
<td>(340 kgf•cm)</td>
<td>(150 kgf•cm)</td>
<td>(60 kgf•cm)</td>
</tr>
</tbody>
</table>

NOTE: Do not fix the main unit to a base with these fixing bolts. Follow the description in the Fixing Main Unit section to fix the main unit to a base.

NOTE: To determine the maximum transportable work load, see the “Technical Specifications” section, “Transportable Load of Moving Axes” starting on page 198 for single-axis and multi-axis configurations.

5.10 Assembling a Gantry Support Module

Adept recommends the use of the support module (gantry) when system stroke lengths exceed 950 mm in the Y-axis. These configurations include G, D, and P type configurations with the H-Module as the X-axis. Gantry modules come in lengths that match the lengths of the H-Module.
Figure 5-17. Gantry Module

1. Mount the gantry module support bracket to the face plate of the Y-axis of the system. Use M3 x 6 screws and torque to 1.9 N.m (16.8 lb·in)

2. Position the gantry slider to the bracket and slide the bracket stud into the gantry slider.

3. Mount the gantry support module to the mounting base or work station. Refer to Chapter 3 for mounting bolt specifications

Figure 5-18. Exploded View of the Gantry Module Assembly
Mechanical Installation, AdeptCartesian

6.1 Assembling an AdeptCartesian Robot ........................................ 173
6.2 Installing the Z-Theta Module .................................................. 176
   Removal of the Z-Theta Top Cover ........................................ 176
   Attaching the Adept Z-Theta Module ...................................... 176
6.3 Installing the Cable Covers ................................................... 178
6.4 AdeptCartesian Electrical Connections .................................... 180
6.1 Assembling an AdeptCartesian Robot

An AdeptCartesian robot is a 4-axis system comprised of two AdeptModules and a 2-axis Z-Theta unit, which provides both vertical and rotational motion. The following illustrates a typical AdeptCartesian robot configuration.

![Figure 6-1. AdeptCartesian Robot System](image)

**Required Components**

Verify that all required components are available before beginning assembly (refer to Table 6-1).

**Table 6-1. AdeptCartesian Robot Required Components**

<table>
<thead>
<tr>
<th>Component</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z-Theta Unit</td>
<td>30451-51000</td>
</tr>
<tr>
<td>Cable track</td>
<td>10450-63000 Standard or 10451-65000 Extended</td>
</tr>
<tr>
<td>H-Module</td>
<td>90400-1****</td>
</tr>
<tr>
<td>M-Module</td>
<td>90400-2****</td>
</tr>
<tr>
<td>GHM Combining Bracket</td>
<td>90400-05002</td>
</tr>
<tr>
<td>H-Module Mounting Brackets</td>
<td>90400-01100</td>
</tr>
<tr>
<td>LMMV Interface Cable Set</td>
<td>10451-641**</td>
</tr>
<tr>
<td>Module to RSC Box Cable</td>
<td>10400-070**</td>
</tr>
<tr>
<td>Signal Interface Box</td>
<td>30400-00200</td>
</tr>
</tbody>
</table>

*NOTE:* The "****" represents changes in the part number, which varies according to the length of the individual components.
NOTE: Gantry modules (pt# 90400-041**) are recommended by Adept when stroke lengths exceed 950 mm in the Y-axis.

Assembling the X- and Y-axis should be performed as described in Chapter 4 for the G style configuration. This section gives the assembly instructions for the Z-Theta (third and fourth axis) module.

Procedures

**Figure 6-2. Screw Guides**

1. Slide the screw guides into the two grooves on the back of the H-Modules as shown in Figure 6-2 (motor end).

**Figure 6-3. Cable Track Supports**

2. Align the cable Track Supports for the cable track with the screw guides and attach using four M3 screws. Leave the screws loose for later adjustment (see Figure 6-3).
3. Align the Cable Track bracket with screw guides. Align the cable track supports and the Cable Track Bracket and secure with four M3 screws (see Figure 6-4).

Figure 6-4. Cable Track Bracket Mounting

Figure 6-5. Mounting Cable Track to the Y-Axis
4. Set the other end of the X-axis cable track on the motor end of the M-Module. Secure the bracket using eight M3 screws. The Y-axis cable track should rest on top of the M-Module (see Figure 6-5).

5. Raise the Y-axis cable track and slide seven screw guides into the grooves as shown in Figure 6-6. Three screw guides should be placed in the groove closest to the Z-Theta combining bracket and four screw guides in the other groove.

![Figure 6-6. Y-Axis Cable Track Support Bracket Mounting Keys](image)

### 6.2 Installing the Z-Theta Module

**Removal of the Z-Theta Top Cover**

1. Remove the three M5 Pan head screws on the top cover. Lift the cover straight up off the main body.

**Attaching the Adept Z-Theta Module**

1. Attach the unit to the M-Module slider with four M6 screws using an extended-length Hex wrench with a ball point as shown in Figure 6-7 and Figure 6-8.
NOTE: The bottom two mounting screws are accessed from underneath the Z-Theta Module. Using the extended-length Hex wrench, tighten the unit to the M-Module.
2. Replace the top cover of the Z-Theta unit and secure it with the three M5 pan head screws which were removed earlier.

3. Fold the Y-axis cable track over and attach it to the rear of the Z-Theta unit with two M6 pan head screws (see Figure 6-10).

![Figure 6-9. Attaching the Y-axis Cable Track to the Z-Theta Module](image)

### 6.3 Installing the Cable Covers

**NOTE:** The middle cover is predrilled for the different size M-Modules. Align the proper set of holes for the length of the module being used.

1. Locate and remove the two pan head screws from the Y-axis cable track. These are attached to the cable tie down (see Figure 6-10).

![Figure 6-10. Y-axis Cable Track Screw Removal](image)

2. Attach the bottom cover to the Y-axis cable track by one M3 x 6 screw at the back of the cover into one of the screw sliders (see Figure 6-11).
3. Align the middle cover holes with the bottom cover threaded holes and secure to the M-Module with two M3 x 30 screws at the front of the middle cover (see Figure 6-12). This will also secure the bottom cover to the Y-axis.

4. Place the top cover over the bottom cover and secure with four M3 x 7 pan head screws (see Figure 6-13).
6.4 AdeptCartesian Electrical Connections

When connecting the cables to the controller, ensure that all are connected to the proper connection.

**WARNING:** Improper connection of the cables could result in personal injury or damage to the equipment.

Table 6-2 includes all of the cable sets that are required for a standard AdeptCartesian robot.

**Table 6-2. AdeptCartesian Cable Options**

<table>
<thead>
<tr>
<th>Cable</th>
<th>Part Number</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>EJI to Amp Cable Assemble</td>
<td>10330-11140</td>
<td>1</td>
</tr>
<tr>
<td>Amp Break-out Cable</td>
<td>10400-00600</td>
<td>1</td>
</tr>
<tr>
<td>Module to RSC Box Cable (3m)</td>
<td>10400-07003</td>
<td>1</td>
</tr>
<tr>
<td>Arm Signal Cable</td>
<td>10861-01330</td>
<td>1</td>
</tr>
<tr>
<td>LMMV Interface Cable Set (3m)</td>
<td>10451-64103</td>
<td>1</td>
</tr>
<tr>
<td>DIO Cable Set</td>
<td>90330-01080</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE:** The DIO Cable Set is required only if an optional DIO board is present in the controller.

