# Table of Contents

About the Documentation ..................................................... xxii
  Documentation and Release Notes ..................................... xxii
  Documentation Conventions ............................................. xxii
  Documentation Feedback ................................................ xxiii
  Requesting Technical Support ......................................... xxiv
  Self-Help Online Tools and Resources .............................. xxiv
  Opening a Case with JTAC ............................................... xxiv

Part 1 Overview

Chapter 1 System Overview ................................................. 3
  M120 Router Description ................................................ 3
  M120 Component Redundancy .......................................... 4

Chapter 2 M120 Router Release Notes ................................. 5
  Outstanding Issues with the M120 Router .......................... 5
  Errata with the M120 Router Documentation ....................... 5

Chapter 3 Chassis Components and Descriptions ................... 7
  M120 Router Chassis Description ..................................... 7
  M120 Midplane Description .......................................... 9
  M120 Cable Management System Description ...................... 10
  M120 Craft Interface Description .................................. 11
    Craft Interface Front Panel ........................................ 11
    M120 Alarm Relay Contacts on the Craft Interface ........... 12
    M120 External Clock Interface Ports on the Craft Interface 12
    M120 Routing Engine Interface Ports and Status Indicators 12
  M120 Alarm LEDs and Alarm Cutoff/Lamp Test Button .......... 13
  M120 Component LEDs on the Craft Interface .................... 14
    Host Subsystem LEDs on the M120 Craft Interface ............. 14
    Ethernet Port LEDs on the Craft Interface ..................... 14
    FEB LEDs on the M120 Craft Interface ........................ 15
    FPC LEDs on the M120 Craft Interface ........................ 15
    Power Supply LEDs on the M120 Craft Interface ............... 15
    External Clocking Inputs LEDs on the M120 Craft Interface 15
  M120 External Clock Interface Ports on the Craft Interface 16
  M120 Alarm Relay Contacts on the Craft Interface ............ 17

Chapter 4 Cooling System Components and Descriptions ........ 19
  M120 Cooling System Description .................................. 19
<table>
<thead>
<tr>
<th>Chapter 5</th>
<th>Host Subsystem Components and Descriptions</th>
<th>21</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M120 Host Subsystem Description</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>M120 Routing Engine Description</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Routing Engine Components</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Routing Engine Boot Sequence</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>M120 Routing Engine LEDs</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>M120 RE-A-1800x2 Routing Engine Description</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Routing Engine Components</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Routing Engine Boot Sequence</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>RE-A-1800 Routing Engine LEDs</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>M120 Routing Engine Interface Ports and Status Indicators</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Routing Engine Specifications</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Supported Routing Engines by Router</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>M7i Routing Engines</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>M10i Routing Engines</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>M40e Routing Engines</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>M120 Routing Engines</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>M320 Routing Engines</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>MX5, MX10, MX40, and MX80 Routing Engine</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>MX104 Routing Engines</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>MX240 Routing Engines</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>MX480 Routing Engines</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>MX960 Routing Engines</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>MX2008 Routing Engines</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>MX2010 Routing Engines</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>MX2020 Supported Routing Engines</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>MX10003 Routing Engines</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>PTX1000 Routing Engines</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>PTX3000 Routing Engines</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>PTX5000 Routing Engines</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>PTX1000B and PTX10016 Routing Engines</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>T320 Routing Engines</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>T640 Routing Engines</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Ti600 Routing Engines</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>T4000 Routing Engines</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>TX Matrix Routing Engines</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>TX Matrix Plus Routing Engines</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>TX Matrix Plus (with 3D SIBs) Routing Engines</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>M120 Control Board (CB) Description</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>CB Components</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>M120 Control Board (CB) LEDs</td>
<td>48</td>
</tr>
<tr>
<td>Chapter</td>
<td>Component/Description</td>
<td>Page</td>
</tr>
<tr>
<td>-----------</td>
<td>------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Chapter 6</td>
<td>Line Card Components and Descriptions</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>M120 Flexible PIC Concentrators (FPCs) Description</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>FPC Components</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>FPC Terminology</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>M120 Flexible PIC Concentrators (FPCs) LED</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>M120 Compact FPCs (CFPCs) Description</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>CFPC Components</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>M120 FPCs and CFPCs Supported</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>M120 PICs Description</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>M120 PIC LEDs</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>M120 PICs Supported</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>M120 End-of-Life PICs Supported</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>M120 PIC/FPC Compatibility</td>
<td>66</td>
</tr>
<tr>
<td>Chapter 7</td>
<td>Power System Components and Descriptions</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>M120 Power Supplies Description</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>M120 DC Power Supply Description</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>M120 AC Power Supply Description</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>M120 Power Supply LEDs</td>
<td>73</td>
</tr>
<tr>
<td>Chapter 8</td>
<td>Switch Fabric Components and Descriptions</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>M120 Forwarding Engine Boards (FEBs) Description</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>FEB Components</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>M120 Forwarding Engine Boards (FEBs) LEDs</td>
<td>77</td>
</tr>
<tr>
<td>Part 2</td>
<td>Site Planning, Preparation, and Specifications</td>
<td></td>
</tr>
<tr>
<td>Chapter 9</td>
<td>Preparation Overview</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>M120 Site Preparation Checklist</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>M120 Router Physical Specifications</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>M120 Cabinet Size and Clearance Requirements</td>
<td>82</td>
</tr>
<tr>
<td></td>
<td>M120 Cabinet Airflow Requirements</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>M120 Rack Mounting Requirements</td>
<td>83</td>
</tr>
<tr>
<td></td>
<td>M120 Clearance Requirements for Airflow and Hardware</td>
<td>85</td>
</tr>
<tr>
<td></td>
<td>M120 Router Environmental Specifications</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>M120 Chassis Grounding Specifications</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>M120 Router Power Requirements</td>
<td>88</td>
</tr>
<tr>
<td>Chapter 10</td>
<td>AC Power Requirements and Specifications</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>M120 AC Power, Connection, and Power Cord Specifications</td>
<td>93</td>
</tr>
<tr>
<td></td>
<td>Electrical Specifications for the M120 AC Power Supply</td>
<td>95</td>
</tr>
<tr>
<td>Chapter 11</td>
<td>DC Power Requirements and Specifications</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>M120 DC Power, Connection, and Cable Specifications</td>
<td>97</td>
</tr>
<tr>
<td></td>
<td>Electrical Specifications for the M120 DC Power Supply</td>
<td>100</td>
</tr>
</tbody>
</table>
Chapter 12  Network Cable and Transceiver Planning .............................................. 101
Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion ........... 101
Signal Loss in Multimode and Single-Mode Fiber-Optic Cable ......................... 101
Attenuation and Dispersion in Fiber-Optic Cable .............................................. 101
Calculating Power Budget and Power Margin for Fiber-Optic Cables ................. 102
Calculating Power Budget for Fiber-Optic Cable ............................................ 102
Calculating Power Margin for Fiber-Optic Cable ............................................ 103

Chapter 13  Management Cable and Transceiver Specifications and Pinouts .......... 105
Routing Engine Interface Cable and Wire Specifications for the M120 Router .... 105
RJ-45 Connector Pinouts for the M120 Routing Engine ETHERNET Port ............ 106
RJ-45 Connector Pinouts for the Routing Engine AUX and CONSOLE Ports .... 106
RJ-45 Connector Pinouts for the External Clock Ports .................................... 107

Part 3  Initial Installation and Configuration
Chapter 14  Installation Overview .............................................................. 111
M120 Router Installation Summary ............................................................ 111
Chapter 15  Unpacking the M120 ............................................................... 113
Tools and Parts Required to Unpack the M120 Router .................................. 113
Unpacking the M120 Router ........................................................................ 113
Verifying M120 Parts Received ................................................................. 115
Chapter 16  Installing the Mounting Hardware ............................................ 119
Installing the Mounting Hardware for a Front-Mount Four-Post Rack or Cabinet .... 119
Installing the Mounting Hardware for a Front-Mount Open-Frame Rack .......... 121
Installing the Mounting Hardware for a Center-Mount Open-Frame Rack ......... 123
Chapter 17  Installing the M120 With a Mechanical Lift ............................... 125
Tools Required to Install the M120 Router Using a Mechanical Lift ................. 125
Installing the M120 Router Using a Mechanical Lift ................................... 125
Chapter 18  Installing the M120 Without a Mechanical Lift .......................... 129
Tools and Parts Required to Install the M120 Router Without a Mechanical Lift .... 129
Removing Components from the Chassis Before Installing the M120 Router .... 129
Removing a Mechanical Lift ...................................................................... 129
Removing the Power Supplies .................................................................... 130
Removing FEBs ......................................................................................... 131
Removing CBs ......................................................................................... 132
Removing a Fan Tray ................................................................................ 133
Removing the Cable Management System .................................................. 135
Removing FPCs ....................................................................................... 136
Removing a CFPC .................................................................................... 137
Installing the M120 Router Without Using a Mechanical Lift ....................... 139
Reinstalling Components in the Chassis After Installing the M120 Router Without a Mechanical Lift ................................................................. 142
Reinstalling CBs ....................................................................................... 142
Reinstalling the FEBs ............................................................................... 143
Reinstalling the Power Supplies ................................................................. 144
Reinstalling FPCs .................................................................................. 145
Reinstalling a CFPC .............................................................................. 146
Reinstalling the Fan Trays ................................................................... 148
Reinstalling the Cable Management System ...................................... 149

Chapter 19 Connecting the M120 to Ground ........................................ 151
Connecting the Grounding Cable to the M120 Router ..................... 151

Chapter 20 Connecting the M120 to External Devices ....................... 153
Tools and Parts Required to Connect the M120 Router .................... 153
Connecting the M120 Router to Management and Alarm Devices ...... 153
   Connecting the M120 Router to a Management Console or Auxiliary Device ......................................................... 155
   Connecting the M120 Router to a Network for Out-of-Band Management ................................................................. 156
Connecting the M120 Router to an External Alarm-Reporting Device . . 158
Connecting the M120 Router to a Network for Out-of-Band Management . 160
Connecting the M120 Router to an External Alarm-Reporting Device . . 161
Connecting the M120 Router to an External Clocking Device . . . . . 163
Connecting PIC Cables to the M120 Router ........................................ 164

Chapter 21 Providing Power to the M120 ........................................... 167
Connecting Power to an AC-Powered M120 Router ......................... 167
Connecting Power to a DC-Powered M120 Router ......................... 169
Powering On the M120 Router ........................................................... 170
Powering Off the M120 Router ............................................................ 171

Chapter 22 Configuring the Junos Software ..................................... 173
Initially Configuring Junos OS on the M120 Router ......................... 173

Part 4 Installing and Replacing Components

Chapter 23 Overview of Installing and Replacing Components .......... 179
M120 Field-Replaceable Units (FRUs) ...................................................... 179
Tools and Parts Required to Replace M120 Components ................. 180

Chapter 24 Replacing Chassis Components ..................................... 183
Replacing Alarm Relay Wires on the M120 Craft Interface ................ 183
Replacing the M120 Craft Interface ....................................................... 184
   Removing the M120 Craft Interface .................................................. 184
   Installing the M120 Craft Interface .................................................... 185

Chapter 25 Replacing Cooling System Components ........................... 187
Replacing an M120 Air Filter ............................................................... 187
   Removing the M120 Air Filter .......................................................... 187
   Installing the M120 Air Filter ........................................................... 188
Replacing an M120 Fan Tray ............................................................... 190
   Removing an M120 Fan Tray ............................................................ 190
   Installing an M120 Fan Tray ............................................................ 192
<table>
<thead>
<tr>
<th>Chapter 26</th>
<th>Replacing Host Subsystem Components .................................. 195</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Replacing an M120 Routing Engine ........................................ 195</td>
</tr>
<tr>
<td></td>
<td>Removing an M120 Routing Engine ........................................... 195</td>
</tr>
<tr>
<td></td>
<td>Installing an M120 Routing Engine ........................................ 197</td>
</tr>
<tr>
<td></td>
<td>Replacing an SSD Drive on an RE-A-1800 or RE-S-1800 ..................... 198</td>
</tr>
<tr>
<td></td>
<td>Replacing a DIMM Module in M120 Routing Engines .......................... 200</td>
</tr>
<tr>
<td></td>
<td>Removing a M120 DIMM Module .................................................. 200</td>
</tr>
<tr>
<td></td>
<td>Installing a M120 DIMM Module .............................................. 201</td>
</tr>
<tr>
<td></td>
<td>Replacing an M120 CB .......................................................... 202</td>
</tr>
<tr>
<td></td>
<td>Removing an M120 CB ............................................................ 202</td>
</tr>
<tr>
<td></td>
<td>Installing an M120 CB ........................................................... 204</td>
</tr>
<tr>
<td></td>
<td>Replacing Connections to M120 Routing Engine Interface Ports ............. 206</td>
</tr>
<tr>
<td></td>
<td>Replacing the Management Ethernet Cable on the M120 Routing Engine ... 206</td>
</tr>
<tr>
<td></td>
<td>Replacing the Console or Auxiliary Cable on the M120 Routing Engine ... 207</td>
</tr>
<tr>
<td></td>
<td>Replacing Alarm Relay Wires on the M120 Craft Interface .................. 208</td>
</tr>
<tr>
<td></td>
<td>Replacing the Console or Auxiliary Cable on the M120 Routing Engine ... 209</td>
</tr>
<tr>
<td></td>
<td>Replacing the Management Ethernet Cable on the M120 Routing Engine ... 210</td>
</tr>
<tr>
<td>Chapter 27</td>
<td>Replacing Line Card Components .............................................. 213</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Replacing an M120 FPC .......................................................... 213</td>
</tr>
<tr>
<td></td>
<td>Removing an M120 FPC ........................................................... 213</td>
</tr>
<tr>
<td></td>
<td>Installing an M120 FPC ........................................................ 216</td>
</tr>
<tr>
<td></td>
<td>Replacing an M120 CFPC .......................................................... 219</td>
</tr>
<tr>
<td></td>
<td>Removing an M120 CFPC ........................................................... 219</td>
</tr>
<tr>
<td></td>
<td>Installing an M120 CFPC ....................................................... 221</td>
</tr>
<tr>
<td></td>
<td>Replacing an M120 PIC ............................................................ 223</td>
</tr>
<tr>
<td></td>
<td>Removing an M120 PIC ............................................................ 223</td>
</tr>
<tr>
<td></td>
<td>Installing an M120 PIC ........................................................... 225</td>
</tr>
<tr>
<td></td>
<td>Replacing an M120 PIC Cable .................................................... 228</td>
</tr>
<tr>
<td></td>
<td>Removing an M120 PIC Cable ..................................................... 228</td>
</tr>
<tr>
<td></td>
<td>Installing an M120 PIC Cable ................................................... 229</td>
</tr>
<tr>
<td></td>
<td>Replacing an M120 XENPAK Module .............................................. 231</td>
</tr>
<tr>
<td></td>
<td>Removing an M120 XENPAK Module .............................................. 231</td>
</tr>
<tr>
<td></td>
<td>Installing an M120 XENPAK Module ............................................ 232</td>
</tr>
<tr>
<td></td>
<td>Replacing an SFP or XFP Transceiver ......................................... 234</td>
</tr>
<tr>
<td></td>
<td>Removing an SFP or XFP Transceiver ......................................... 234</td>
</tr>
<tr>
<td></td>
<td>Installing an SFP or XFP Transceiver ....................................... 236</td>
</tr>
<tr>
<td>Chapter 28</td>
<td>Replacing Power System Components .......................................... 239</td>
</tr>
<tr>
<td>-------------------</td>
<td>---------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Replacing an M120 AC Power Supply .......................................... 239</td>
</tr>
<tr>
<td></td>
<td>Removing an M120 AC Power Supply .......................................... 239</td>
</tr>
<tr>
<td></td>
<td>Installing an M120 AC Power Supply ........................................ 242</td>
</tr>
<tr>
<td></td>
<td>Replacing an M120 AC Power Supply Cord .................................... 244</td>
</tr>
<tr>
<td></td>
<td>Replacing an M120 DC Power Supply .......................................... 245</td>
</tr>
<tr>
<td></td>
<td>Removing an M120 DC Power Supply .......................................... 245</td>
</tr>
<tr>
<td></td>
<td>Installing an M120 DC Power Supply ........................................ 248</td>
</tr>
<tr>
<td></td>
<td>Replacing an M120 DC Power Supply Cable .................................... 251</td>
</tr>
</tbody>
</table>
Chapter 29 Replacing Switch Fabric Components ................................................. 255
Replacing an M120 FEB ................................................................. 255
Removing an M120 FEB ............................................................... 255
Installing an M120 FEB ............................................................... 256