Refer to Figure 6-14 and Figure 6-15 for the proper cable connections.
Figure 6-14. System Cable Layout

AdeptCartesian Electrical Connections
Figure 6-15. Cable Track Connector Plate
# Maintenance

## 7.1 Initial Confirmation

## 7.2 Maintenance

- **Daily Maintenance**

## 7.3 Modules Lubrication

- **Lubrication Schedule**
- **Lubrication Grease**
- **Grease Adaptor Nozzle**
- **Lubrication Procedures**

## 7.4 Pins, Connectors, and Screws

- **Connector Pins and Inserter/Extractor Tools**
- **DDK Compatible Connectors**
- **JAE Connectors and DDK Connector Cross Reference List**
- **Robot Cable Mounting Screws**
- **Periodic Maintenance**
  - **Grease Refill**
  - **EXC/EXA Controller Back-up Batteries**
7.1 Initial Confirmation

Confirm the following before applying power:

1. Check that the main unit joint bolts are firmly tightened.

2. Move each axis to the stroke limit and verify that the module does not strike any obstacles.
   a. For the vertical axis, apply power, turn on the servo, and release the brake.
   b. Select manual control mode, then move the unit slowly by JOG operation.
   c. Check that the axis does not strike an obstacle.

   NOTE: See the instruction manual for the controller and ensure that the servo is on before releasing the brake.

3. Check the cables for correct connection.
   a. The same robot module connector is used regardless of motor output.
   b. Before supplying power, check that the controller’s motor power output is connected to the proper module type as shown in Table 7-1.

<table>
<thead>
<tr>
<th>Main Unit</th>
<th>Controller Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-Module</td>
<td>300W</td>
</tr>
<tr>
<td>M-Module</td>
<td>300W</td>
</tr>
<tr>
<td>S-Module</td>
<td>100W</td>
</tr>
</tbody>
</table>

Table 7-1. Module Power Output

WARNING: Improper connection may result in damage to the motor.

Upon completing this verification, proceed with test operation according to the procedures specified in the AdeptModules Vol. 1 MV Controller Interface manual.

7.2 Maintenance

To prevent accidents, observe the following precautions when inspecting or maintaining the unit:

WARNING: Turn off the power to the controller when personnel or tools are in the vicinity of the robot work area.
WARNING: Do not disassemble or modify the unit except as instructed in this manual.

Daily Maintenance

Perform daily checks as shown in Figure 7-2.

Table 7-2. Daily Maintenance Checks

<table>
<thead>
<tr>
<th>Check Points</th>
<th>Procedures and Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base fixing bolt</td>
<td>Check for looseness; tighten as necessary.</td>
</tr>
<tr>
<td>Work fixing bolt</td>
<td>See “Installation” for tightening torque.</td>
</tr>
<tr>
<td>Main Unit seal bolt</td>
<td>Remove dust.</td>
</tr>
<tr>
<td>Robot cable</td>
<td>Check cap nut for looseness; tighten as necessary.</td>
</tr>
<tr>
<td></td>
<td>7.5 to 9.0 N•m (77 to 92 kgf•cm)</td>
</tr>
<tr>
<td></td>
<td>Check holder fixing bolt (M3) for looseness; tighten as necessary.</td>
</tr>
<tr>
<td></td>
<td>1.47 N•m (15 kgf•cm)</td>
</tr>
<tr>
<td></td>
<td>Check elbow fixing screw (M5) for looseness; tighten as necessary.</td>
</tr>
<tr>
<td></td>
<td>1.47 N•m (15 kgf•cm)</td>
</tr>
<tr>
<td></td>
<td>Check cable for deep scratches and damage; replace as necessary.</td>
</tr>
<tr>
<td>Controller cable</td>
<td>Check cable for deep scratches and damage; replace as necessary.</td>
</tr>
</tbody>
</table>

NOTE: No brush replacement is required because AC servo motors are used in this product.

Figure 7-1. Robot Cable Maintenance Checks
7.3 Modules Lubrication

Lubrication Schedule

Each Module should be lubricated after 5000 kilometers, 3,100 miles, or 16,400,000 feet of travel.

To calculate the estimated elapsed time in hours to achieve this module travel distance use the following equation:

\[
\text{Number of Hours} = \frac{\text{Travel Distance to Lubricate} \times \text{Seconds/Cycle}}{\text{Travel Distance/Cycle} \times 3600 \text{ seconds/hour}}
\]

For example, if a module performs a 2-meter travel in 4 seconds, the recommended number of elapsed hours between lubrication is:

\[
\text{Number of Hours} = \frac{5,000,000 \text{ meters} \times 4 \text{ seconds/cycle}}{2 \text{ meters/cycle} \times 3600 \text{ seconds/hour}} = 2,778 \text{ hours}
\]

2,778 hours could translate to a different lubrication interval (in weeks) depending on the production schedule of the modules equipment.

<table>
<thead>
<tr>
<th>Production Schedule</th>
<th>1 shift/day 5 days/week 40 hours/week</th>
<th>2 shifts/day 6 days/week 96 hours/week</th>
<th>3 shifts/day 7 days/week 168 hours/week</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lubrication Interval</td>
<td>70 weeks</td>
<td>29 weeks</td>
<td>17 weeks</td>
</tr>
</tbody>
</table>

The table below provides an estimated lubrication schedule (in actual production weeks) based on the length of the module and an assumption of the travel distance and time required to perform the cycle. If your system includes two or more modules, all modules should be lubricated at the same time and the time should be determined by the module that requires the most frequent lubrication.

<table>
<thead>
<tr>
<th>Module Stroke Length (mm)</th>
<th>Estimated Module travel distance (meters)</th>
<th>Cycle time (seconds)</th>
<th>Total number of hours (hours)</th>
<th>Lubrication interval for 1 shift/day 5 days/week 40 hrs/week (weeks)</th>
<th>Lubrication interval for 2 shift/day 6 days/week 96 hrs/week (weeks)</th>
<th>Lubrication interval for 3 shift/day 7 days/week 168 hrs/week (weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>0.13</td>
<td>1.0</td>
<td>10,684</td>
<td>267</td>
<td>111</td>
<td>64</td>
</tr>
<tr>
<td>230,250</td>
<td>0.24</td>
<td>1.5</td>
<td>8,680</td>
<td>217</td>
<td>91</td>
<td>52</td>
</tr>
<tr>
<td>300,330,350</td>
<td>0.325</td>
<td>2.0</td>
<td>8,550</td>
<td>214</td>
<td>89</td>
<td>51</td>
</tr>
<tr>
<td>400,430,450</td>
<td>0.425</td>
<td>2.5</td>
<td>8,170</td>
<td>204</td>
<td>85</td>
<td>49</td>
</tr>
</tbody>
</table>
Lubrication Grease

For standard non-cleanroom modules (module part numbers that begin with 90400-xxxxx), Shell Alvania No. 2 grease is recommended. Adept recommends that the customer purchase this grease from a third party. Adept does not offer this grease for the modules product. An alternative grease that may be more readily available is Dow Corning BR2 Plus Multi-Purpose EP grease.

For cleanroom modules (module part numbers that begin with 90401-xxxxx) a special cleanroom grease is required. This grease is supplied by Adept Technology in single 50 cc tubes. The Adept part number is 90401-04029. Please contact Adept Customer Service to order.

Grease Adaptor Nozzle

A grease nozzle for the AdeptModules is available from Adept Technology (part number 90400-04100). This nozzle does not fit over the 3.5mm fitting, but must be pressed against the fitting to make a seal.

Applying grease through the fitting lubricates both the ball screw assembly and the linear bearing.

Lubrication Procedures

1. Remove the plastic black circular cap(s) from the module. The cap is approximately 10 mm (0.5”) diameter.
   - The H-Module has two black caps located on each side of the module at the end of the module opposite the motor.
   - The M-Module has a single black cap located on the same side of the module as the cable connections and near the motor end of the module.
   - The S and Sz-Modules have a single black cap located on the same side as the motor housing at the end of the module opposite the motor.

2. Move the module slider until the grease nipple(s) can be seen through the access hole(s).
   - The slider of the H-Module must be moved to the end of the module travel.
   - The slider of the M-Module must be moved to a position 10 mm (0.5”) from the motor end.
   - The slider of the S- and Sz-Module must be moved to a position 35 mm (1.5”) from the end opposite the motor.
3. Fill the module with the appropriate amount of grease.
   - The H-Module requires 20 cc (2/3 oz.) of grease. It is recommended to fill each side with approximately 10 cc (1/3 oz.).
   - The M-Module requires 10 cc (1/3 oz.).
   - The S- and Sz-Module require 2.0 cc (0.1 oz.).

4. Replace the black plastic cap(s) on the modules.

### 7.4 Pins, Connectors, and Screws

#### Connector Pins and Inserter/Extractor Tools

The modules and spare motors are supplied with JAE connectors with crimp-style pins. If these pins need to be repaired or replaced, additional pins and an inserter/extractor tool are required.

<table>
<thead>
<tr>
<th>Description</th>
<th>JAE Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoder Pins</td>
<td>030-51906-800</td>
</tr>
<tr>
<td>Motor Pins</td>
<td>030-51928-800</td>
</tr>
</tbody>
</table>

The motor pins are the larger of the two pins. Adept Technology-San Jose has a limited supply of these pins to send to customers upon request. Please contact Adept Technology Customer Service.

In order to replace encoder or motor pins an inserter/extractor tool is required.

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoder Pin Inserter/Extractor Tool</td>
<td>JIET-D*C-20</td>
<td>Red/White</td>
</tr>
</tbody>
</table>

Contact JAE directly for this Inserter/Extractor Tool

JAE Electronics
142 Technology Drive
Irvine, CA 92718-2401
Phone (714) 753-2600
Fax (714) 753-2699

A different tool is required for replacing motor pins.
DDK Compatible Connectors

JAE connectors have 12- to 14-week lead times. An alternative source for JAE compatible connectors is DDK Electronics. DDK can generally offer much shorter lead times. The DDK JM Series connectors are compatible with JAE SRCD connectors. However, the DDK connectors are solder style connectors while the JAE connectors are crimp-style.

Contact DDK directly for these connectors:

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Pin</td>
<td>CIET-16</td>
<td>Blue/White</td>
</tr>
<tr>
<td>Inserter/Extractor Tool</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This tool is provided with each spare motor shipped by Adept. Contact JAE for additional tools.

Another source for this tool is Aiconics USA. The Aiconics part number is M81969 14-03. Contact the following company for this Aiconics tool:

Connector MicroTooling Systems
14500 Trinity Blvd. Suite 110
Fort Worth, Texas 76155
Phone (817) 283-4882
Fax (817) 354-0790
JAE Connectors and DDK Connector Cross Reference List

The following table lists the compatible DDK connectors.

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Cable</th>
<th>JAE Connector</th>
<th>DDK Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>90400-0300x</td>
<td>Controller to Module Cable (Module End)</td>
<td>SRCD6A21-16SC-A-FO</td>
<td>JMSP2116F</td>
</tr>
<tr>
<td>(x = 3, 6, 9, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90400-0300x</td>
<td>Controller to Module Cable (Module End)</td>
<td>SRCD6A21-10SC-A-FO</td>
<td>JMSP2110F</td>
</tr>
<tr>
<td>(x = 3, 6, 9, ...)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90400-03100</td>
<td>Cable Inside cable track (Cable end)</td>
<td>SRCD1A21-16PC-A-FO</td>
<td>JMCR2116M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90400-03100</td>
<td>Cable Inside cable track (Cable end)</td>
<td>SRCD1A21-10PC-A-FO</td>
<td>JMCR2110M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Modules</td>
<td>Flanged Connector inside Module unit</td>
<td>SRCD2A21-16PC-A-FO</td>
<td>JMR2116M</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Modules</td>
<td>Flanged Connector inside Module unit</td>
<td>SRCD2A21-10PC-A-FO</td>
<td>JMR2110M</td>
</tr>
</tbody>
</table>

Robot Cable Mounting Screws

The Robot Cables require a special metric mounting screw of size M3 x 57. These screws cannot be purchased “off-the-shelf” in the United States. Adept Technology can provide these screws to customers at no charge. Please contact Adept Customer Service to obtain these screws.

Periodic Maintenance

Grease Refill

Replenish the grease every 5000 km of travel. This is assuming the module is in a clean environment. In other than a clean environment greasing will need to be done more frequently than every 5000 km.

Grease: Shell Alvania No.2

Refill Method for an H-Module

1. Position the slider to the counter motor stroke end (away from the motor).

2. Remove the black cap on one side of the frame with a standard screw driver or similar tool.
3. Locate the grease nipple inside the frame, and deposit approximately 20 cc of grease with a grease gun (Figure 7-2).

![Figure 7-2. Greasing an H-Type Module](image)

4. Replace the cap flush with the frame.

5. Repeat steps 2 through 4 for the opposite side.

Refill Method for an M-Module

1. Position the slider to within 10 mm of the motor side stroke end.

2. Remove the black cap on the side of the frame with a standard screwdriver or similar tool.
3. Locate the grease nipple inside the frame, and deposit approximately 10 cc of grease with a grease gun (Figure 7-3).

![Figure 7-3. Greasing an M-Type Module](image)

4. Replace the cap flush with the frame.

**Refill Method for an S-Module**

1. Position the slider to within 35 mm of the counter motor side stroke end (away from the motor).

2. Remove the black cap on the side of the frame with a standard screwdriver or similar tool.
3. Locate the grease nipple inside the frame, and deposit approximately 2 cc of grease with a grease gun (Figure 7-4).