Part 5 Maintaining the Chassis and Components
Chapter 30 Routine Maintenance Procedures .......................................... 261
Routine Maintenance Procedures on the M120 Router ................................. 261

Chapter 31 Maintaining Components and Cables .................................... 263
Tools and Parts Required to Maintain M120 Hardware Components ................ 263
Maintaining the M120 Air Filter .................................................. 263
Maintaining the M120 Fan Trays ................................................... 264
Maintaining the M120 Host Subsystem ........................................... 266
Taking the M120 Host Subsystem Offline ......................................... 267
Maintaining M120 FPCs and CFPCs ............................................. 270
Storing an M120 FPC ................................................................. 271
Holding an M120 FPC ............................................................... 271
Maintaining M120 PICs and PIC Cables ...................................... 275
Maintaining the M120 Power Supplies ............................................ 277
Maintaining the M120 FEBs ......................................................... 278

Part 6 Troubleshooting Hardware
Chapter 32 Troubleshooting Components ............................................. 283
Overview of Troubleshooting Resources for the M120 Router ....................... 283
Troubleshooting Using the Command-Line Interface ................................ 283
Troubleshooting Using the Chassis and Interface Alarm Messages ............... 284
Troubleshooting Using the Juniper Networks Technical Assistance Center ........ 284
M120 LED Overview ................................................................. 284
Craft Interface LEDs ............................................................... 284
Component LEDs ................................................................. 285
Troubleshooting the M120 Cooling System ....................................... 286
Troubleshooting M120 FPCs and CFPCs ....................................... 287
Troubleshooting M120 PICs ......................................................... 288
Troubleshooting the M120 Power System ....................................... 288
Troubleshooting M120 FEBs ......................................................... 289
Troubleshooting an M120 FEB When a Chassis Alarm Is Lit Upon Initial Startup or Removal ................................................................. 291

Part 7 Contacting Customer Support and Returning the Chassis or Components
Chapter 33 Contacting Customer Support ............................................. 295
Contacting Customer Support ....................................................... 295
<table>
<thead>
<tr>
<th>Chapter 34</th>
<th>Locating Component Serial Numbers</th>
<th>297</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 35</td>
<td>Packing and Returning Components</td>
<td>305</td>
</tr>
<tr>
<td>Part 8</td>
<td>Safety and Compliance Information</td>
<td></td>
</tr>
<tr>
<td>Chapter 36</td>
<td>General Safety Guidelines and Warnings</td>
<td>311</td>
</tr>
<tr>
<td>Chapter 37</td>
<td>Fire Safety Requirements</td>
<td>319</td>
</tr>
<tr>
<td>Chapter 38</td>
<td>Installation Safety Guidelines and Warnings</td>
<td>321</td>
</tr>
<tr>
<td>Chapter 39</td>
<td>Laser and LED Safety Guidelines and Warnings</td>
<td>329</td>
</tr>
</tbody>
</table>
Chapter 40  Maintenance and Operational Safety Guidelines and Warnings .......... 333
  Maintenance and Operational Safety Warnings for Juniper Networks Devices . . . . . . 333
    Battery Handling Warning ............................................. 333
    Jewelry Removal Warning ............................................. 334
    Lightning Activity Warning .......................................... 335
    Operating Temperature Warning .................................... 336
    Product Disposal Warning ........................................... 337

Chapter 41  Electrical Safety Guidelines and Warnings ................................. 339
  In Case of an Electrical Accident ..................................... 339
  General Electrical Safety Warnings for Juniper Networks Devices .................. 339
    Grounded Equipment Warning ....................................... 340
    Grounding Requirements and Warning ................................ 340
    Midplane Energy Hazard Warning .................................... 341
    Multiple Power Supplies Disconnection Warning ................................ 341
    Power Disconnection Warning ........................................ 342
  AC Power Electrical Safety Guidelines for the M120 Router ....................... 343
  Japanese AC Power Cord Warning for M Series and MX Series Routers ............ 344
  DC Power Electrical Safety Warnings for Juniper Networks Devices ................. 344
    DC Power Copper Conductors Warning ................................ 344
    DC Power Disconnection Warning ..................................... 345
    DC Power Wiring Terminations Warning ................................ 346
  DC Power Electrical Safety Guidelines for the M120 Router ....................... 347
  Site Electrical Wiring Guidelines for Juniper Networks Devices .................... 349
    Distance Limitations for Signaling .................................. 349
    Radio Frequency Interference ........................................ 349
    Electromagnetic Compatibility ....................................... 349

Chapter 42  Agency Approvals and Compliance Statements ........................... 351
  Agency Approvals for M120 Routers ...................................... 351
  Compliance Statements for EMC Requirements for the M120 Router (European Community) ................................................. 353
  Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada) ......................................................... 353
  Compliance Statements for EMC Requirements for Juniper Networks Devices (Israel) .......................................................... 353
  Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan) .......................................................... 354
  Compliance Statements for EMC Requirements for Juniper Networks Devices (United States) .................................................... 354
  Compliance Statements for Environmental Requirements .......................... 354
  Compliance Statements for NEBS for the M120 Router .......................... 354
  Compliance Statements for Acoustic Noise for the M120 Router ................. 355
List of Figures

Part 1 Overview

Chapter 3 Chassis Components and Descriptions .................................................. 7
Figure 1: Front View of a Fully Configured M120 Router Chassis .......................... 8
Figure 2: Rear View of a Fully Configured AC-Powered M120 Router Chassis .......... 8
Figure 3: Rear View of a Fully Configured DC-Powered M120 Router Chassis .......... 9
Figure 4: M120 Midplane .................................................................................. 10
Figure 5: M120 Cable Management System ......................................................... 11
Figure 6: Front Panel of the M120 Craft Interface .................................................. 11

Chapter 4 Cooling System Components and Descriptions ..................................... 19
Figure 7: Airflow Through the M120 Chassis ......................................................... 20
Figure 8: M120 Front Fan Tray ........................................................................ 20
Figure 9: M120 Rear Fan Tray ........................................................................ 20

Chapter 5 Host Subsystem Components and Descriptions ..................................... 21
Figure 10: M120 Routing Engine ..................................................................... 22
Figure 11: RE-A-1800x2 Routing Engine ................................................................ 23
Figure 12: USB Memory Device in an M120 Routing Engine ................................. 24
Figure 13: RE-A-1800x2 Routing Engine ............................................................. 26
Figure 14: USB Memory Device in a Routing Engine ............................................. 27
Figure 15: M120 CB .................................................................................... 48

Chapter 6 Line Card Components and Descriptions ............................................. 51
Figure 16: FPC and CFPCs Installed in an M120 Router Chassis ......................... 52
Figure 17: FPC1, FPC2, and FPC3 for the M120 Router ........................................ 53
Figure 18: FPC and CFPCs Installed in an M120 Router Chassis ............................ 55
Figure 19: Ethernet 10GBASE XFP CFPC for the M120 Router ......................... 55

Chapter 7 Power System Components and Descriptions .................................... 71
Figure 20: M120 DC Power Supply .................................................................. 72
Figure 21: M120 AC Power Supply .................................................................. 73

Chapter 8 Switch Fabric Components and Descriptions ..................................... 75
Figure 22: M120 FEB .................................................................................. 76

Part 2 Site Planning, Preparation, and Specifications

Chapter 9 Preparation Overview ............................................................................. 81
Figure 23: Typical Open-Frame Rack ................................................................. 85
Figure 24: M120 Chassis Dimensions and Clearance Requirements .................. 86
Figure 25: M120 DC Power and Grounding Cable Lug ....................................... 88

Chapter 10 AC Power Requirements and Specifications ...................................... 93
Figure 26: M120 AC Plug Types .................................................. 95

Chapter 11 DC Power Requirements and Specifications ......................... 97
Figure 27: Typical DC Source Cabling to the M120 Router ......................... 98

Part 3 Initial Installation and Configuration

Chapter 15 Unpacking the M120 .............................................. 113
Figure 28: Contents of the M120 Shipping Container ................................ 115

Chapter 16 Installing the Mounting Hardware ................................ 119
Figure 29: Installing the M120 Mounting Hardware for a Four-Post Rack or Cabinet ................................................................. 121
Figure 30: Installing the M120 Mounting Hardware for an Open-Frame Rack ........ 123

Chapter 17 Installing the M120 With a Mechanical Lift ......................... 125
Figure 31: Installing the M120 Router in the Rack ................................... 127

Chapter 18 Installing the M120 Without a Mechanical Lift .................... 129
Figure 32: Removing a Power Supply Before Installing the M120 Router ........ 131
Figure 33: Removing a FEB Before Installing the M120 Router .................. 132
Figure 34: Removing a CB Before Installing the M120 Router .................... 133
Figure 35: Removing an Upper Front Fan Tray Before Installing the M120 Router ........................................................................... 134
Figure 36: Removing a Lower Rear Fan Tray Before Installing the M120 Router ........................................................................... 135
Figure 37: Removing the Cable Management System Before Installing the M120 Router ........................................................................... 136
Figure 38: Removing an FPC Before Installing the M120 Router ................. 137
Figure 39: Removing a CFPC Before Installing the M120 Router ................. 138
Figure 40: Installing the M120 Router in the Rack ..................................... 141
Figure 41: Reinstalling a CB After Installing the M120 Router ..................... 143
Figure 42: Reinstalling a FEB After Installing the M120 Router .................... 144
Figure 43: Reinstalling a Power Supply After Installing the M120 Router .......... 145
Figure 44: Reinstalling an FPC After Installing the M120 Router .................. 146
Figure 45: Reinstalling a CFPC After Installing the M120 Router .................. 148
Figure 46: Reinstalling a Front Fan Tray After Installing the M120 Router .......... 149

Chapter 19 Connecting the M120 to Ground ......................................... 151
Figure 47: Connecting the Grounding Cable to the M120 Router ................. 152

Chapter 20 Connecting the M120 to External Devices ............................ 153
Figure 48: M120 Routing Engine Management Ports and Alarm Relay Contacts .................................................................................. 154
Figure 49: M120 Console and Auxiliary Serial Port Connector ..................... 155
Figure 50: M120 Routing Engine Management Ports and Alarm Relay Contacts .................................................................................. 156
Figure 51: M120 Routing Engine Ethernet Cable Connector .......................... 157
Figure 52: M120 Routing Engine External Device Ports ............................... 157
Figure 53: M120 Routing Engine Alarm Relay Contacts ............................... 159
Figure 54: M120 Routing Engine Ethernet Cable Connector .......................... 160
Figure 55: M120 Routing Engine External Device Ports ............................... 161
### List of Figures

**Chapter 21** Providing Power to the M120
- Figure 56: M120 Routing Engine Alarm Relay Contacts .................................. 163
- Figure 57: Attaching a Cable to an M120 PIC .................................................. 166

**Part 4** Installing and Replacing Components

**Chapter 24** Replacing Chassis Components
- Figure 60: M120 Routing Engine Interface Ports and Alarm Relay Contacts .... 184
- Figure 61: Removing the M120 Craft Interface ............................................... 185
- Figure 62: Installing the M120 Craft Interface ................................................. 186

**Chapter 25** Replacing Cooling System Components
- Figure 63: Removing the M120 Air Filter ...................................................... 188
- Figure 64: Installing the M120 Front Air Filter .............................................. 189
- Figure 65: Removing an M120 Upper Front Fan Tray ................................... 191
- Figure 66: Removing an M120 Lower Rear Fan Tray ................................... 191
- Figure 67: Installing an M120 Upper Front Fan Tray ................................... 192
- Figure 68: Installing an M120 Lower Rear Fan Tray ................................... 193

**Chapter 26** Replacing Host Subsystem Components
- Figure 69: Removing an M120 Routing Engine ............................................. 197
- Figure 70: Installing an M120 Routing Engine .............................................. 198
- Figure 71: RE-A-1800 Storage Drive Slots .................................................... 199
- Figure 72: RE-S-1800 Storage Drive Slots .................................................... 199
- Figure 73: Installing the DIMM Module ......................................................... 202
- Figure 74: Removing an M120 CB ................................................................ 204
- Figure 75: Installing an M120 CB ................................................................ 205
- Figure 76: M120 Routing Engine Interface Ports and Alarm Relay Contacts .. 206
- Figure 77: M120 Ethernet Cable Connectors ................................................... 206
- Figure 78: M120 Routing Engine Interface Ports and Alarm Relay Contacts .. 207
- Figure 79: M120 Routing Engine Interface Ports and Alarm Relay Contacts .. 208
- Figure 80: M120 Routing Engine Interface Ports and Alarm Relay Contacts .. 209
- Figure 81: M120 Routing Engine Interface Ports and Alarm Relay Contacts .. 210
- Figure 82: M120 Ethernet Cable Connectors ................................................... 211
- Figure 83: M120 Routing Engine Interface Ports and Alarm Relay Contacts .. 211