![Figure 7-4. Greasing an S-Type Module](image)

4. Replace the cap flush with the frame.

EXC/EXA Controller Back-up Batteries
Replace the EXC/EXA controller back-up batteries every two years.
8.1 Specifications ........................................................................................................................................ 197
   Specifications ......................................................... 197
   Transportable Load of Moving Axes ........................................ 198

8.2 Module Dimensions .......................................................................................................................... 199
   H Module ........................................................................ 199
   M Module ........................................................................ 200
   S Module ......................................................................... 201
   Sz Module ...................................................................... 202
   Ztheta Module .............................................................. 203

8.3 Bracket Dimensions ........................................................................................................................ 204
   H-Module Mounting Bracket ...................................... 204
   M-Module Mounting Bracket .................................... 205
   S/Sz-Module Mounting Bracket ................................ 206
   Gantry Support Bracket ............................................. 207
   CMS Bracket ................................................................. 208
   DHM Bracket ................................................................. 209
   DMM Bracket ................................................................. 210
   DSS Bracket ................................................................. 211
   D-Type Combination End Plate .................................. 212
   DMS Bracket ................................................................. 213
   GHM Bracket ................................................................. 214
   GMS Bracket ................................................................. 215
   GSS Bracket ................................................................. 216
   XHH Bracket ................................................................. 217
   XHM Bracket ................................................................. 218
   XMM Bracket ................................................................. 219
   TMS Bracket ................................................................. 220

8.4 Work Envelopes and Payload Capacities ........................................................................................ 221
   G1 Configuration ............................................................ 221
   G2 Configuration ............................................................ 222
   G3 Configuration ............................................................ 223
   D1 Configuration ............................................................ 224
   D2 Configuration ............................................................ 225
   D1 and D2 Extended Stroke Configurations .................... 226
   D3 Configuration ............................................................ 227
   D4 Configuration ............................................................ 228
   X1 Configuration ............................................................ 229
Chapter 8 - Technical Specifications

X2 Configuration ............................................. 230
X1 and X2 Extended Stroke Configuration ..................... 231
X3 Configuration ............................................. 232
K2 Configuration ............................................. 233
K3 Configuration ............................................. 234
K4 Configuration ............................................. 235
Z2 Configuration ............................................. 236
Z3 Configuration ............................................. 237
Z4 Configuration ............................................. 238
P1 Unit Stroke Configuration .................................. 239
P1 Slider Stroke Configuration ................................ 240
P1 Extended Stroke Configuration .............................. 241
P2 Unit Stroke Configuration .................................. 242
P2 Configuration ............................................. 243
J Configuration ................................................. 244
J Extended Stroke Configuration .............................. 245
T Configuration ............................................... 246
Adept Cartesian Robot ........................................... 247
8.1 Specifications

Specifications

Standard Modules

<table>
<thead>
<tr>
<th></th>
<th>H-Module</th>
<th>M-Module</th>
<th>S-Module</th>
<th>Sz-Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke (mm)</td>
<td>300/400/500/600/800/1000</td>
<td>250/350/450/550/750/950</td>
<td>130/230/330/430/530</td>
<td>130/230</td>
</tr>
<tr>
<td>Maximum speed (mm•s)</td>
<td>1200</td>
<td>1200</td>
<td>1200&lt;sup&gt;a&lt;/sup&gt;</td>
<td>600</td>
</tr>
<tr>
<td>Horizontally transportable load (kg)</td>
<td>60</td>
<td>40</td>
<td>20</td>
<td>15&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Rated thrust force (N)&lt;sup&gt;c&lt;/sup&gt;</td>
<td>300</td>
<td>300</td>
<td>120&lt;sup&gt;d&lt;/sup&gt;</td>
<td>240</td>
</tr>
<tr>
<td>Transportable moment&lt;sup&gt;f&lt;/sup&gt;</td>
<td>Roll (N•m)&lt;sup&gt;e&lt;/sup&gt;</td>
<td>600</td>
<td>70</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Pitch (N•m)</td>
<td>400</td>
<td>120</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Yaw (N•m)</td>
<td>350</td>
<td>120</td>
<td>10</td>
</tr>
<tr>
<td>Repeatability (mm)</td>
<td>±0.010</td>
<td>±0.010</td>
<td>±0.010</td>
<td>±0.010</td>
</tr>
<tr>
<td>Motor output (W)</td>
<td>300</td>
<td>300</td>
<td>100</td>
<td>100&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>Ball screw lead (mm)</td>
<td>20</td>
<td>20</td>
<td>20&lt;sup&gt;h&lt;/sup&gt;</td>
<td>10</td>
</tr>
<tr>
<td>Motor mount position</td>
<td>Direct mount</td>
<td>Direct mount</td>
<td>Right side</td>
<td>Left side</td>
</tr>
</tbody>
</table>

<sup>a</sup> The maximum speed for 130 mm and 230 mm stroke models is 600 mm per second
<sup>b</sup> Vertically transportable load
<sup>c</sup> 1N @ 0.102 kgf
<sup>d</sup> The rated thrust force for 130 mm and 230 mm stroke models is 240 N
<sup>e</sup> 1N•m @ 0.102 kgf•m
<sup>f</sup> The rate of acceleration affects the maximum transportable moment
<sup>g</sup> With brake
<sup>h</sup> The lead for 130 mm and 230 mm stroke models is 10 mm
Transportable Load of Moving Axes

**Table 8-1. Horizontal Axis Transportable Load**

<table>
<thead>
<tr>
<th>Stroke (mm)</th>
<th>Transportable load W(kg)</th>
<th>Stroke (mm)</th>
<th>Transportable load W(kg)</th>
<th>Stroke (mm)</th>
<th>Transportable load W(kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>300</td>
<td>40</td>
<td>250</td>
<td>25</td>
<td>130</td>
<td>3</td>
</tr>
<tr>
<td>400</td>
<td>40</td>
<td>350</td>
<td>20</td>
<td>230</td>
<td>1.4</td>
</tr>
<tr>
<td>500</td>
<td>40</td>
<td>450</td>
<td>16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>36</td>
<td>550</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>25</td>
<td>750</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>17</td>
<td>950</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 8-2. Vertical Axis Transportable Load**

<table>
<thead>
<tr>
<th>Stroke (mm)</th>
<th>Transportable load W(kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>10</td>
</tr>
<tr>
<td>230</td>
<td>9</td>
</tr>
</tbody>
</table>
8.2 Module Dimensions

H Module

<table>
<thead>
<tr>
<th>Ref. number</th>
<th>Stroke (mm)</th>
<th>L (mm)</th>
<th>S A (mm)</th>
<th>S B (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90400-10100</td>
<td>1000</td>
<td>1440</td>
<td>800</td>
<td>540</td>
<td>34</td>
</tr>
<tr>
<td>90400-10080</td>
<td>800</td>
<td>1240</td>
<td>600</td>
<td>440</td>
<td>29</td>
</tr>
<tr>
<td>90400-10060</td>
<td>600</td>
<td>1040</td>
<td>400</td>
<td>340</td>
<td>25</td>
</tr>
<tr>
<td>90400-10050</td>
<td>500</td>
<td>940</td>
<td>300</td>
<td>290</td>
<td>23</td>
</tr>
<tr>
<td>90400-10040</td>
<td>400</td>
<td>840</td>
<td>200</td>
<td>240</td>
<td>21</td>
</tr>
<tr>
<td>90400-10030</td>
<td>300</td>
<td>740</td>
<td>100</td>
<td>190</td>
<td>19</td>
</tr>
</tbody>
</table>

Note: In the figure the tap hole on the left that is marked with an asterisk is 8-M8, depth 12, for the XY-HRS040-H201.

<table>
<thead>
<tr>
<th>Ref. number</th>
<th>Stroke (mm)</th>
<th>L (mm)</th>
<th>S A (mm)</th>
<th>S B (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90400-12**0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mounting bracket kit (sold separately)

Note: Each kit has one bracket. We recommend that you use 2 kits for models with a stroke of 600 mm or less, and 3 kits for models with a stroke of 800 mm or more.

Figure 8-1. H Module
## M Module

<table>
<thead>
<tr>
<th>Ref. number</th>
<th>Stroke (mm)</th>
<th>L  (mm)</th>
<th>S A (mm)</th>
<th>S B (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90400-20095</td>
<td>950</td>
<td>1420</td>
<td>770</td>
<td>527</td>
<td>20.0</td>
</tr>
<tr>
<td>90400-20075</td>
<td>750</td>
<td>1220</td>
<td>570</td>
<td>427</td>
<td>17.0</td>
</tr>
<tr>
<td>90400-20055</td>
<td>550</td>
<td>1020</td>
<td>370</td>
<td>327</td>
<td>14.5</td>
</tr>
<tr>
<td>90400-20045</td>
<td>450</td>
<td>920</td>
<td>270</td>
<td>277</td>
<td>13.5</td>
</tr>
<tr>
<td>90400-20035</td>
<td>350</td>
<td>820</td>
<td>170</td>
<td>277</td>
<td>12.5</td>
</tr>
<tr>
<td>90400-20025</td>
<td>250</td>
<td>720</td>
<td>70</td>
<td>177</td>
<td>11.5</td>
</tr>
</tbody>
</table>

### Mounting bracket kit (sold separately)

<table>
<thead>
<tr>
<th>Ref. number:</th>
<th>90400-01200</th>
</tr>
</thead>
</table>

Note: Each kit has one bracket. We recommend that you use 2 kits for models with a stroke of 550 mm or less, and 3 kits for models with a stroke of 750 mm or more.

---

**Figure 8-2. M Module**
### S Module

<table>
<thead>
<tr>
<th>Ref. number</th>
<th>Stroke (mm)</th>
<th>L (mm)</th>
<th>S A (mm)</th>
<th>S B (mm)</th>
<th>S C (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90400-30053</td>
<td>530</td>
<td>760</td>
<td>460</td>
<td>330</td>
<td>560</td>
<td>8.0</td>
</tr>
<tr>
<td>90400-30043</td>
<td>430</td>
<td>660</td>
<td>360</td>
<td>280</td>
<td>460</td>
<td>7.3</td>
</tr>
<tr>
<td>90400-30033</td>
<td>330</td>
<td>560</td>
<td>260</td>
<td>230</td>
<td>360</td>
<td>6.6</td>
</tr>
<tr>
<td>90400-30023</td>
<td>230</td>
<td>460</td>
<td>160</td>
<td>180</td>
<td>260</td>
<td>6.0</td>
</tr>
<tr>
<td>90400-30013</td>
<td>130</td>
<td>360</td>
<td>60</td>
<td>130</td>
<td>160</td>
<td>5.3</td>
</tr>
</tbody>
</table>

#### Mounting bracket kit (sold separately)

<table>
<thead>
<tr>
<th>Ref. number</th>
<th>90400-01300</th>
</tr>
</thead>
</table>

Note: Each kit has one bracket. We recommend that you use 2 kits.

---

**Figure 8-3. S Module**

![Diagram of S Module dimensions and mounting brackets](image)
Sz Module

<table>
<thead>
<tr>
<th>Ref. number</th>
<th>Stroke (mm)</th>
<th>L (mm)</th>
<th>S A (mm)</th>
<th>S B (mm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90400-40023</td>
<td>230</td>
<td>460</td>
<td>160</td>
<td>180</td>
<td>6.2</td>
</tr>
<tr>
<td>90400-40013</td>
<td>130</td>
<td>360</td>
<td>60</td>
<td>130</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Note: You can use the same type of mounting bracket as for the S-module horizontal axes.

Figure 8-4. Sz Module
Z-theta Module

<table>
<thead>
<tr>
<th>Part number</th>
<th>Vertical Stroke (mm)</th>
<th>Rotation (deg)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30451-51000</td>
<td>( \pm 210^\circ )</td>
<td>360</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Figure 8-5. Z-Theta Module
8.3 Bracket Dimensions

H-Module Mounting Bracket

Figure 8-6. H-Module Mounting Bracket
M-Module Mounting Bracket

4-Φ9 through Φ14 counterbore depth 8.6 mm
4-Φ6.6 through Φ11 counterbore depth 9 mm (back side)

Figure 8-7. M-Module Mounting Bracket
S/Sz-Module Mounting Bracket

Figure 8-8. S/Sz-Module Mounting Bracket
Gantry Support Bracket

Figure 8-9. Gantry Support Bracket
CMS Bracket

Figure 8-10. CMS Type Bracket
DHM Bracket

Figure 8-11. DHM Type Bracket
DMM Bracket

4-4.6.6 through φ11 counterbore depth 6.5 mm (back side)

Figure 8-12. DMM Type Bracket
DSS Bracket

Figure 8-13. DSS Type Bracket
D-Type Combination End Plate

Figure 8-14. D-Type End Plate

4-ϕ5.5 through ϕ9.5 counterbore depth 5.4 mm
Figure 8-15. DMS Bracket
GHM Bracket

Figure 8-16. GHM Bracket
GMS Bracket

Figure 8-17. GMS Bracket
Figure 8-18. GSS Bracket
XHH Bracket

**Figure 8-19. XHH Bracket**

- 2-49 through 4-14 counterbore
- 3-M4 depth 6 mm (back side)
- 3-M5 depth 18 mm 4-10 counterbore depth 7 mm (back side)
- 4-49 through 4-14 counterbore (back side)
XHM Bracket

Figure 8-20. XHM Bracket
XMM Bracket

Figure 8-21. XMM Bracket
**Figure 8-22. TMS Bracket**
8.4 Work Envelopes and Payload Capacities

G1 Configuration

<table>
<thead>
<tr>
<th>Y stroke [mm]</th>
<th>250 to 550</th>
<th>750</th>
<th>950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>40</td>
<td>35</td>
<td>30</td>
</tr>
</tbody>
</table>

Figure 8-23. G1 Type Configuration
G2 Configuration

Figure 8-24. G2 Type Configuration

<table>
<thead>
<tr>
<th>Y stroke [mm]</th>
<th>130</th>
<th>230</th>
<th>330</th>
<th>430</th>
<th>530</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>20</td>
<td>16</td>
<td>11</td>
<td>8</td>
<td>5</td>
</tr>
</tbody>
</table>
G3 Configuration

<table>
<thead>
<tr>
<th>Y stroke [mm]</th>
<th>130</th>
<th>230</th>
<th>330</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>8</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

Figure 8-25. G3 Type Configuration
**D1 Configuration**

![Diagram of D1 Configuration]