**Chapter 27** Replacing Line Card Components
- Figure 84: Removing an M120 FPC ................................................................ 215
- Figure 85: Installing an M120 FPC ................................................................ 218
- Figure 86: Connecting Fiber-Optic Cable to an M120 PIC .......................... 218
- Figure 87: Removing an M120 CFPC ............................................................... 220
- Figure 88: Installing an M120 CFPC ............................................................... 222
- Figure 89: Removing an M120 PIC ............................................................... 225
- Figure 90: Installing an M120 PIC ............................................................... 227
- Figure 91: Connecting Fiber-Optic Cable to an M120 PIC .......................... 230
- Figure 92: Removing a M120 XENPAK Module .......................................... 232
- Figure 93: Installing a M120 XENPAK Module .......................................... 234
- Figure 94: Removing M120 SFPs or XFPs ..................................................... 236
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>Replacing Power System Components</td>
<td>239</td>
</tr>
<tr>
<td></td>
<td>Figure 95: Removing an M120 AC Power Supply</td>
<td>241</td>
</tr>
<tr>
<td></td>
<td>Figure 96: Rear of the M120 Power Supply Showing Midplane Connector</td>
<td>241</td>
</tr>
<tr>
<td></td>
<td>Figure 97: Installing an M120 AC Power Supply</td>
<td>243</td>
</tr>
<tr>
<td></td>
<td>Figure 98: Disconnecting Power Cables from the M120 DC Power Supply</td>
<td>246</td>
</tr>
<tr>
<td></td>
<td>Figure 99: Removing an M120 DC Power Supply</td>
<td>248</td>
</tr>
<tr>
<td></td>
<td>Figure 100: Installing an M120 DC Power Supply</td>
<td>250</td>
</tr>
<tr>
<td></td>
<td>Figure 101: Connecting Power Cables to the M120 DC Power Supply</td>
<td>251</td>
</tr>
<tr>
<td>29</td>
<td>Replacing Switch Fabric Components</td>
<td>255</td>
</tr>
<tr>
<td></td>
<td>Figure 102: Removing an M120 FEB</td>
<td>256</td>
</tr>
<tr>
<td></td>
<td>Figure 103: Installing an M120 FEB</td>
<td>257</td>
</tr>
<tr>
<td>5</td>
<td>Maintaining the Chassis and Components</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Maintaining Components and Cables</td>
<td>263</td>
</tr>
<tr>
<td></td>
<td>Figure 104: Holding an M120 FPC Vertically</td>
<td>272</td>
</tr>
<tr>
<td></td>
<td>Figure 105: Holding an M120 FPC Horizontally</td>
<td>273</td>
</tr>
<tr>
<td></td>
<td>Figure 106: Do Not Grasp the Connector Edge</td>
<td>273</td>
</tr>
<tr>
<td></td>
<td>Figure 107: Do Not Carry an FPC with Only One Hand</td>
<td>274</td>
</tr>
<tr>
<td></td>
<td>Figure 108: Do Not Rest the FPC on an Edge</td>
<td>275</td>
</tr>
<tr>
<td>7</td>
<td>Contacting Customer Support and Returning the Chassis or Components</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Locating Component Serial Numbers</td>
<td>297</td>
</tr>
<tr>
<td></td>
<td>Figure 109: Serial Number ID Label</td>
<td>298</td>
</tr>
<tr>
<td></td>
<td>Figure 110: M120 Chassis Serial Number Label</td>
<td>299</td>
</tr>
<tr>
<td></td>
<td>Figure 111: M120 Craft Interface Serial Number Label</td>
<td>299</td>
</tr>
<tr>
<td></td>
<td>Figure 112: M120 Routing Engine Serial Number Label</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Figure 113: M120 CB Serial Number Label</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Figure 114: M120 FPC Serial Number Label</td>
<td>301</td>
</tr>
<tr>
<td></td>
<td>Figure 115: M120 Routing Engine Serial Number Label</td>
<td>301</td>
</tr>
<tr>
<td></td>
<td>Figure 116: M120 PIC Serial Number Label</td>
<td>302</td>
</tr>
<tr>
<td></td>
<td>Figure 117: M120 AC Power Supply Serial Number Label</td>
<td>303</td>
</tr>
<tr>
<td></td>
<td>Figure 118: M120 DC Power Supply Serial Number Label</td>
<td>303</td>
</tr>
<tr>
<td></td>
<td>Figure 119: M120 FEB Serial Number Label</td>
<td>304</td>
</tr>
<tr>
<td>8</td>
<td>Safety and Compliance Information</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>General Safety Guidelines and Warnings</td>
<td>311</td>
</tr>
<tr>
<td></td>
<td>Figure 120: Placing a Component into an Electrostatic Bag</td>
<td>316</td>
</tr>
</tbody>
</table>
# List of Tables

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>About the Documentation</strong></td>
<td>xxi</td>
</tr>
<tr>
<td>Table 1: Notice Icons</td>
<td>xxii</td>
</tr>
<tr>
<td>Table 2: Text and Syntax Conventions</td>
<td>xxii</td>
</tr>
<tr>
<td><strong>Part 1 Overview</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Chapter 3</strong></td>
<td></td>
</tr>
<tr>
<td>Chassis Components and Descriptions</td>
<td>7</td>
</tr>
<tr>
<td>Table 3: M120 Alarm LEDs and Alarm Cutoff/Lamp Test Button</td>
<td>13</td>
</tr>
<tr>
<td>Table 4: M120 Host Subsystem LEDs</td>
<td>14</td>
</tr>
<tr>
<td>Table 5: FEB LEDs on the M120 Craft Interface</td>
<td>15</td>
</tr>
<tr>
<td>Table 6: M120 FPC LEDs</td>
<td>15</td>
</tr>
<tr>
<td>Table 7: Power Supply LEDs on the M120 Craft Interface</td>
<td>15</td>
</tr>
<tr>
<td>Table 8: External Clock LEDs on the M120 Craft Interface</td>
<td>16</td>
</tr>
<tr>
<td><strong>Chapter 5</strong></td>
<td></td>
</tr>
<tr>
<td>Host Subsystem Components and Descriptions</td>
<td>21</td>
</tr>
<tr>
<td>Table 9: M120 Routing Engine LED</td>
<td>25</td>
</tr>
<tr>
<td>Table 10: Routing Engine LEDs</td>
<td>28</td>
</tr>
<tr>
<td>Table 11: Routing Engine Specifications</td>
<td>29</td>
</tr>
<tr>
<td>Table 12: End-of-Life Routing Engine Specifications</td>
<td>32</td>
</tr>
<tr>
<td>Table 13: M7i Routing Engines</td>
<td>34</td>
</tr>
<tr>
<td>Table 14: M10i Routing Engines</td>
<td>34</td>
</tr>
<tr>
<td>Table 15: M40e Routing Engines</td>
<td>35</td>
</tr>
<tr>
<td>Table 16: M120 Routing Engines</td>
<td>35</td>
</tr>
<tr>
<td>Table 17: M320 Routing Engines</td>
<td>36</td>
</tr>
<tr>
<td>Table 18: MX5, MX10, MX40, and MX80 Routing Engine</td>
<td>36</td>
</tr>
<tr>
<td>Table 19: MX104 Routing Engines</td>
<td>37</td>
</tr>
<tr>
<td>Table 20: MX240 Supported Routing Engines</td>
<td>37</td>
</tr>
<tr>
<td>Table 21: MX480 Supported Routing Engines</td>
<td>38</td>
</tr>
<tr>
<td>Table 22: MX960 Supported Routing Engines</td>
<td>39</td>
</tr>
<tr>
<td>Table 23: MX2008 Supported Routing Engines</td>
<td>40</td>
</tr>
<tr>
<td>Table 24: MX2010 Supported Routing Engines</td>
<td>40</td>
</tr>
<tr>
<td>Table 25: MX2020 Supported Routing Engines</td>
<td>40</td>
</tr>
<tr>
<td>Table 26: MX10003 Supported Routing Engines</td>
<td>41</td>
</tr>
<tr>
<td>Table 27: PTX1000 Routing Engines</td>
<td>41</td>
</tr>
<tr>
<td>Table 28: PTX3000 Routing Engines</td>
<td>42</td>
</tr>
<tr>
<td>Table 29: PTX5000 Routing Engines</td>
<td>43</td>
</tr>
<tr>
<td>Table 30: PTX10008 and PTX10016 Routing Engines</td>
<td>43</td>
</tr>
<tr>
<td>Table 31: T320 Routing Engines</td>
<td>43</td>
</tr>
<tr>
<td>Table 32: T640 Routing Engines</td>
<td>44</td>
</tr>
<tr>
<td>Table 33: T1600 Routing Engines</td>
<td>45</td>
</tr>
<tr>
<td>Table 34: T4000 Routing Engines</td>
<td>46</td>
</tr>
</tbody>
</table>
Chapter 6  Line Card Components and Descriptions ........................................ 51
Table 39: FPCs Supported by the M120 Router ........................................... 56
Table 40: CFPCs Supported by the M120 Router ......................................... 57
Table 41: PICs Supported in the M120 Router .............................................. 58
Table 42: End-of-Life PICs Supported in the M120 Router ......................... 63
Table 43: M120 PIC/FPC Compatibility ....................................................... 66

Chapter 7  Power System Components and Descriptions ............................ 71
Table 44: M120 Power Supply LED .......................................................... 74

Chapter 8  Switch Fabric Components and Descriptions .......................... 75
Table 45: M120 FEB LEDs ........................................................................ 77

Part 2  Site Planning, Preparation, and Specifications

Chapter 9  Preparation Overview ............................................................. 81
Table 46: M120 Site Preparation Checklist ............................................... 81
Table 47: M120 Physical Specifications .................................................... 82
Table 48: M120 Rack Requirements and Specifications ............................. 84
Table 49: M120 Router Environmental Specifications ............................... 86
Table 50: Power System Electrical Specifications ................................... 88
Table 51: AC Power Supply Electrical Specifications ............................... 89
Table 52: DC Power Supply Electrical Specifications ................................ 89
Table 53: Component Power Requirements ............................................. 89

Chapter 10  AC Power Requirements and Specifications ......................... 93
Table 54: AC Power Cord Specifications .................................................. 94
Table 55: AC Power Supply Electrical Specifications ............................... 96

Chapter 11  DC Power Requirements and Specifications ........................ 97
Table 56: M120 DC Power and Grounding Cable Specifications ............... 99
Table 57: DC Power Supply Electrical Specifications ................................ 100

Chapter 12  Network Cable and Transceiver Planning ............................ 101
Table 58: Estimated Values for Factors Causing Link Loss ....................... 103

Chapter 13  Management Cable and Transceiver Specifications and Pinouts ... 105
Table 59: Routing Engine Interface Cable and Wire Specifications ............ 105
Table 60: RJ-45 Connector Pinout for the Routing Engine ETHERNET Port ... 106
Table 61: RJ-45 Connector Pinout for the Routing Engine AUX and CONSOLE Ports ................................................................. 106
Table 62: RJ-45 Connector Pinout for the External Interface Ports ............. 107

Part 3  Initial Installation and Configuration

Chapter 15  Unpacking the M120 ........................................................... 113
Table 63: Parts List for a Fully Configured M120 Router ......................... 115
List of Tables

Table 64: Accessory Box Parts List ................................................................. 116

Chapter 16 Installing the Mounting Hardware .................................. 119
  Table 65: Four-Post Rack or Cabinet Mounting Hole Locations for the M120 Router ................................................................. 119
  Table 66: Open-Frame Rack Mounting Hole Locations for the M120 Router ................................................................. 121

Part 4 Installing and Replacing Components

Chapter 23 Overview of Installing and Replacing Components ................. 179
  Table 67: M120 Field-Replaceable Units ............................................................. 180
  Table 68: Tools and Parts Required ................................................................. 180

Part 5 Maintaining the Chassis and Components

Chapter 31 Maintaining Components and Cables .................................. 263
  Table 69: Effect of Taking the M120 Host Subsystem Offline ................. 268
About the Documentation

• Documentation and Release Notes on page xxi
• Documentation Conventions on page xxi
• Documentation Feedback on page xxiii
• Requesting Technical Support on page xxiv

Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at https://www.juniper.net/documentation/.

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

Juniper Networks Books publishes books by Juniper Networks engineers and subject matter experts. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration. The current list can be viewed at https://www.juniper.net/books.

Documentation Conventions

Table 1 on page xxii defines notice icons used in this guide.
### Table 1: Notice Icons

<table>
<thead>
<tr>
<th>Icon</th>
<th>Meaning</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔄</td>
<td>Informational note</td>
<td>Indicates important features or instructions.</td>
</tr>
<tr>
<td>⚠️</td>
<td>Caution</td>
<td>Indicates a situation that might result in loss of data or hardware damage.</td>
</tr>
<tr>
<td>⚠️</td>
<td>Warning</td>
<td>Alerts you to the risk of personal injury or death.</td>
</tr>
<tr>
<td>⚠️</td>
<td>Laser warning</td>
<td>Alerts you to the risk of personal injury from a laser.</td>
</tr>
<tr>
<td>💡</td>
<td>Tip</td>
<td>Indicates helpful information.</td>
</tr>
<tr>
<td>🌟</td>
<td>Best practice</td>
<td>Alerts you to a recommended use or implementation.</td>
</tr>
</tbody>
</table>

*Table 2 on page xxii defines the text and syntax conventions used in this guide.*

### Table 2: Text and Syntax Conventions

<table>
<thead>
<tr>
<th>Convention</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bold text like this</strong></td>
<td>Represents text that you type.</td>
<td>To enter configuration mode, type the <code>configure</code> command:</td>
</tr>
<tr>
<td></td>
<td></td>
<td><code>user@host&gt; configure</code></td>
</tr>
<tr>
<td><strong>Fixed-width text like this</strong></td>
<td>Represents output that appears on the terminal screen.</td>
<td><code>user@host&gt; show chassis alarms</code></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No alarms currently active</td>
</tr>
<tr>
<td><strong>Italic text like this</strong></td>
<td>• introduces or emphasizes important new terms.</td>
<td>• A policy term is a named structure that defines match conditions and actions.</td>
</tr>
<tr>
<td></td>
<td>• Identifies guide names.</td>
<td>• <em>Junos OS CLI User Guide</em></td>
</tr>
<tr>
<td></td>
<td>• Identifies RFC and Internet draft titles.</td>
<td>• RFC 1997, <em>BGP Communities Attribute</em></td>
</tr>
<tr>
<td><strong>Italic text like this</strong></td>
<td>Represents variables (options for which you substitute a value) in commands or configuration statements.</td>
<td>Configure the machine’s domain name:</td>
</tr>
</tbody>
</table>
|                                  |                                       | `[edit]
root@# set system domain-name domain-name`                             |
### Table 2: Text and Syntax Conventions (continued)

<table>
<thead>
<tr>
<th>Convention</th>
<th>Description</th>
<th>Examples</th>
</tr>
</thead>
</table>
| **Text like this** | Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components. | • To configure a stub area, include the `stub-statement at the [edit protocols ospf area area-id] hierarchy level.  
• The console port is labeled **CONSOLE**. |
| `< >` (angle brackets) | Encloses optional keywords or variables. | `stub <default-metric metric>;` |
| `|` (pipe symbol) | Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity. | `broadcast | multicast`  
`string1 | string2 | string3` |
| `#` (pound sign) | Indicates a comment specified on the same line as the configuration statement to which it applies. | `rsvp [ # Required for dynamic MPLS only` |
| `[ ]` (square brackets) | Encloses a variable for which you can substitute one or more values. | `community name members [community-ids ]` |
| Indention and braces `{ }` | Identifies a level in the configuration hierarchy. | `[edit]`  
`routing-options {`  
`static {`  
`next-hop address;`  
`retain;`  
`}`  
`}` |
| `:` (semicolon) | Identifies a leaf statement at a configuration hierarchy level. | |

### GUI Conventions

| **Bold text like this** | Represents graphical user interface (GUI) items you click or select. | • In the Logical Interfaces box, select **All Interfaces**.  
• To cancel the configuration, click **Cancel**. |
| `>` (bold right angle bracket) | Separates levels in a hierarchy of menu selections. | In the configuration editor hierarchy, select **Protocols>Osfp**. |

### Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can provide feedback by using either of the following methods:

- **Online feedback rating system**—On any page of the Juniper Networks TechLibrary site at [https://www.juniper.net/documentation/index.html](https://www.juniper.net/documentation/index.html), simply click the stars to rate the content, and use the pop-up form to provide us with information about your experience. Alternately, you can use the online feedback form at [https://www.juniper.net/documentation/feedback/](https://www.juniper.net/documentation/feedback/).
E-mail—Send your comments to techpubs-comments@juniper.net. Include the document or topic name, URL or page number, and software version (if applicable).