<table>
<thead>
<tr>
<th></th>
<th>Y stroke [mm]</th>
<th>Transportable load [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y stroke</td>
<td>250 to 750</td>
<td>950</td>
</tr>
<tr>
<td>Transportable load</td>
<td>40</td>
<td>38</td>
</tr>
</tbody>
</table>

**Figure 8-26. D1 Type Configuration**
D2 Configuration

![Diagram of D2 Configuration]

<table>
<thead>
<tr>
<th>Y stroke [mm]</th>
<th>250</th>
<th>350</th>
<th>450</th>
<th>550</th>
<th>750</th>
<th>950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>28</td>
<td>27</td>
<td>26</td>
<td>24</td>
<td>18</td>
<td>14</td>
</tr>
</tbody>
</table>

Figure 8-27. D2 Type Configuration
### D1 and D2 Extended Stroke Configurations

<table>
<thead>
<tr>
<th>Y Stroke [mm]</th>
<th>250</th>
<th>350</th>
<th>550</th>
<th>750</th>
<th>950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>40</td>
<td>38</td>
<td>36</td>
<td>34</td>
<td>32</td>
</tr>
</tbody>
</table>

Figure 8-28. D1 and D2 Extended Stroke Configurations
D3 Configuration

Figure 8-29. D3 Type Configuration

Transportable load: 20kg
D4 Configuration

Figure 8-30. D4 Type Configuration

<table>
<thead>
<tr>
<th>Y stroke [mm]</th>
<th>130</th>
<th>230</th>
<th>330</th>
<th>430</th>
<th>530</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>14</td>
<td>13</td>
<td>12</td>
<td>11</td>
<td>10</td>
</tr>
</tbody>
</table>
X1 Configuration

Figure 8-31. X1 Type Configuration

<table>
<thead>
<tr>
<th>Y Stroke [mm]</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>600</th>
<th>800</th>
<th>1000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>37</td>
<td>35</td>
<td>33</td>
<td>31</td>
<td>27</td>
<td>20</td>
</tr>
</tbody>
</table>
X2 Configuration

Figure 8-32. X2 Type Configuration

<table>
<thead>
<tr>
<th>Y Stroke [mm]</th>
<th>250</th>
<th>350</th>
<th>450</th>
<th>550</th>
<th>750</th>
<th>950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>23</td>
<td>17</td>
<td>13</td>
<td>10</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>
X1 and X2 Extended Stroke Configuration

![Diagram of X1 and X2 Extended Stroke Configuration]

<table>
<thead>
<tr>
<th>Y Stroke [mm]</th>
<th>250</th>
<th>350</th>
<th>450</th>
<th>550</th>
<th>750</th>
<th>950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>23</td>
<td>17</td>
<td>13</td>
<td>10</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 8-33. X1 and X2 Extended Stroke Configurations
X3 Configuration

Figure 8-34. X3 Type Configuration

<table>
<thead>
<tr>
<th>Y stroke [mm]</th>
<th>250</th>
<th>350</th>
<th>450</th>
<th>550</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>11</td>
<td>8</td>
<td>6</td>
<td>3</td>
</tr>
</tbody>
</table>
K2 Configuration

Figure 8-35. K2 Type Configuration

<table>
<thead>
<tr>
<th>Z stroke [mm]</th>
<th>250 TO 950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>40</td>
</tr>
</tbody>
</table>
K3 Configuration

Figure 8-36. K3 Type Configuration

<table>
<thead>
<tr>
<th>Y stroke [mm]</th>
<th>250</th>
<th>350</th>
<th>450</th>
<th>550</th>
<th>750</th>
<th>950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>27.5</td>
<td>26.5</td>
<td>25.5</td>
<td>24.5</td>
<td>22</td>
<td>20</td>
</tr>
</tbody>
</table>
K4 Configuration

Figure 8-37. K4 Type Configuration

<table>
<thead>
<tr>
<th>Y stroke [mm]</th>
<th>130 TO 630</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>15</td>
</tr>
</tbody>
</table>

AdeptModules Instruction Handbook, Volume 2: Mechanical Assembly, Rev A 235
Z2 Configuration

Figure 8-38. Z2 Type Configuration

<table>
<thead>
<tr>
<th>Z Stroke [mm]</th>
<th>250</th>
<th>350</th>
<th>450</th>
<th>550</th>
<th>750</th>
<th>950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>27.5</td>
<td>26.5</td>
<td>25.5</td>
<td>24.5</td>
<td>22</td>
<td>20</td>
</tr>
</tbody>
</table>
Z3 Configuration

<table>
<thead>
<tr>
<th>Z stroke [mm]</th>
<th>250</th>
<th>350</th>
<th>450</th>
<th>550</th>
<th>750</th>
<th>950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>27.5</td>
<td>26.5</td>
<td>25.5</td>
<td>24.5</td>
<td>22</td>
<td>20</td>
</tr>
</tbody>
</table>

Figure 8-39. Z3 Type Configuration
Z4 Configuration

Figure 8-40. Z4 Type Configuration

<table>
<thead>
<tr>
<th>Z stroke [mm]</th>
<th>Transportable load [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>130</td>
<td>9.5</td>
</tr>
<tr>
<td>230</td>
<td>8.8</td>
</tr>
<tr>
<td>330</td>
<td>8.2</td>
</tr>
<tr>
<td>430</td>
<td>7.5</td>
</tr>
<tr>
<td>530</td>
<td>6.8</td>
</tr>
</tbody>
</table>

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**P1 Unit Stroke Configuration**

![Diagram of P1 Unit Stroke Configuration]

| Y stroke [mm] | 130 | 230 |
| Transportable load [kg] | 10 | 9 |

**Figure 8-41. P1 Unit Stroke Configuration**
**P1 Slider Stroke Configuration**

Transportable load: 15kg

**Figure 8-42. P1 Slider Stroke Configuration**
**P1 Extended Stroke Configuration**

![Diagram of P1 Extended Stroke Configuration]

- **Transportable load**: 15 [kg]
- **Support rest**
- **Cable support**
- **Combining bracket**
- **Combining bracket**
- **Cable lead-out channel**
- **X-axis controller cable**
- **Y-axis controller cable**
- **Z-axis controller cable**
- **Y-axis robot cable**
- **Z-axis robot cable**

**Figure 8-43. P1 Extended Stroke Configuration**
**P2 Unit Stroke Configuration**

![Diagram of P2 Unit Stroke Configuration]

<table>
<thead>
<tr>
<th>Z stroke [mm]</th>
<th>130 230 330 430</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable</td>
<td>130 10 10 5 2</td>
</tr>
<tr>
<td>load [kg]</td>
<td>230 9 9 4 —</td>
</tr>
</tbody>
</table>

**Figure 8-44. P2 Unit Stroke Configuration**
P2 Configuration

Figure 8-45. P2 Slider Stroke Configuration

<table>
<thead>
<tr>
<th>Z stroke [mm]</th>
<th>130</th>
<th>230</th>
<th>330</th>
<th>430</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportable load [kg]</td>
<td>130</td>
<td>14</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>230</td>
<td>13</td>
<td>9</td>
<td>4</td>
<td>—</td>
</tr>
</tbody>
</table>

AdeptModules Instruction Handbook, Volume 2: Mechanical Assembly, Rev A 243

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J Configuration

Figure 8-46. J Slider Stroke Configuration
J Extended Stroke Configuration

Figure 8-47. J Extended Stroke Configuration
TConfiguration

Figure 8-48. TType Configuration

Transportable load: 15kg
Adept Cartesian Robot

Figure 8-49. Adept Cartesian Robot
## CleanRoom Modules

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>251</td>
</tr>
<tr>
<td>Difference</td>
<td>251</td>
</tr>
<tr>
<td>Maintenance of Cleanroom Models</td>
<td>251</td>
</tr>
</tbody>
</table>
A.1 **Introduction**

AdeptModules are available in cleanroom models which meet Class 10 specifications. The following is a description on how the cleanroom model differs from that of the standard model.

A.2 **Difference**

In all aspects, the dimensions of the cleanroom models are the same as the standard models. The cleanroom models, however, have two vacuum connections on one end of the module. These allow for the removal of particles from within the module during operation.

Cleanroom models also have different seal belts. This belt seals the module tighter than the standard model belts, thus preventing particles from escaping from the module.

The cleanroom quality may decrease as the speed of the module increases. The modules are guaranteed to meet class 10 specifications only at a maximum speed of 400 mm/s (this value includes a small safety margin), with a vacuum flow rate of 60 L/min. If the vacuum flow rate is increased to 90 L/min, the module speed may be subsequently increased to 600 mm/s.

A.3 **Maintenance of Cleanroom Models**

The only real difference in maintenance between cleanroom and non-cleanroom is the type of grease that is used. Shell Alvania LG2 (Pt# 90401-04029) grease is recommended for use in the cleanroom modules.

Another check that must be performed is that all vacuum lines are secure and that the right amount of vacuum is present (60 L/min).
B.1 Introduction

For some applications, a side-mounted motor must be moved to the other side of the module. The following procedures explain how to swap the motor position on an Sz-Module. Pay special attention to the Notes for valuable information that will help in swapping the motor.

B.2 Procedure

The following is a step-by-step procedure on swapping the motor from one side of the module to the other. Use of the Figures and Notes will help with the process of swapping the motor.

1. Remove the four motor cover screws and pull off the motor cover (see Figure B-1).

![Figure B-1. Motor Cover Removal](image)

2. Remove the four screws on the connector base and remove the connector base (see Figure B-2).
3. Remove the seal belt screw. Remove the four screws on the end cap and remove end cap (see Figure B-3).

4. Cut the tie rap on the belt cover and remove the belt cover.

5. Using an extraction tool remove pins 4 to 7 from the thicker connector. The color of the cables are listed in Table B-1.
Table B-1. Cable Color to Pin Number Connections

<table>
<thead>
<tr>
<th>Pin #1</th>
<th>Grey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin #2</td>
<td>Orange and Pink</td>
</tr>
<tr>
<td>Pin #3</td>
<td>Blue and Yellow</td>
</tr>
<tr>
<td>Pin #4</td>
<td>Brown</td>
</tr>
</tbody>
</table>

6. Remove the four screws from the motor base plate to separate motor from the base plate (see Figure B-4).

Figure B-4. Separating Motor From Base

7. Cut the tie-wrap on the module (see Figure B-4).
8. Paint a mark on the pulley (see Figure B-5).

**NOTE:** This paint mark is going to be use as a timing mark. The paint mark should cross both the pulley and the motor shaft.

9. Remove the two pulley set bolts and remove the pulley (see Figure B-5).

10. Remove the wires from the base plate (see Figure B-5).

**NOTE:** Mark the base plate (paint or tape) on the top to distinguish the top from the bottom (see Figure B-6).

11. Rotate the base plate to the other side of the motor (see Figure B-6).
12. Install the base plate using the four removed screws (see Figure B-7).
13. Install the wires. Place the wires through the hole and collar (see Figure B-7).
14. Install the pulley (see Figure B-8).

**NOTE:** Ensure that new shims are use when installing the pulley.

15. Install the motor and drive pulley (see Figure B-9).

**NOTE:** Ensure that the timing marks that were painted in step 8 are aligned when installing the pulley.
NOTE: Tighten the drive belt tension between 4 and 4.5 kgf (10 in. lbs.).

Figure B-9. Motor Installation

16. Install the belt cover (see Figure B-10).

Figure B-10. Belt Cover Installation

17. Install the four stand-offs (see Figure B-11).

NOTE: Tighten by hand only (never use any type of tool to tighten stand-offs).
18. Using an insertion tool, insert the four removed wires into the connector (refer to Table B-1 for pin numbers).

19. Tie-wrap the wires on the belt cover (see Figure B-12).

20. Install the connector base on the four stand-offs (see Figure B-13).
Figure B-13. Reinstalling Connector Base Plate

21. Installation of the end cap (see Figure B-14).
   a. Remove the plastic piece from the end cap.
   b. Insert the seal belt into the end cap.
   c. Install the plastic piece.
   d. Fix the end cap to the module with the four screws that were removed in step 1.
22. Fix the seal belt onto the slider (see Figure B-15).

23. Install the motor cover (see Figure B-16).
Figure B-16. Motor Cover Insertion
C.1 Introduction

In some cases the electrical connections of a direct-mount motor need to be reversed to meet the needs of the application. This section describes how to perform the electrical connection reversing process.

C.2 Procedure

1. Remove the four screws on the connector mounting panel (see Figure C-1).

2. Remove the four screws on the motor end cover and remove the end cover panel (see Figure C-1).

3. Slide the connector mounting panel through the slot towards the inside of the motor cover and remove the motor cover from the module (see Figure C-2).
Figure C-2. Removing the Motor Cover

4. Flip motor cover over (see Figure C-3).

Figure C-3. Motor Cover Flipping

5. Slide the connector mounting panel through the slot toward the outside of the motor cover as shown in Figure C-4).
Figure C-4. Re-inserting Connector Cover Panel

6. Attach the motor cover and the motor end cover to the module with the four long screws as shown in figure Figure C-5).