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Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or Partner Support Service support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.


Product warranties—For product warranty information, visit https://www.juniper.net/support/warranty/.

JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

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For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: https://www.juniper.net/customers/support/
- Search for known bugs: https://prsearch.juniper.net/
- Find product documentation: https://www.juniper.net/documentation/
- Find solutions and answer questions using our Knowledge Base: https://kb.juniper.net/
- Download the latest versions of software and review release notes: https://www.juniper.net/customers/csc/software/
- Search technical bulletins for relevant hardware and software notifications: https://kb.juniper.net/InfoCenter/
- Join and participate in the Juniper Networks Community Forum: https://www.juniper.net/company/communities/
- Open a case online in the CSC Case Management tool: https://www.juniper.net/cm/

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: https://entitlementsearch.juniper.net/entitlementsearch/

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at https://www.juniper.net/cm/.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).
For international or direct-dial options in countries without toll-free numbers, see https://www.juniper.net/support/requesting-support.html.
PART 1

Overview

- System Overview on page 3
- M120 Router Release Notes on page 5
- Chassis Components and Descriptions on page 7
- Cooling System Components and Descriptions on page 19
- Host Subsystem Components and Descriptions on page 21
- Line Card Components and Descriptions on page 51
- Power System Components and Descriptions on page 71
- Switch Fabric Components and Descriptions on page 75
System Overview

- M120 Router Description on page 3
- M120 Component Redundancy on page 4

M120 Router Description

The M120 Multiservice Edge router is a complete routing system that provides SONET/SDH, ATM, Ethernet, and channelized interfaces for large networks and network applications, such as those supported by Internet service providers (ISPs) and large enterprise customers. Application-specific integrated circuits (ASICs), a definitive part of the router design, enable the router to forward data at the high speeds demanded by current network media.

The router provides multiple redundancy options and chassis configurations, enhanced ASIC features, and chassis and Packet Forwarding Engine (PFE) scaling. PFE routing functionality is performed by Forwarding Engine Boards (FEBs) which separate routing ASICs from Flexible PIC Concentrators (FPCs) to provide high availability and redundancy of the forwarding engine. The router utilizes the I-chip ASIC, which supports up to 32,000 logical interfaces depending on your configuration. The base chassis provides 120 gigabits per second (Gbps) of midplane bandwidth between the interfaces and FEBs, and 144 Gbps, half duplex, of fabric bandwidth between the FEBs.

The router is a quarter-rack chassis that supports up to six FPCs. Four slots accept FPCs of Types 1, 2, and 3 and two slots accept Compact FPCs (CFPCs). Each FPC can be configured with a variety of network media types, altogether providing up to 130 physical interface ports per system. The CFPC slots are identical to the Type 1, 2, and 3 FPC slots, but feature a smaller form factor to provide higher density 10-Gigabit interfaces. The router height of 20.75 in. (52.71 cm) enables stacked installation of four routers in a single floor-to-ceiling rack, for increased port density per unit of floor space. In a standalone configuration, the router’s maximum aggregate throughput is 60 Gbps, full duplex.

The router architecture separates control operations from packet forwarding operations, which helps to eliminate processing and traffic bottlenecks. Control operations in the router are performed by the Routing Engine, which runs Junos OS to handle routing protocols, traffic engineering, policy, policing, monitoring, and configuration management. Forwarding operations in the router are performed by the Packet Forwarding Engine (PFE), which includes ASICs, designed by Juniper Networks contained on the FEBs. The redundant FEBs provide route lookup and forwarding functions from the PICs and CFPCs...
with fast switchover times and higher bandwidth PFEs provide support for larger numbers of PICs.

**M120 Component Redundancy**

A fully configured router is designed so that no single point of failure can cause the entire system to fail. Only a fully configured router provides complete redundancy. All other configurations provide partial redundancy. The following major hardware components are redundant:

- **Host subsystem**—The host subsystem requires a Routing Engine to be installed directly into the CB. The router can have one or two host subsystems. If two host subsystems are installed, one functions as the master and the other functions as the backup. If the master host subsystem (or either of its components) fails, the backup can take over as the master.

- **Power supplies**—A router with two AC power supplies or two DC power supplies is fully power redundant. In both AC and DC configurations, the power supplies share the load almost evenly.

  **CAUTION:** Mixing AC and DC power supplies is not supported. The first power supply powered on will electrically disable the second power supply without damaging any components in the system.

- **Cooling system**—The cooling system has redundant components, which are controlled by the host subsystem. If one of the fans fails, the host subsystem increases the speed of the remaining fans to provide sufficient cooling for the router indefinitely.
CHAPTER 2

M120 Router Release Notes

- Outstanding Issues with the M120 Router on page 5
- Errata with the M120 Router Documentation on page 5

Outstanding Issues with the M120 Router

This section lists outstanding issues with the M120 Multiservice Edge Router. For information about software issues, see the Junos OS Release Notes.

- There are currently no outstanding issues for the M120 router documentation.

Errata with the M120 Router Documentation

This section lists outstanding issues with the documentation.

- External clock synchronization on M120 routers is supported but not currently documented in the M120 Hardware Guide. External clock synchronization enables you to configure an interface that synchronizes the router’s internal Stratum 3 clock to an external source, and then synchronize the chassis interface clock to that source. You can configure the feature for external primary and secondary interfaces that use Building Integrated Timing System (BITS) or SDH Equipment Timing Source (SETS) timing sources, or an equivalent quality timing source. To configure, include the synchronization statement at the [edit chassis] hierarchy level. To view information about the external source used for chassis synchronization, issue the show chassis synchronization command. To change the external clock source, issue the request chassis synchronization switch command. To change the external clock source, issue the request chassis synchronization switch command. Refer to the System Basics, and System Basics Command Reference for configuration information.

Related Documentation

- Outstanding Issues with the M120 Router on page 5
M120 Router Chassis Description

The router chassis is a rigid sheet metal structure that houses all the other router components (see Figure 1 on page 8, Figure 2 on page 8, and Figure 3 on page 9). The chassis measures 20.75 in. (52.71 cm) high, 17.43 in. (44.3 cm) wide, and 24.3 in. (61.7 cm) deep (from the front-mounting flanges to the rear of the chassis). The chassis installs in standard 800-mm (or larger) enclosed cabinets, 19-in. equipment racks, or telco open-frame racks. Up to four routers can be installed in one standard (48-U) rack if the rack can handle their combined weight, which can be greater than 900 lb (408.4 kg).

The chassis includes three electrostatic discharge points (banana plug receptacle). Two are located in the front of the chassis and one in the rear of the chassis.

CAUTION: Before removing or installing components of a router, attach an ESD strap to an ESD point and place the other end of the strap around your bare wrist. Failure to use an ESD strap can result in damage to the router.

WARNING: The router must be connected to earth ground during normal operation.
Figure 3: Rear View of a Fully Configured DC-Powered M120 Router Chassis

For chassis serial number information, see “Displaying M120 Router Components and Serial Numbers” on page 297.

Related Documentation
• M120 Router Physical Specifications on page 82
• General Safety Warnings for Juniper Networks Devices on page 314
• General Safety Guidelines for Juniper Networks Devices on page 313
• M120 Chassis Lifting Guidelines on page 321

M120 Midplane Description

The midplane is located in the center of the chassis and forms the rear of the FPC card cage (see Figure 4 on page 10). The FPCs install into the midplane from the front of the chassis, and the FEBs, Routing Engines, power supplies, and CBs install into the midplane from the rear of the chassis. The power supplies and cooling system components also connect to the midplane.

The midplane performs the following major functions:

• Data path—Data packets are transferred across the midplane between an FPC and its associated FEB, and between the FEBs via the fabric ASICs on the CB.
- Power distribution—The router power supplies are connected to the midplane, which distributes power to all the router components.
- Signal path—The midplane provides the signal path to the FPCs, FEBs, Routing Engines, CB, and other system components for monitoring and control of the system.

Figure 4: M120 Midplane

For chassis serial number information, see “Displaying M120 Router Components and Serial Numbers” on page 297.

M120 Cable Management System Description

The cable management system (see Figure 5 on page 11) consists of a row of nine semicircular plastic bobbins mounted on the front of the router below the FPC card cage. The PIC cables pass between the bobbins and into the tray, keeping the cables organized and securely in place. The curvature of the bobbins also helps maintain the proper bend radius for optical PIC cables.

You can pull the cable management system up and outward to lock it into the maintenance position. This allows you to access the lower fan tray and the front air filter.
M120 Craft Interface Description

The craft interface allows you to view status and troubleshooting information at a glance and to perform many system control functions. It is hot-insertable and hot-removable. The craft interface is located on the front of the router above the upper fan tray and contains the following:

Craft Interface Front Panel

The craft interface allows you to view status and troubleshooting information at a glance and to perform many system control functions. It is hot-insertable and hot-removable. The craft interface is located on the front of the router above the upper fan tray and contains the following:

Figure 6: Front Panel of the M120 Craft Interface

The front panel of the craft interface contains:

- Yellow Minor Alarm LED, red Major Critical Alarm LED.
- Alarm cutoff/lamp test ACO/LT button.
- Chassis Status Master and Standby LEDs.
- OK, FAIL, and ACT LEDs for each TXP-F13 SIB.
- OK and FAIL LEDs for the front and rear fan trays.
- OK and FAIL LEDs for each power supply.

**M120 Alarm Relay Contacts on the Craft Interface**

The host interface has two alarm relay contacts for connecting the router to external alarm devices (see Figure 6 on page 11). Whenever a system condition triggers either the red or yellow alarm on the craft interface, the alarm relay contacts are also activated. The alarm relay contacts are located below the Routing Engine ports.

**M120 External Clock Interface Ports on the Craft Interface**

Two external clock ports EXT CLOCK to the right of the craft interface alarm LEDs enable you to connect the router's internal Stratum 3 clock to an external reference clock source with an RJ-45 cable. Using the router's software, you can configure the internal Stratum 3 clock to synchronize with an external Building Integrated Timing System (BITS) or SDH Equipment Timing Source (SETS) timing source by including a clock synchronization statement at the [edit chassis] hierarchy level.

---

**NOTE:** Refer to the, Junos OS Administration Library for configuration information.

The EXT CLOCK ports are labeled A and B. They accept two RJ-45 connectors for external clock inputs with T1 or E1 reference clocks.

**M120 Routing Engine Interface Ports and Status Indicators**

To the right of the alarm relay contact on the craft interface are two sets of ports that connect the Routing Engines to one or more external devices on which system administrators can issue Junos OS command-line interface (CLI) commands to manage the router (see Figure 6 on page 11). The set of ports in the left connects to the Routing Engine in the left Routing Engine slot (REO) and the set on the right connects to the Routing Engine (RE1) in the right Routing Engine slot.

The ports with the indicated label in each set function as follows:

- **AUX**—Connects the Routing Engine to a laptop, modem, or other auxiliary device through a cable with an RJ-45 connector.
- **CONSOLE**—Connects the Routing Engine to a system console through a cable with an RJ-45 connector.
- **ETHERNET**—Connects the Routing Engine through an Ethernet connection to a management LAN (or any other device that plugs into an Ethernet connection) for out-of-band management. The port uses an autosensing RJ-45 connector to support both 10- and 100-Mbps connections. Two small LEDs on the bottom of the port indicate the connection in use: the LED lights yellow or green for a 10-Mbps or 100-Mbps connection, and the LED lights green when traffic is passing through the port.
M120 Alarm LEDs and Alarm Cutoff/Lamp Test Button

Two large alarm LEDs are located at the upper left of the craft interface (see Figure 6 on page 11). The circular red LED lights to indicate a critical condition that can result in a system shutdown. The triangular yellow LED lights to indicate a less severe condition that requires monitoring or maintenance. Both LEDs can be lit simultaneously.

A condition that causes an LED to light also activates the corresponding alarm relay contact on the craft interface, as described in “M120 Alarm Relay Contacts on the Craft Interface” on page 17.

To deactivate red and yellow alarms, press the button labeled ACO/LT (for “alarm cutoff/lamp test”), which is located to the right of the alarm LEDs. Deactivating an alarm turns off both LEDs and deactivates the device attached to the corresponding alarm relay contact on the craft interface.

Table 3 on page 13 describes the alarm LEDs and alarm cutoff button in more detail.

Table 3: M120 Alarm LEDs and Alarm Cutoff/Lamp Test Button

<table>
<thead>
<tr>
<th>Shape</th>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>![CriticalAlarmLED]</td>
<td>Red</td>
<td>On steadily</td>
<td>Critical alarm LED—Indicates a critical condition that can cause the router to stop functioning. Possible causes include component removal, failure, or overheating.</td>
</tr>
<tr>
<td>![WarningAlarmLED]</td>
<td>Yellow</td>
<td>On steadily</td>
<td>Warning alarm LED—Indicates a serious but nonfatal error condition, such as a maintenance alert or a significant increase in component temperature.</td>
</tr>
<tr>
<td>![ACOLT]</td>
<td>—</td>
<td>—</td>
<td>Alarm cutoff/lamp test button—Deactivates red and yellow alarms. Causes all LEDs on the craft interface to light (for testing purposes), when pressed and held.</td>
</tr>
</tbody>
</table>
M120 Component LEDs on the Craft Interface

Each host subsystem has three LEDs, located in the middle of the craft interface, that indicate its status. The LED labeled 0 indicates the status of the Routing Engine and CB installed in slot CB0. The LED labeled 1 indicates the status of the Routing Engine and CB installed in slot CB1. Table 4 on page 14 describes the functions of the host subsystem LEDs.

Table 4: M120 Host Subsystem LEDs

<table>
<thead>
<tr>
<th>Label</th>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMASTER</td>
<td>Green</td>
<td>On steadily</td>
<td>Routing Engine is the master.</td>
</tr>
<tr>
<td>RE STATUS</td>
<td>Green</td>
<td>On steadily</td>
<td>The Routing Engine is functioning.</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>On steadily</td>
<td>The Routing Engine has failed.</td>
</tr>
<tr>
<td>CB STATUS</td>
<td>Green</td>
<td>On steadily</td>
<td>The board is online.</td>
</tr>
<tr>
<td></td>
<td>Blinking</td>
<td></td>
<td>The board is transitioning online/offline.</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>On steadily</td>
<td>The CB has failed.</td>
</tr>
</tbody>
</table>

Ethernet Port LEDs on the Craft Interface

Two small LEDs on the bottom of the ETHERNET port indicate the connection in use: the LED lights yellow or green for a 10-Mbps or 100-Mbps connection, and the LED lights green when traffic is passing through the port. Related Documentation M Series RJ-45 Connector Pinouts for the M120 Routing Engine ETHERNET Port RJ-45 Connector Pinouts for the Routing Engine AUX and CONSOLE Ports RJ-45 Connector Pinouts for the External Clock Ports
FEB LEDs on the M120 Craft Interface

Each FEB has two LEDs on the craft interface that indicate its status. The LEDs, labeled 0 through 5, are located on the lower right of the craft interface below the **FEBS** label. Table 5 on page 15 describes the functions of the FEB LEDs.

<table>
<thead>
<tr>
<th>Label</th>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTIVE</td>
<td>Green</td>
<td>On steadily</td>
<td>FEB is active.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinking</td>
<td>FEB is transitioning online/offline.</td>
</tr>
<tr>
<td>STATUS</td>
<td>Green</td>
<td>On steadily</td>
<td>FEB is functioning normally.</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>On steadily</td>
<td>FEB is not functioning normally.</td>
</tr>
</tbody>
</table>

FPC LEDs on the M120 Craft Interface

Each FPC slot has one LED that indicates its status. The FPC LEDs, labeled **FPC0** through **FPC5**, are located along the bottom of the craft interface. Table 6 on page 15 describes the functions of the FPC LEDs.

<table>
<thead>
<tr>
<th>Label</th>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATUS</td>
<td>Red</td>
<td>On steadily</td>
<td>FPC has failed.</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>On steadily</td>
<td>FPC is functioning normally.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinking</td>
<td>FPC is transitioning online/offline.</td>
</tr>
</tbody>
</table>

Power Supply LEDs on the M120 Craft Interface

Each power supply has one LED on the craft interface that indicates its status. The LEDs, labeled 0 and 1, are located on the lower left of the craft interface under the **POWER** label. Table 7 on page 15 describes the functions of the power supply LEDs.

<table>
<thead>
<tr>
<th>Label</th>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>STATUS</td>
<td>Red</td>
<td>On steadily</td>
<td>Power supply has failed.</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>On steadily</td>
<td>Power supply is functioning normally.</td>
</tr>
</tbody>
</table>

External Clocking Inputs LEDs on the M120 Craft Interface

The **EXT CLOCK** ports are labeled **A** and **B**.
Two bi-color LEDs in the lower left and right corners of each port indicate port status. The LED on the lower left as you face the craft interface indicates whether an external clock source is present. The LED on the lower right as you face the craft interface indicates if there is a fault. Table 8 on page 16 describes the external clock port LEDs.

**Table 8: External Clock LEDs on the M120 Craft Interface**

<table>
<thead>
<tr>
<th>Label</th>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Green</td>
<td>On steadily</td>
<td>External clock source is plugged into the port, physical signal is present.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– Off</td>
<td>No external clock source is plugged into the port, no physical signal is present.</td>
</tr>
<tr>
<td>B</td>
<td>Yellow</td>
<td>On steadily</td>
<td>Fault condition; external reference clock frequency is out of the tolerance threshold deviation of 10 parts-per-million (PPM).</td>
</tr>
<tr>
<td>(Fault LED)</td>
<td></td>
<td>– Off</td>
<td>External clock signal is validated or no external clock source is plugged into the port.</td>
</tr>
</tbody>
</table>

**Related Documentation**
- M120 Craft Interface Description on page 11
- Maintaining the M120 Host Subsystem on page 266
- Replacing the M120 Craft Interface on page 184

**M120 External Clock Interface Ports on the Craft Interface**

Two external clock ports EXT CLOCK to the right of the craft interface alarm LEDs enable you to connect the router’s internal Stratum 3 clock to an external reference clock source with an RJ-45 cable. Using the router’s software, you can configure the internal Stratum 3 clock to synchronize with an external Building Integrated Timing System (BITS) or SDH Equipment Timing Source (SETS) timing source by including a clock synchronization statement at the [edit chassis] hierarchy level.

**NOTE:** Refer to the, Junos OS Administration Library for configuration information.

The EXT CLOCK ports are labeled A and B. They accept two RJ-45 connectors for external clock inputs with T1 or E1 reference clocks.

Two bi-color LEDs in the lower left and right corners of each port indicate port status. The LED on the lower left as you face the craft interface indicates whether an external clock source is present. The LED on the lower right as you face the craft interface indicates if there is a fault. Table 8 on page 16 describes the external clock port LEDs.
M120 Alarm Relay Contacts on the Craft Interface

The host interface has two alarm relay contacts for connecting the router to external alarm devices (see Figure 6 on page 11). Whenever a system condition triggers either the red or yellow alarm on the craft interface, the alarm relay contacts are also activated. The alarm relay contacts are located below the Routing Engine ports.

Related Documentation
- RJ-45 Connector Pinouts for the External Clock Ports on page 107
- Connecting the M120 Router to an External Clocking Device on page 163

- M120 Craft Interface Description on page 11
- Maintaining the M120 Power Supplies on page 277
- Replacing Alarm Relay Wires on the M120 Craft Interface on page 183
CHAPTER 4

Cooling System Components and Descriptions

- M120 Cooling System Description on page 19

M120 Cooling System Description

The cooling system consists of the following components:

- Two front fan trays
- Two rear fan trays
- Front air filter

The cooling system components work together to keep all router components within the acceptable temperature range (see Figure 7 on page 20, Figure 8 on page 20, and Figure 9 on page 20). The router cooling system comprises two front and two rear fan trays (see Figure 1 on page 8 and Figure 2 on page 8). Both the front and rear fan trays install horizontally above and below the front and rear card cages. Each fan tray contains eight fans. The two front fan trays are interchangeable, the two rear fan trays are interchangeable, but the front and rear fan trays are not interchangeable. The fan trays are hot-insertable and hot-removable. The front fan trays cool the components installed in the front card cage (the FPCs, CFPCs, PICs, and craft interface). The rear fan trays cool the components installed in the rear card cage (the Routing Engines, CBs, power supplies, and FEBs). Figure 7 on page 20 shows the airflow through the router.

An air filter in the front in the chassis located beneath the lower fan tray helps keep dust and other particles from entering the cooling system. To function properly, the entire cooling system requires an unobstructed airflow and proper clearance around the site, as described in “M120 Clearance Requirements for Airflow and Hardware Maintenance” on page 85.
Figure 7: Airflow Through the M120 Chassis

The host subsystem monitors the temperature of the router components. When the router is operating normally, the fans function at lower than full speed. If a fan fails or the ambient temperature rises above a threshold, the speed of the remaining fans is automatically adjusted to keep the temperature within the acceptable range. If the ambient maximum temperature specification is exceeded and the system cannot be adequately cooled, the Routing Engine shuts down the system by disabling output power from each PEM.

Both the front and rear card cages pull air from a single intake in the front of the router. Air is pushed up through both card cages where it combines in a common exhaust plenum and is exhausted out the upper sides and rear of the system. Some air is circulated back down through the power supplies and is exhausted out the lower rear area of the chassis below the power supplies.

Figure 8: M120 Front Fan Tray

Figure 9: M120 Rear Fan Tray

Related Documentation

- Troubleshooting the M120 Cooling System on page 286
- Maintaining the M120 Air Filter on page 263
- Replacing an M120 Air Filter on page 187
- Maintaining the M120 Fan Trays on page 264
- Replacing an M120 Fan Tray on page 190
Host Subsystem Components and Descriptions

- M120 Host Subsystem Description on page 21
- M120 Routing Engine Description on page 22
- M120 Routing Engine LEDs on page 25
- M120 RE-A-1800x2 Routing Engine Description on page 25
- RE-A-1800 Routing Engine LEDs on page 27
- M120 Routing Engine Interface Ports and Status Indicators on page 28
- Routing Engine Specifications on page 29
- Supported Routing Engines by Router on page 33
- M120 Control Board (CB) Description on page 47
- M120 Control Board (CB) LEDs on page 48

M120 Host Subsystem Description

The host subsystem provides the routing and system management functions of the router. You can install one or two host subsystems on the router. Each host subsystem functions as a unit; the Routing Engine must be installed directly into the Control Board.

NOTE: We recommend you install two host subsystems for redundant protection. If you install only one host subsystem, we recommend you install it in slot CB0.

Each host subsystem has three LEDs that display its status. The host subsystem LEDs are located in the middle of the craft interface. For more information about the host subsystem LEDs, see “Host Subsystem LEDs on the M120 Craft Interface” on page 14.

The host subsystem consists of the following components:

- Taking the M120 Host Subsystem Offline on page 267
- Maintaining the M120 Host Subsystem on page 266
- M120 Routing Engine Description on page 22
The Routing Engine runs the Junos OS. The software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the router, control the router interfaces, control some chassis components, and provide the interface for system management and user access to the router.

You can install one or two Routing Engines in the router. The Routing Engines install into the rear of the chassis in vertical slots directly into the CB labeled CB0 and CB1. If two Routing Engines are installed, one functions as the master and the other acts as the backup. If the master Routing Engine fails or is removed, and the backup is configured appropriately, the backup takes over as the master. For detailed information, see "Taking the M120 Host Subsystem Offline" on page 267.

If the host system is redundant, the backup Routing Engine is hot-removable and hot-insertable, but the master Routing Engine is hot-pluggable. A Routing Engine that is not redundant is hot-pluggable. Each Routing Engine requires a CB to be installed in the adjacent slot. RE0 installs below CB0, and RE1 installs below CB1. A Routing Engine does not power up if it is not installed into the CB.

**NOTE:** If two Routing Engines are installed, they must both be the same hardware model.

There is a USB memory device that connects directly into the front of Routing Engine. The USB port allows you to plug in a USB keychain device.

*Figure 10: M120 Routing Engine*
Routing Engine Components

Each Routing Engine (shown in Figure 10 on page 22) consists of the following components:

- **CPU**—Runs Junos OS to maintain the router’s routing tables and routing protocols. It has a Pentium-class processor.

- **DRAM**—Provides storage for the routing and forwarding tables and for other Routing Engine processes.

- **USB port**—Provides a removable media interface through which you can install the Junos OS manually. See Figure 12 on page 24. Junos supports USB version 1.0.

- **CompactFlash card**—Provides primary storage for software images, configuration files, and microcode. The disk is a fixed compact flash and is inaccessible from outside the router.

- **Hard disk**—Provides secondary storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.

- **LED**—Indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.

**NOTE:** The LEDs that report host module status (including Routing Engine status) are on the craft interface rather than the Routing Engine faceplate.

- **HDD LED**—Indicates disk activity for the hard disk drive.

- **Interfaces for out-of-band management access**—Provide information about Routing Engine status to devices (console, laptop, or terminal server) that can be attached to access ports located on the craft interface.

Every Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

- **EEPROM**—Stores the serial number of the Routing Engine.
• Reset button—Reboots the Routing Engine when pressed.
• Offline button—Takes the Routing Engine offline when pressed.
• Extractor clips—Control the locking system that secures the Routing Engine.

**NOTE:** For specific information about Routing Engine components (for example, the amount of DRAM), issue the `show chassis routing-engine` command.

**Figure 12: USB Memory Device in an M120 Routing Engine**

Routing Engine Boot Sequence

The Routing Engine boots from the storage media in this order: the USB device, then the CompactFlash card (if present), then the hard disk (or two solid state drives (SSD) in the case of the RE-A-1800x2, which appear as DISK1 and DISK2), and then the LAN. The disk from which the router boots is called the *primary boot device*, and the other disk is the *alternate boot device*.

**NOTE:** If the router boots from an alternate boot device, a yellow alarm lights the LED on the router’s craft interface.
M120 Routing Engine LEDs

Each Routing Engine has one LED that indicates its status. The LED, labeled ONLINE, is located directly on the faceplate of the Routing Engine. Table 9 on page 25 describes the functions of the Routing Engine LED.

<table>
<thead>
<tr>
<th>Label</th>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ONLINE</td>
<td>Green</td>
<td>Blinking</td>
<td>Routing Engine is transitioning online.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>On steadily</td>
<td>Routing Engine is functioning normally.</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>On steadily</td>
<td>Routing Engine has failed.</td>
</tr>
<tr>
<td>HDD</td>
<td>Green</td>
<td>Blinking</td>
<td>Hard disk is being accessed.</td>
</tr>
</tbody>
</table>

Routing Engine Components

The Routing Engine (shown in Figure 13 on page 26) consists of the following components:

- CPU—Runs Junos OS to maintain the router’s routing tables and routing protocols.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
• USB port—Provides a removable media interface through which you can install the Junos OS manually. See Figure 14 on page 27. Junos supports USB version 1.0.

• CompactFlash card—Provides primary storage for software images, configuration files, and microcode. The disk is a fixed compact flash and is inaccessible from outside the router.

• SSD—Provides storage for log files, memory dumps, and rebooting the system if the CompactFlash card fails.

• LED—Indicates disk activity. It does not necessarily indicate routing-related activity.

  NOTE: The LEDs that report host module status (including Routing Engine status) are on the craft interface rather than the Routing Engine faceplate.

• Storage LED—Indicates disk activity for the solid state disk drive.

• Interfaces for out-of-band management access—Provide information about Routing Engine status to devices (console, laptop, or terminal server) that can be attached to access ports located on the craft interface.

  Each Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

• EEPROM—Stores the serial number of the Routing Engine.

• Reset button—Reboots the Routing Engine when pressed.

• Offline button—Takes the Routing Engine offline when pressed.

• Extractor clips—Control the locking system that secures the Routing Engine.

Figure 13: RE-A-1800x2 Routing Engine

NOTE: For specific information about Routing Engine components (for example, the amount of DRAM), issue the show chassis routing-engine command.
Routing Engine Boot Sequence

The Routing Engine boots from the storage media in this order: the USB device, then the CompactFlash card (if present), then the two solid state drives (SSD) and then the LAN. The device from which the router boots is called the primary boot device, and the other device is the alternate boot device.