Figure C-5. Attaching Motor Cover and Connector Cover Panel

7. Attach the connector mounting panel to the motor cover using the four shorter screws as shown in figure Figure C-5).
Index

A
Acceptable 27
Acceptable Modifications 27
Adding User Cables 85, 136, 152, 167
Additional Safety Information 26
Adept Cartesian Robot 249
Adept MV Controller 30
Adept MV Controller Connections 56, 68, 72, 76, 82, 88, 93, 98, 102, 106, 111, 115, 119, 124, 129, 133, 139, 148, 156, 163
Adept Cartesian Connections 182
Adept Module Life and Yawing Moment Calculations 40
Adept Modules 23, 25
Adept Modules Modifications 27
Adept Modules Static Forces 25
Assembling a Gantry Support Module 169
Assembling an Adept Cartesian Robot 175
Assembling D-Type Combinations 78
Assembling G-Type Combinations 65
Assembling J-Type Combinations 159
Assembling K-Type Combinations 95
Assembling P-Type Combinations 144
Assembling T-Type Combinations 121
Assembling X-Type Combinations 126
Assembling Z-Type Combinations 108
Attaching the Adept Z-Theta Module 178
Attaching Using the Optional Mounting Brackets 55
Automatic Mode 30

B
Bracket Dimensions 206

C
Changing the Angle of the Cable End 64
Class 10 Cleanroom Modules 36
CMS Bracket 210
Combining Methods 63
Connector Cross Reference List 193
Connector Pins and Inserter/Extractor Tools 191
Cover screw removal 269

D
D1 and D2 Cable Track Installation 84
D1 and D2 Extended Stroke Configurations 228
D1 and D-2 Type Electrical Connections 80
D1 and D-2 Type Installation Procedure 79
D1 Configuration 226
D2 Configuration 227
D3 Configuration 229
D-3 Type Electrical Connections 87
D-3 Type Installation Procedure 86
D4 Configuration 230
D-4 Type Electrical Connections 91
D-4 Type Installation Procedure 90
Daily Maintenance 188
DDK Compatible Connectors 192
Definition of Manipulating Industrial Robot 24
DHM Bracket 211
Direct Attachment Using the Tap Holes on the Bottom of the Main Unit 54
DMM Bracket 212
DMS Bracket 215
DSS Bracket 213
D-Style Configuration 42
D-Type Combination End Plate 214

E
Endangerment Through Additional Equipment 28
EXA and EXC Electrical Connections 56, 67, 71, 75, 81, 87, 92, 97, 101, 105, 110, 114, 118, 123, 128, 132, 138, 147, 155, 162
EXC / EXA Controller Back up Batteries 196
EXC/EXA controller 30
External Operations 30

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Index

G
G-2 Type Electrical Connections 71
G-1 Configuration 223
G-1 Type Electrical Connections 67
G-1 Type Installation Procedure 66
G2 Configuration 224
G-2 Type Installation Procedure 70
G3 Configuration 225
G-3 Type Electrical Connections 75
G-3 Type Installation Procedure 74
Gantry Support Bracket 209
Gantry Support Modules 36
GHM Bracket 216
GMS Bracket 217
Grease Adaptor Nozzle 190
Grease Refill 193
GSS Bracket 218
G-Style Configuration 41

H
H Module 201
H-Module 35
H-Module Mounting Bracket 206
How to use this Manual 23

I
Initial Confirmation 187
Inserting Chamfered and Straight Pin 64
Installing the Cable Covers 180
Installing the Z-Theta Module 178
Instructed persons 29
Intended Use of the AdeptModules 26
Introduction 23, 35, 51, 63, 143

J
J Configuration 246
J Extended Stroke Configuration 247
J Type Electrical Connections 161
J Type Extended Stroke Cable Track Installation 166
J Type Installation Procedure 160
J-Style Configuration 47

K
K2 Configuration 235
K-2 Type Electrical Connections 96
K-2 Type Installation Procedure 96
K3 Configuration 236
K-3 Type Electrical Connections 100
K-3 Type Installation Procedure 100
K4 Configuration 237
K-4 Type Electrical Connections 104
K-4 Type Installation Procedure 104
K-Style Configuration 44

L
Life Calculations 40
Life calculations 40
Lubrication Grease 190
Lubrication Procedures 190
Lubrication Schedule 189

M
M Module 202
Maintenance 187
Manual Mode 30
M-Module 35
M-Module Mounting Bracket 207
Modifications
acceptable 27
unacceptable 28
Module 1 41, 42, 43, 44, 45, 47
Module 2 41, 42, 43, 44, 46, 48
Module 3 47
Module Calculations X-axis 48
Module Calculations Y-axis 45
Module Calculations Z-axis 46
Module Dimensions 201
Module Moment Capacity 38
Module Specifications 37
Module Types 35
Module types 35
Class 10 Clean Room 36
Gantry Support Modules 36
H-Module 35
M-Module 35
S-Module 35
Sz-Module 36
Modules Lubrication 189
Modules Specifications 37
Moment Calculations 40
Moment calculations 40
Moment Capacity 38
Mounting Attachments on End Face 169
Mounting Attachments on Slider 168
Mounting Components to the Main Unit 57
Mounting the Cable Holder 64
Mounting the Main Unit to a Base 53
Index

Mounting Tooling to an AdeptModule 168

N
Notes, Cautions, and Warnings 24

O
operating modes
  Automatic 30
  Manual 30
Operating Modes of AdeptModules 30

P
P1 Extended stroke Cable Track Installation 151
P1 Extended Stroke Configuration 243
P1 Slider Stroke Configuration 242
P-1 Type Electrical Connections 146
P-1 Type Installation Procedure 145
P1 Unit Stroke Configuration 241
P2 Configuration 245
P-2 Type Electrical Connections 155
P-2 Type Installation Procedure 153
P2 Unit Stroke Configuration 244
Periodic Maintenance 193
Pins, Connectors, and Screws 191
Precautions 63
Precautions and Required Safeguards 25
Protection Against Unauthorized Operation 30
P-Style Configuration 46

Q
Qualification of Personnel 29
qualification of personnel 29

R
Removal of the Z-Theta Top Cover 178
robot
definition of industrial 24
intended uses 26
joint locations 24
modifications 27
static forces 25
working area 28
Robot Cable Mounting Screws 193
Robot Cables 63

S
S Module 203
S/Sz-Module Mounting Bracket 208
Safety 25
  while performing maintenance 31
safety
during maintenance 31
equipment for operators 29
qualification of personnel 29
required safeguards 25
sources for information 26
Safety Barriers 25
safety barriers
  requirements 25
Safety Equipment for Operators 29
Single Axis Electrical Connections 56
Skilled persons 29
S-Module 35
Specifications 199
Standard Modules 199
Sz Module 204
Sz-Module 36

T
T Configuration 248
T Type Electrical Connections 123
T Type Installation Procedure 122
Teach Box Operation 31
TMS Bracket 222
Transport 29
Transportable Load of Moving Axis 200
Transporting a Single Axis 52
Transporting AdeptModules 51

U
Unacceptable Modifications 28

W
Warranty Requirements 52
What to Do in an Emergency Situation 31
Work Envelopes and Payload Capacities 223
Working Areas 28

X
X-2 Type Electrical Connections 131
X1 and X2 Extended stroke Cable Track Installation 134
X1 and X2 Extended Stroke Configuration 233
X1 Configuration 231
X-1 Type Electrical Connections 127
Index

X-1 Type Installation Procedure 127
X2 Configuration 232
X-2 Type Installation Procedure 130
X3 Configuration 234
X-3 Type Electrical Connections 137
X-3 Type Installation Procedure 136
XHH Bracket 219
XHM Bracket 220
XMM Bracket 221
X-Style Configuration 43

Z
Z2 configuration 238
Z-2 Type Electrical Connections 109
Z-2 Type Installation Procedure 109
Z3 configuration 239
Z-3 Type Electrical Connections 113
Z-3 Type Installation Procedure 113
Z4 configuration 240
Z-4 Type Electrical Connections 117
Z-4 Type Installation Procedure 117
Z-Style Configuration 45
Z-theta Module 205
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