NOTE: If the router boots from an alternate boot device, a yellow alarm lights the LED on the router’s craft interface.

Related Documentation
- M120 Routing Engine Description on page 22
- M120 Host Subsystem Description on page 21
- Taking the M120 Host Subsystem Offline on page 267
- Supported Routing Engines by Router on page 33

RE-A-1800 Routing Engine LEDs

Each Routing Engine has four LEDs that indicate its status. The LEDs, labeled MASTER, STORAGE, ONLINE, and OK/FAIL, are located directly on the faceplate of the Routing Engine. Table 10 on page 28 describes the functions of the Routing Engine LEDs.
Table 10: Routing Engine LEDs

<table>
<thead>
<tr>
<th>Label</th>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MASTER</td>
<td>Blue</td>
<td>On steadily</td>
<td>Routing Engine is the Master.</td>
</tr>
<tr>
<td>STORAGE</td>
<td>Green</td>
<td>Blinking</td>
<td>Indicates activity on the SSD or Compact Flash.</td>
</tr>
<tr>
<td>ONLINE</td>
<td>Green</td>
<td>Blinking</td>
<td>Routing Engine is transitioning online.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>On steadily</td>
<td>Routing Engine is functioning normally.</td>
</tr>
<tr>
<td>OK/FAIL</td>
<td>Red</td>
<td>On steadily</td>
<td>Routing Engine has failed.</td>
</tr>
</tbody>
</table>

Related Documentation

- M320 LED Overview
- M320 RE-A-1800 Routing Engine Description
- Maintaining the M320 Host Subsystem

M120 Routing Engine Interface Ports and Status Indicators

To the right of the alarm relay contact on the craft interface are two sets of ports that connect the Routing Engines to one or more external devices on which system administrators can issue Junos OS command-line interface (CLI) commands to manage the router (see Figure 6 on page 11). The set of ports in the left connects to the Routing Engine in the left Routing Engine slot (REO) and the set on the right connects to the Routing Engine (RE1) in the right Routing Engine slot.

The ports with the indicated label in each set function as follows:

- **AUX**—Connects the Routing Engine to a laptop, modem, or other auxiliary device through a cable with an RJ-45 connector.
- **CONSOLE**—Connects the Routing Engine to a system console through a cable with an RJ-45 connector.
- **ETHERNET**—Connects the Routing Engine through an Ethernet connection to a management LAN (or any other device that plugs into an Ethernet connection) for out-of-band management. The port uses an autosensing RJ-45 connector to support both 10- and 100-Mbps connections. Two small LEDs on the bottom of the port indicate the connection in use: the LED lights yellow or green for a 10-Mbps or 100-Mbps connection, and the LED lights green when traffic is passing through the port.

Related Documentation

- RJ-45 Connector Pinouts for the M120 Routing Engine ETHERNET Port on page 106
- RJ-45 Connector Pinouts for the Routing Engine AUX and CONSOLE Ports on page 106
- RJ-45 Connector Pinouts for the External Clock Ports on page 107
Routing Engine Specifications

Table 11 on page 29 lists the current specifications for Routing Engines supported on M Series, MX Series, and T Series routers. Table 12 on page 32 lists the specifications for end-of-life Routing Engines.

NOTE: For a list of the routing engines that are supported on the M Series, MX Series, T Series, and PTX routers, see “Supported Routing Engines by Router” on page 33.

NOTE: For information about PTX Series Routing Engine specifications, see Routing Engines Supported on PTX Series Routers. For information about

<table>
<thead>
<tr>
<th>Routing Engine</th>
<th>Processor</th>
<th>Memory</th>
<th>Connection to PFEs</th>
<th>Disk</th>
<th>Media</th>
<th>First Junos OS Support</th>
<th>Switch Control Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-400-768</td>
<td>400-MHz Celeron</td>
<td>768 MB</td>
<td>Fast Ethernet</td>
<td>40 GB hard disk</td>
<td>1 GB CompactFlash card</td>
<td>9.0</td>
<td>–</td>
</tr>
<tr>
<td>RE-1000-2048</td>
<td>1.0-GHz Pentium</td>
<td>2048 MB</td>
<td>Gigabit Ethernet</td>
<td>40 GB hard disk</td>
<td>1 GB CompactFlash card</td>
<td>8.1</td>
<td>–</td>
</tr>
<tr>
<td>RE-2000-4096</td>
<td>2.0-GHz Pentium</td>
<td>4096 MB</td>
<td>Gigabit Ethernet</td>
<td>40 GB hard disk</td>
<td>1 GB CompactFlash card</td>
<td>8.1</td>
<td>–</td>
</tr>
<tr>
<td>RE-3000-2048</td>
<td>1.3-GHz Pentium</td>
<td>2048 MB</td>
<td>Gigabit Ethernet</td>
<td>40 GB hard disk</td>
<td>1 GB CompactFlash card</td>
<td>8.2</td>
<td>SCB, SCBE</td>
</tr>
<tr>
<td>RE-5000-4096</td>
<td>2.0-GHz Pentium</td>
<td>4096 MB</td>
<td>Gigabit Ethernet</td>
<td>40 GB hard disk</td>
<td>1 GB CompactFlash card</td>
<td>8.2</td>
<td>SCB, SCBE</td>
</tr>
</tbody>
</table>
### Table 11: Routing Engine Specifications (continued)

<table>
<thead>
<tr>
<th>Routing Engine</th>
<th>Processor</th>
<th>Memory</th>
<th>Connection to PFEs</th>
<th>Disk</th>
<th>Media</th>
<th>First Junos OS Support</th>
<th>Switch Control Board</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-C1800</td>
<td>1.8-GHz</td>
<td>8 GB</td>
<td>Gigabit Ethernet</td>
<td>SSD</td>
<td>4 GB CompactFlash card</td>
<td>T1600 router in a routing matrix: 9.6R2 Standalone T640 or T1600 router: 11.2</td>
<td>CB-T for a standalone router.</td>
</tr>
<tr>
<td></td>
<td>1.8 Ghz</td>
<td>16 GB</td>
<td>Gigabit Ethernet</td>
<td>SSD</td>
<td>4 GB CompactFlash card</td>
<td>32-bit Junos OS on a standalone T1600 router: 11.4R2 32-bit Junos OS on a T1600 router in a routing matrix: 11.4R2 64-bit Junos OS on a standalone T1600 router: 11.4R2</td>
<td>CB-T for a standalone router. CB-LCC for a router in a routing matrix.</td>
</tr>
<tr>
<td>RE-C2600</td>
<td>2.6-GHz</td>
<td>16 GB</td>
<td>Gigabit Ethernet</td>
<td>SSD</td>
<td>4 GB CompactFlash card</td>
<td>TX Matrix Plus router: 9.6R2</td>
<td>--</td>
</tr>
<tr>
<td>RE-A-1800x2</td>
<td>1800-MHz</td>
<td>8 GB or 16 GB</td>
<td>Gigabit Ethernet</td>
<td>32 GB SSD</td>
<td>4 GB CompactFlash card</td>
<td>10.4</td>
<td>--</td>
</tr>
<tr>
<td>RE-S-1800x2</td>
<td>1800-MHz</td>
<td>8 GB or 16 GB</td>
<td>Gigabit Ethernet</td>
<td>32 GB SSD</td>
<td>4 GB CompactFlash card</td>
<td>10.4</td>
<td>SCB, SCBE</td>
</tr>
<tr>
<td>RE-S-1800x4</td>
<td>1800-MHz</td>
<td>8 GB or 16 GB</td>
<td>Gigabit Ethernet</td>
<td>32 GB SSD</td>
<td>4 GB CompactFlash card</td>
<td>10.4</td>
<td>SCB, SCBE, SCBE2</td>
</tr>
<tr>
<td>RE-S-MX104</td>
<td>1.8-GHz</td>
<td>4 GB</td>
<td>Gigabit Ethernet</td>
<td>--</td>
<td>8 GB NAND Flash</td>
<td>13.2</td>
<td>--</td>
</tr>
<tr>
<td>REB1800x4G</td>
<td>1.73-GHz</td>
<td>4 GB</td>
<td>Gigabit Ethernet</td>
<td>64 GB SSD</td>
<td>4 GB CompactFlash card</td>
<td>12.1R2, 11.4R4, and 12.2R1</td>
<td>--</td>
</tr>
<tr>
<td>Routing Engine</td>
<td>Processor</td>
<td>Memory</td>
<td>Connection to PFEs</td>
<td>Disk</td>
<td>Media</td>
<td>First Junos OS Support</td>
<td>Switch Control Board</td>
</tr>
<tr>
<td>---------------</td>
<td>-----------</td>
<td>--------</td>
<td>-----------------</td>
<td>------</td>
<td>-------</td>
<td>------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>REM2000-120Gx6</td>
<td>1.8-GHz</td>
<td>16 GB</td>
<td>Gigabit Ethernet</td>
<td>32 GB SSD</td>
<td>4 GB Fixed Internal CompactFlash card</td>
<td>12.3R2</td>
<td>SCB, SCBE</td>
</tr>
<tr>
<td>REM4000-232Gx6</td>
<td>1.8 GHz</td>
<td>32 GB</td>
<td>Gigabit Ethernet</td>
<td>32 GB SSD</td>
<td>4 GB Fixed Internal CompactFlash card</td>
<td>12.3R4, 13.2R1</td>
<td>SCB, SCBE, SCBE2</td>
</tr>
<tr>
<td>REM4000-232Gx6</td>
<td>1.8 GHz</td>
<td>32 GB</td>
<td>Gigabit Ethernet</td>
<td>32 GB SSD</td>
<td>4 GB Fixed Internal CompactFlash card</td>
<td>12.3R4, 13.2R1</td>
<td>–</td>
</tr>
<tr>
<td>RE-S-X6-64G</td>
<td>2 GHz</td>
<td>64 GB</td>
<td>Gigabit Ethernet</td>
<td>Two 50-GB SSDs</td>
<td>–</td>
<td>15.1F4, 16.1</td>
<td>SCBE2</td>
</tr>
<tr>
<td>REMQKX8-64G</td>
<td>2.3 GHz</td>
<td>64 GB</td>
<td>Gigabit Ethernet</td>
<td>Two 100-GB SSDs</td>
<td>–</td>
<td>15.1F5-S1, 16.1R2, and 16.2R1</td>
<td>–</td>
</tr>
<tr>
<td>REMQXK-64G</td>
<td>2.3 GHz</td>
<td>64 GB</td>
<td>Gigabit Ethernet</td>
<td>Two 50-GB SSDs</td>
<td>–</td>
<td>15.1F7</td>
<td>–</td>
</tr>
<tr>
<td>REMQXK-64G</td>
<td>2.3 GHz</td>
<td>64 GB</td>
<td>Gigabit Ethernet</td>
<td>Two 50-GB SSDs</td>
<td>–</td>
<td>15.1F7</td>
<td>–</td>
</tr>
<tr>
<td>RE-S-1600x8</td>
<td>1.6 GHz</td>
<td>64 GB</td>
<td>Gigabit Ethernet</td>
<td>Two 50-GB SSDs</td>
<td>–</td>
<td>17.3R1</td>
<td>–</td>
</tr>
<tr>
<td>RE-S-1600x8</td>
<td>1.6 GHz</td>
<td>64 GB</td>
<td>Gigabit Ethernet</td>
<td>Two 50-GB SSDs</td>
<td>–</td>
<td>17.3R1</td>
<td>–</td>
</tr>
<tr>
<td>REM2000-120Gx6</td>
<td>2.1 GHz</td>
<td>64 GB</td>
<td>Gigabit Ethernet</td>
<td>Two 100-GB SSDs</td>
<td>–</td>
<td>17.2R1</td>
<td>–</td>
</tr>
<tr>
<td>REMQKX8-128G</td>
<td>2.1 GHz</td>
<td>128 GB</td>
<td>Gigabit Ethernet</td>
<td>Two 100-GB SSDs</td>
<td>–</td>
<td>18.1R1</td>
<td>–</td>
</tr>
<tr>
<td>REMQKX8-128G</td>
<td>2.1 GHz</td>
<td>128 GB</td>
<td>Gigabit Ethernet</td>
<td>Two 100-GB SSDs</td>
<td>–</td>
<td>18.1R1</td>
<td>–</td>
</tr>
</tbody>
</table>
NOTE: Use shielded CAT5e cable for connecting the AUX, CONSOLE, and MGMT ports in RE-S-X6-64G, REMX2K-X8-64G, and REMX2008-X8-64G Routing Engines.

Table 12: End-of-Life Routing Engine Specifications

<table>
<thead>
<tr>
<th>Routing Engine</th>
<th>Processor</th>
<th>Memory</th>
<th>Connection to PFEs</th>
<th>Disk</th>
<th>Media</th>
<th>First Junos OS Support</th>
<th>EOL Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-333-256</td>
<td>333-MHz Pentium II</td>
<td>256 MB</td>
<td>Fast Ethernet</td>
<td>6.4 GB hard disk</td>
<td>80 MB CompactFlash card</td>
<td>3.4</td>
<td>PSN-2003-01-063</td>
</tr>
<tr>
<td>RE-333-768</td>
<td>333-MHz Pentium II</td>
<td>768 MB</td>
<td>Fast Ethernet</td>
<td>6.4 GB hard disk</td>
<td>80 MB CompactFlash card</td>
<td>3.4</td>
<td>PSN-2003-01-063</td>
</tr>
<tr>
<td>RE-600-512</td>
<td>600-MHz Pentium III</td>
<td>512 MB</td>
<td>Fast Ethernet</td>
<td>30 GB hard disk</td>
<td>256 MB CompactFlash card</td>
<td>5.4</td>
<td>PSN-2004-07-019</td>
</tr>
<tr>
<td>RE-600-2048</td>
<td>600-MHz Pentium III</td>
<td>2048 MB</td>
<td>Fast Ethernet</td>
<td>40 GB hard disk</td>
<td>1 GB CompactFlash card</td>
<td>5.3</td>
<td>PSN-2008-02-018</td>
</tr>
<tr>
<td>RE-850-1536</td>
<td>850-MHz Pentium III</td>
<td>1536 MB</td>
<td>Fast Ethernet</td>
<td>40 GB hard disk</td>
<td>1 GB CompactFlash card</td>
<td>7.2</td>
<td>PSN-2011-04-226</td>
</tr>
<tr>
<td>RE-M40</td>
<td>200-MHz Pentium</td>
<td>256 MB</td>
<td>Fast Ethernet</td>
<td>6.4 GB hard disk</td>
<td>80 MB CompactFlash card</td>
<td>3.2</td>
<td>FA-HW-0101-001</td>
</tr>
<tr>
<td>REM40-333-768</td>
<td>333-MHz Pentium II</td>
<td>768 MB</td>
<td>Fast Ethernet</td>
<td>10 GB hard disk</td>
<td>80 MB CompactFlash card</td>
<td>4.2</td>
<td>PSN-2003-01-063</td>
</tr>
<tr>
<td>REMX2006-2048</td>
<td>600-MHz Pentium III</td>
<td>2048 MB</td>
<td>Fast Ethernet</td>
<td>30 GB hard disk</td>
<td>128 MB CompactFlash card</td>
<td>5.4</td>
<td>PSN-2004-11-020</td>
</tr>
<tr>
<td>RE-1600-2048</td>
<td>1.6-GHz Pentium M</td>
<td>2048 MB</td>
<td>Gigabit Ethernet</td>
<td>40 GB hard disk</td>
<td>1 GB CompactFlash card</td>
<td>6.2</td>
<td>PSN-2008-02-019</td>
</tr>
</tbody>
</table>

NOTE: The memory in Table 11 on page 29 indicates the amount of total memory. To determine the amount of available memory, issue the show chassis routing-engine CLI command.
On routers that accept two Routing Engines, you cannot mix Routing Engine types except for a brief period (one minute or so) during an upgrade or downgrade to two Routing Engines of the same type.

### Related Documentation
- Supported Routing Engines by Router on page 33

### Supported Routing Engines by Router

The following tables list the Routing Engines that each router supports, the first supported release for the Routing Engine in the specified router, the management Ethernet interface, and the internal Ethernet interfaces for each Routing Engine.

- M7i Routing Engines on page 34
- M10i Routing Engines on page 34
- M40e Routing Engines on page 34
- M120 Routing Engines on page 35
- M320 Routing Engines on page 35
- MX5, MX10, MX40, and MX80 Routing Engine on page 36
- MX104 Routing Engines on page 36
- MX240 Routing Engines on page 37
- MX480 Routing Engines on page 38
- MX960 Routing Engines on page 39
- MX2008 Routing Engines on page 39
- MX2010 Routing Engines on page 40
- MX2020 Supported Routing Engines on page 40
- MX10003 Routing Engines on page 41
- PTX1000 Routing Engines on page 41
- PTX3000 Routing Engines on page 42
- PTX5000 Routing Engines on page 42
- PTX10008 and PTX10016 Routing Engines on page 43
- T320 Routing Engines on page 43
- T640 Routing Engines on page 44
- T1600 Routing Engines on page 45
- T4000 Routing Engines on page 45
- TX Matrix Routing Engines on page 46
- TX Matrix Plus Routing Engines on page 46
- TX Matrix Plus (with 3D SiBs) Routing Engines on page 47
### M7i Routing Engines

Table 13 on page 34 lists the Routing Engines supported by the M7i router. The M7i router supports 32-bit Junos OS only.

**Table 13: M7i Routing Engines**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-400-768 (EOL details: TSB16445)</td>
<td>RE-5.0</td>
<td>9.0</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>RE-850-1536 (EOL details: TSB15553)</td>
<td>RE-850</td>
<td>7.2</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>RE-B-1800X1-4G</td>
<td>RE-B-1800X1</td>
<td>11.4R4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.1R2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### M10i Routing Engines

Table 14 on page 34 lists the Routing Engines supported by the M10i router. The M10i router supports 32-bit Junos OS only.

**Table 14: M10i Routing Engines**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-400-768 (EOL details: TSB16445)</td>
<td>RE-5.0</td>
<td>9.0</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>RE-850-1536 (EOL details: TSB15553)</td>
<td>RE-850</td>
<td>7.2</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>RE-B-1800X1-4G</td>
<td>RE-B-1800X1</td>
<td>11.4R4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.1R2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### M40e Routing Engines

Table 15 on page 35 lists the Routing Engines supported by the M40e router.
Table 15: M40e Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-600-2048 (EOL details: TSB14373)</td>
<td>RE-3.0 or RE-3.0 (RE-600)</td>
<td>5.3</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>RE-A-1000-2048</td>
<td>RE-A-1000</td>
<td>8.1</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
</tbody>
</table>

M120 Routing Engines

Table 16 on page 35 lists the Routing Engines supported by the M120 router.

Table 16: M120 Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-A-1000-2048</td>
<td>RE-A-1000</td>
<td>8.0R2</td>
<td>--</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>RE-A-2000-4096</td>
<td>RE-A-2000</td>
<td>8.0R2</td>
<td>--</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>bcm0</td>
</tr>
<tr>
<td>RE-A-1800X2-8G</td>
<td>RE-A-1800x2</td>
<td>• 11.4R5</td>
<td>10.4</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.1R3</td>
<td></td>
<td></td>
<td>fxp2</td>
</tr>
<tr>
<td>RE-A-1800X2-16G</td>
<td>RE-A-1800x2</td>
<td>• 11.4R5</td>
<td>10.4</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.1R3</td>
<td></td>
<td></td>
<td>fxp2</td>
</tr>
<tr>
<td>RE-A-1800X4-16G</td>
<td>RE-A-1800x4</td>
<td>• 11.4R5</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.1R3</td>
<td></td>
<td></td>
<td>em1</td>
</tr>
</tbody>
</table>

M320 Routing Engines

Table 17 on page 36 lists the Routing Engines supported by the M320 router.
### Table 17: M320 Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-1600-2048 (EOL details: TSB14374)</td>
<td>RE-4.0</td>
<td>6.2</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>fxp2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>bcm0</td>
</tr>
<tr>
<td>RE-A-1800X2-8G</td>
<td>RE-A-1800x2</td>
<td>• 11.4R5</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.1R3</td>
<td></td>
<td></td>
<td>bcm0</td>
</tr>
<tr>
<td>RE-A-1800X2-16G</td>
<td>RE-A-1800x2</td>
<td>• 11.4R5</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.1R3</td>
<td></td>
<td></td>
<td>bcm0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RE-A-1800X4-8G</td>
<td>RE-A-1800X4</td>
<td>• 11.4R5</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.1R3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### MX5, MX10, MX40, and MX80 Routing Engine

Table 18 on page 36 lists the Routing Engines supported by the MX5, MX10, MX40, and MX80 routers.

### Table 18: MX5, MX10, MX40, and MX80 Routing Engine

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built-in Routing Engine</td>
<td>Routing Engine RE-MX80</td>
<td>12.3</td>
<td>–</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>em1</td>
</tr>
</tbody>
</table>

**NOTE:** em1 is used to communicate with the MS-MIC when it is inserted.

### MX104 Routing Engines

Table 19 on page 37 lists the Routing Engines supported by MX104 routers.
Table 19: MX104 Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-S-MX104</td>
<td>Routing Engine</td>
<td>13.2</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
</tbody>
</table>

MX240 Routing Engines

Table 20 on page 37 lists the Routing Engines supported by MX240 routers.

Table 20: MX240 Supported Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-S-1300-2048 (EOL details: TSB16556)</td>
<td>RE-S-1300</td>
<td>9.0</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
</tbody>
</table>

| RE-S-2000-4096 (EOL details: TSB16735) | RE-S-2000 | 9.0                                    | –                                      | fxp0                          | fxp1                       |

| RE-S-1800X2-8G (EOL details: TSB16556) | RE-S-1800x2 | • 11.4R5 <br> • 12.1R3 | 10.4                                    | fxp0                          | em0<br>em1                  |

| RE-S-1800x2-16G (EOL details: TSB16556) | RE-S-1800x2 | • 11.4R5 <br> • 12.1R3 | 10.4                                    | fxp0                          | em0<br>em1                  |

| RE-S-1800X4-8G | RE-S-1800X4 | • 11.4R5 <br> • 12.1R3 | 10.4                                    | fxp0                          | em0<br>em1                  |

| RE-S-1800X4-16G | RE-S-1800X4 | • 11.4R5 <br> • 12.1R3 | 10.4                                    | fxp0                          | em0<br>em1                  |

| RE-S-1800X4-32G-S | RE-S-1800X4 | • 12.3R4 <br> • 13.2R1 | • 12.3R4 <br> • 13.2R1 | fxp0                          | em0, em1                   |

| RE-S-X6-64G | RE-S-2X00x6 | –                                    | 15.1F4 <br> 16.1R1                  | fxp0                          | ixlv0, igb0                |

| RE-S-X6-64G-LT | RE-S-2X00x6-LT | –                                    | 18.1R1 | fxp0                          | ixlv0, igb0, em0            |
Table 20: MX240 Supported Routing Engines (continued)

RE-S-X6-128G | RE-S-2X00x6-128 | 18.1R1 | fxp0 | ixlv0, igb0 | em0

MX480 Routing Engines

Table 21 on page 38 lists the Routing Engines supported by MX480 routers.

Table 21: MX480 Supported Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-S-1300-2048 (EOL details: TSB16556)</td>
<td>RE-S-1300</td>
<td>8.4</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>RE-S-2000-4096 (EOL details: TSB16735)</td>
<td>RE-S-2000</td>
<td>8.4</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>RE-S-1800X2-8G (EOL details: TSB16556)</td>
<td>RE-S-1800x2</td>
<td>11.4R5, 12.1R3</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td>RE-S-1800X2-16G (EOL details: TSB16556)</td>
<td>RE-S-1800x2</td>
<td>11.4R5, 12.1R3</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td>RE-S-1800X4-8G</td>
<td>RE-S-1800X4</td>
<td>11.4R5, 12.1R3</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td>RE-S-1800X4-16G</td>
<td>RE-S-1800x4</td>
<td>11.4R5, 12.1R3</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td>RE-S-1800X4-32G-S</td>
<td>RE-S-1800X4</td>
<td>12.3R4, 13.2R1</td>
<td>12.3R4, 13.2R1</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td>RE-S-X6-64G</td>
<td>RE-S-2X00x6</td>
<td>–</td>
<td>15.1F4, 16.1R1</td>
<td>fxp0</td>
<td>ixlv0, igb0</td>
</tr>
<tr>
<td>RE-S-X6-64G-LT</td>
<td>RE-S-2X00x6-LT</td>
<td>–</td>
<td>18.1R1</td>
<td>fxp0</td>
<td>ixlv0, igb0, em0</td>
</tr>
<tr>
<td>RE-S-X6-128G</td>
<td>RE-S-2X00x6-128</td>
<td>–</td>
<td>18.1R1</td>
<td>fxp0</td>
<td>ixlv0, igb0, em0</td>
</tr>
</tbody>
</table>
MX960 Routing Engines

Table 22 on page 39 lists the Routing Engines supported by MX960 routers.

Table 22: MX960 Supported Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-S-1300-2048 (EOL details: TSB16556)</td>
<td>RE-S-1300</td>
<td>8.2</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>RE-S-2000-4096 (EOL details: TSB16735)</td>
<td>RE-S-2000</td>
<td>8.2</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>RE-S-1800X2-8G (EOL details: TSB16556)</td>
<td>RE-S-1800x2</td>
<td>• 11.4R5</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.1R3</td>
<td></td>
<td></td>
<td>em1</td>
</tr>
<tr>
<td>RE-S-1800X2-16G (EOL details: TSB16556)</td>
<td>RE-S-1800x2</td>
<td>• 11.4R5</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.1R3</td>
<td></td>
<td></td>
<td>em1</td>
</tr>
<tr>
<td>RE-S-1800X4-8G</td>
<td>RE-S-1800x4</td>
<td>• 11.4R5</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.1R3</td>
<td></td>
<td></td>
<td>em1</td>
</tr>
<tr>
<td>RE-S-1800X4-16G</td>
<td>RE-S-1800x4</td>
<td>• 11.4R5</td>
<td>10.4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 12.1R3</td>
<td></td>
<td></td>
<td>em1</td>
</tr>
<tr>
<td>RE-S-1800X4-32G-S</td>
<td>RE-S-1800x4</td>
<td>• 12.3R4</td>
<td>• 12.3R4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 13.2R1</td>
<td>• 13.2R1</td>
<td></td>
<td>em1</td>
</tr>
<tr>
<td>RE-S-X6-64G</td>
<td>RE-S-2X00x6</td>
<td>–</td>
<td>15.1R4</td>
<td>fxp0</td>
<td>ixlv0, igb0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>16.1R1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RE-S-X6-64G (For MX960-VC)</td>
<td>RE-S-2X00x6</td>
<td>–</td>
<td>17.1R1</td>
<td>fxp0</td>
<td>ixlv0, igb0</td>
</tr>
<tr>
<td>RE-S-X6-128G</td>
<td>RE-S-2X00x6-128</td>
<td>–</td>
<td>18.1R1</td>
<td>fxp0</td>
<td>ixlv0, igb0, em0</td>
</tr>
</tbody>
</table>

MX2008 Routing Engines

Table 23 on page 40 lists the Routing Engines supported by MX2008 routers.
### Table 23: MX2008 Supported Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMX2008-X8-64G</td>
<td>RE-MX2008-X8-64G</td>
<td>15.1F7</td>
<td>fxp0</td>
<td>ixlv0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ixlv1</td>
</tr>
<tr>
<td>REMX2008-X8-64G-LT</td>
<td>REMX2008-X8-64G-LT</td>
<td>17.2R1</td>
<td>fxp0</td>
<td>ixlv0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ixlv1</td>
</tr>
</tbody>
</table>

### MX2010 Routing Engines

Table 24 on page 40 lists the Routing Engines supported by MX2010 routers.

### Table 24: MX2010 Supported Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-MX2000-1800X4</td>
<td>RE-S-1800x4</td>
<td>12.3R2</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>em1</td>
</tr>
<tr>
<td>REMX2K-1800-32G-S</td>
<td>RE-S-1800x4</td>
<td>• 12.3R4</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 13.2R1</td>
<td></td>
<td>em1</td>
</tr>
<tr>
<td>REMX2K-X8-64G</td>
<td>RE-S-2X00x8</td>
<td>• 15.1F5-S1</td>
<td>fxp0</td>
<td>ixlv0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 16.1R2</td>
<td></td>
<td>ixlv1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 16.2R1</td>
<td></td>
<td>em0</td>
</tr>
<tr>
<td>REMX2K-X8-128G</td>
<td>RE-MX200X8-128G</td>
<td>18.1R1</td>
<td>fxp0</td>
<td>ixlv0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ixlv1</td>
</tr>
</tbody>
</table>

### MX2020 Supported Routing Engines

Table 25 on page 40 lists the Routing Engines supported by MX2020 routers.

### Table 25: MX2020 Supported Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-MX2000-1800X4</td>
<td>RE-S-1800x4</td>
<td>12.3R2</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>em1</td>
</tr>
</tbody>
</table>
Table 25: MX2020 Supported Routing Engines (continued)

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>REMX2K-1800-32G-S</td>
<td>RE-S-1800x4</td>
<td>• 12.3R4 • 13.2R1</td>
<td>fxp0</td>
<td>em0</td>
</tr>
<tr>
<td>REMX2K-X8-64G</td>
<td>RE-S-2X00x8</td>
<td>• 15.1F5-S1 • 16.1R2 • 16.2R1</td>
<td>fxp0</td>
<td>ixlv0</td>
</tr>
<tr>
<td>REMX2K-X8-128G</td>
<td>RE-MX200X8-128G</td>
<td>18.1R1</td>
<td>ixlv0</td>
<td>ixlv0</td>
</tr>
</tbody>
</table>

MX10003 Routing Engines

Table 26 on page 41 lists the Routing Engines supported by MX10003 routers.

Table 26: MX10003 Supported Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>JNP10003-RE1</td>
<td>RE-S-2X00x6</td>
<td>17.3R1</td>
<td>fxp0</td>
<td>em3</td>
</tr>
</tbody>
</table>

PTX1000 Routing Engines

Table 27 on page 41 lists the Routing Engine supported on the PTX1000.

NOTE: The PTX1000 supports 64-bit Junos OS only.

Table 27: PTX1000 Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built-in Routing Engine</td>
<td>RE-PTX1000</td>
<td>• 16.1X65-D30 • 17.2R1</td>
<td>em0</td>
<td>bme0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>em1</td>
</tr>
</tbody>
</table>
PTX3000 Routing Engines

Table 28 on page 42 lists the Routing Engines supported on the PTX3000.

NOTE: The PTX3000 supports 64-bit Junos OS only.

Table 28: PTX3000 Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-DUO-C2600-16G</td>
<td>RE-DUO-2600</td>
<td>13.2R2</td>
<td>em0</td>
<td>ixgbe0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ixgbe1</td>
</tr>
<tr>
<td>RCB-PTX-X6-32G</td>
<td>RE-PTX-2X00x6</td>
<td>16.1R4</td>
<td>em0</td>
<td>ixlv0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>17.1R1</td>
<td></td>
<td>ixlv1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>This Routing Engine does not</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>support Junos OS Release 16.2.</td>
<td></td>
</tr>
</tbody>
</table>

PTX5000 Routing Engines

Table 29 on page 43 lists the Routing Engines supported on the PTX5000.

NOTE:
- PTX5000 supports 64-bit Junos OS only.
- The PTX5000 router supports two midplanes. The midplane identified as Midplane-8S in the CLI output is supported in Junos OS releases, 12.1X48, 12.3, and 13.2. The enhanced midplane, identified as Midplane-8SeP is supported from Junos OS release 14.1 onwards.
- The RE-DUO-2600 routing engine with Junos OS 13.2 or earlier is not supported on the PTX5000BASE2 midplane.
Table 29: PTX5000 Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-DUO-C2600-16G</td>
<td>RE-DUO-2600</td>
<td>12.1X48</td>
<td>em0</td>
<td>ixgbe0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.3</td>
<td>ixgbe1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>13.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NOTE:</strong> The PTX5000 does not support Junos OS Releases 12.1, 12.2, or 13.1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RE-PTX-X8-64G</td>
<td>RE-PTX-2X00x8</td>
<td>15.1F4</td>
<td>em0</td>
<td>ixlv0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>16.1R1</td>
<td>ixlv1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>em1</td>
<td></td>
</tr>
<tr>
<td>RE-PTX-X8-128G</td>
<td>RE-PTX-2X00x8-128G</td>
<td>18.1R1</td>
<td>em0</td>
<td>ixlv0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ixlv1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>em1</td>
<td></td>
</tr>
</tbody>
</table>

PTX10008 and PTX10016 Routing Engines

Table 30 on page 43 lists the Routing Engines supported on the PTX10008 and PTX10016 routers.

Table 30: PTX10008 and PTX10016 Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>JNP10K-RE0</td>
<td>RE-PTX-2X00x4</td>
<td>17.2R1</td>
<td>em0, em1</td>
<td>bme0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>bme1</td>
</tr>
</tbody>
</table>

T320 Routing Engines

Table 31 on page 43 lists the Routing Engines supported by the T320 router.

Table 31: T320 Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-600-2048</td>
<td>RE-3.0 or RE-3.0</td>
<td>5.3</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td>(EOL details: TSB14373)</td>
<td></td>
<td>(RE-600)</td>
<td></td>
<td>fxp2</td>
</tr>
</tbody>
</table>
Table 31: T320 Routing Engines (continued)

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-1600-2048 (EOL details: TSB14374)</td>
<td>RE-4.0</td>
<td>6.2</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>fxp2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>fxp2</td>
</tr>
</tbody>
</table>

The T320 router supports the CB-T control board.

T640 Routing Engines

Table 32 on page 44 lists the Routing Engines supported by the T640 router.

Table 32: T640 Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-600-2048 (EOL details: TSB14373)</td>
<td>RE-3.0 or RE-3.0 (RE-600)</td>
<td>5.3</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>fxp2</td>
</tr>
<tr>
<td>RE-1600-2048 (EOL details: TSB14374)</td>
<td>RE-4.0</td>
<td>6.2</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>fxp2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>bcm0</td>
</tr>
<tr>
<td>RE-DUO-C1800-8G</td>
<td>RE-DUO-1800</td>
<td>32-bit Junos OS on a standalone T640 router: 11.2</td>
<td>64-bit Junos OS on a standalone T640 router: 11.3</td>
<td>em0</td>
<td>bcm0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32-bit Junos OS on a T640 router in a routing matrix: 11.4R9</td>
<td>64-bit Junos OS on a T640 router in a routing matrix: 11.4R9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RE-DUO-C1800-16G</td>
<td>RE-DUO-1800</td>
<td>32-bit Junos OS on a standalone T640 router: 11.4R2</td>
<td>64-bit Junos OS on a standalone T640 router: 11.4R2</td>
<td>em0</td>
<td>bcm0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>32-bit Junos OS on a T640 router in a routing matrix: 11.4R9</td>
<td>64-bit Junos OS on a T640 router in a routing matrix: 11.4R9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The T640 standalone router supports CB-T control board and CB-LCC in a T640 routing matrix.
### T1600 Routing Engines

Table 33 on page 45 lists the Routing Engines supported by the T1600 router.

**NOTE:** (Two RE-DUO-C1800-8G or two RE-DUO-C1800-16G are required to connect to a Routing Matrix)

**Table 33: T1600 Routing Engines**

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-600-2048</td>
<td>RE-3.0 or RE-3.0 (RE-600)</td>
<td>8.5</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RE-1600-2048</td>
<td>RE-4.0 (RE-1600)</td>
<td>8.5</td>
<td>–</td>
<td>fxp0</td>
<td>fxp1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RE-DUO-C1800-8G or RE-DUO-1800</td>
<td>RE-TXP-LCC</td>
<td>32-bit Junos OS on a T1600 router in a routing matrix: 9.6</td>
<td>64-bit Junos OS on a T1600 router in a routing matrix: 9.6</td>
<td>em0</td>
<td>bcm0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RE-DUO-C1800-16G</td>
<td>RE-DUO-1800</td>
<td>32-bit Junos OS on a standalone T1600 router: 11.4R2</td>
<td>64-bit Junos OS on a standalone T1600 router: 11.4R2</td>
<td>em0</td>
<td>bcm0</td>
</tr>
</tbody>
</table>

**Note:** Junos OS Releases 9.6 through 10.4 support RE-DUO-C1800-8G only, during upgrade to a line-card chassis (LCC) in a routing matrix.

32-bit Junos OS on a standalone T1600 router: 11.1

### T4000 Routing Engines

Table 34 on page 46 lists the Routing Engines supported by the T4000 router.

**NOTE:** The T4000 router supports 64-bit Junos OS only.
Table 34: T4000 Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-DUO-C1800-8G</td>
<td>RE-DUO-1800</td>
<td>Standalone T4000 router: 12.1</td>
<td>em0</td>
<td>bcm0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T4000 router in a routing matrix: 13.1</td>
<td></td>
<td>em1</td>
</tr>
<tr>
<td>RE-DUO-C1800-16G</td>
<td>RE-DUO-1800</td>
<td>Standalone T4000 router: 12.1R2</td>
<td>em0</td>
<td>bcm0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>T4000 router in a routing matrix: 13.1</td>
<td></td>
<td>em1</td>
</tr>
</tbody>
</table>

The T4000 router supports the CB-LCC control board.

TX Matrix Routing Engines

Table 35 on page 46 lists the Routing Engines supported by the TX Matrix router.

Table 35: TX Matrix Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-600-2048 (EOL details: TSB14373)</td>
<td>RE-3.0 or RE-3.0 (RE-600)</td>
<td>7.0</td>
<td>–</td>
<td>f xp0</td>
<td>f xp1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>f xp2</td>
</tr>
<tr>
<td>RE-1600-2048 (EOL details: TSB14374)</td>
<td>RE-4.0 (RE-1600)</td>
<td>7.0</td>
<td>–</td>
<td>f xp0</td>
<td>f xp1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>f xp2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>bcm0</td>
</tr>
<tr>
<td>RE-DUO-C1800-8G</td>
<td>RE-DUO-1800</td>
<td>11.4R9</td>
<td>11.4R9</td>
<td>em0</td>
<td>bcm0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>em1</td>
</tr>
<tr>
<td>RE-DUO-C1800-16G</td>
<td>RE-DUO-1800</td>
<td>11.4R9</td>
<td>11.4R9</td>
<td>em0</td>
<td>bcm0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>em1</td>
</tr>
</tbody>
</table>

The TXP router supports two control boards, CB-TX and CB-LCC. The CB-LCC is required for both RE-DUO-C1800-8G and RE-DUO-C1800-16G Routing Engines.

TX Matrix Plus Routing Engines

Table 36 on page 47 lists the Routing Engines supported by the TX Matrix Plus router.
Table 36: TX Matrix Plus Routing Engines

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-DUO-C2600-16G</td>
<td>RE-TXP-SFC or RE-DUO-2600</td>
<td>32-bit Junos OS: 9.6</td>
<td>64-bit Junos OS: 11.4</td>
<td>em0</td>
<td>ixgbe0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ixgbe1</td>
</tr>
</tbody>
</table>

The TX Matrix Plus router supports the CB-TXP control board.

TX Matrix Plus (with 3D SIBs) Routing Engines

Table 37 on page 47 lists the Routing Engines supported by the TX Matrix Plus router with 3D SIBs.

Table 37: Routing Engines on TX Matrix Plus with 3D SIBs

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Name in CLI Output</th>
<th>First Supported 32-bit Junos OS Release</th>
<th>First Supported 64-bit Junos OS Release</th>
<th>Management Ethernet Interface</th>
<th>Internal Ethernet Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-DUO-C2600-16G</td>
<td>RE-TXP-SFC or RE-DUO-2600</td>
<td>-</td>
<td>64-bit Junos OS: 11.4</td>
<td>em0</td>
<td>ixgbe0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ixgbe1</td>
</tr>
</tbody>
</table>

Related Documentation

- Routing Engine Specifications on page 29
- Understanding Internal Ethernet Interfaces
- Understanding Management Ethernet Interfaces

M120 Control Board (CB) Description

Each CB works with an installed Routing Engine to provide control and monitoring functions for the router (see Figure 15 on page 48). These functions include determining Routing Engine mastership; controlling power and reset for the other router components; connecting the FEBs and FPCs; monitoring and controlling fan speed; and monitoring system status.

You can install one or two CBs in the router. The CBs install vertically into the rear of the chassis in the slots labeled CB0 and CB1. If two CBs are installed, one functions as the master CB and the other as its backup. If the master fails or is removed, the backup restarts and becomes the master.

With redundant CBs, the backup CB is hot-removable and hot-insertable, but the master CB is hot-pluggable. If a CB fails and switches mastership to the redundant CB, the Routing Engine mastership switches as well.
CB Components

Each CB consists of the following components:

- Switch fabric—Provides transit traffic through the Control Board.
- Control FPGA—Provides the PCI interface to the Routing Engine.
- 1000Base-T Ethernet controller—Provides a 1-Gbps Ethernet link between the Routing Engines.
- Ethernet switch—Provides Ethernet connectivity between the Routing Engine and the FPCs and FEBs; link speeds are 10 Gbps to the Routing Engine and FEBs and 100 Mbps to the FPCs and CFPCs.
- SONET clocking module—Provides a Stratum 3 timing reference for all SONET interfaces installed in the system.
- LEDs—Three LEDs on the CB indicate the status of the CB and whether that CB is master. The LEDs, labeled OK, FAIL, and MSTR are located directly on the control board.
- Circuits for chassis management and control.
- Power circuits for the Routing Engine and CB.
- Offline button—Takes the CB offline when pressed.

Related Documentation

- M120 Control Board (CB) LEDs on page 48
- Maintaining the M120 Host Subsystem on page 266
- Replacing an M120 CB on page 202

M120 Control Board (CB) LEDs

Table 38 on page 49 describes the functions of the Control Board LEDs.
### Table 38: M120 Control Board LEDs

<table>
<thead>
<tr>
<th>Label</th>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td>Green</td>
<td>On steadily</td>
<td>Control board is functioning normally.</td>
</tr>
<tr>
<td>FAIL</td>
<td>Yellow</td>
<td>On steadily</td>
<td>Control board has failed.</td>
</tr>
<tr>
<td>MSTR</td>
<td>Blue</td>
<td>On steadily</td>
<td>Control board is master.</td>
</tr>
</tbody>
</table>

**Related Documentation**
- M120 Control Board (CB) Description on page 47
- Maintaining the M120 Host Subsystem on page 266
- Replacing an M120 CB on page 202
M120 Flexible PIC Concentrators (FPCs) Description

The Flexible PIC Concentrators (FPCs) provide the infrastructure to power and control PICs and to translate packets to and from each PIC into a standard interface that the FEB processes.

Each Packet Forwarding Engine receives incoming packets from the PICs installed on the FPC and forwards them through the switch planes to the appropriate destination FPC and port. Each FPC contains data memory, which is managed by the Queuing and Memory Interface ASICs, and either one or two Packet Forwarding Engines.

Each FPC contains a translator, a crossbar connection to the FEBs, power subsystem, and the physical PIC connectors. The assembly contains a translation component that converts between the midplane signals and the signals required by the types of supported PICs. The translator fully terminates the PIC side connection, providing local flow control, buffering, and electrical conversion.

The FPCs interface with the following router system components: the PEMs, CBs, FEBs, and PICs.

The FPC slots on the router allow four PICs in Type 1 or Type 2 FPCs and one PIC in a Type 3 FPC to share power circuits and a CPU. Up to four FPCs install vertically in the front of the router (see Figure 16 on page 52). The FPC slots are numbered left to right from FPC2 to FPC5. Depending on the FPC type, an FPC has either one or four slots into
which a PIC can be installed. An FPC can be installed into any FPC slot on the router, regardless of which PICs it contains.

If a slot is not occupied by an FPC, an FPC blank panel must be installed to shield the empty slot and to allow cooling air to circulate properly through the router.

FPCs are hot-removable and hot-insertable, as described in "M120 Field-Replaceable Units (FRUs)" on page 179. When you install an FPC into a functioning router, the Routing Engine downloads the FPC software, the FPC runs its diagnostics, and the PICs housed on the FPC, are enabled. Forwarding on other FPC slots continues uninterrupted during this process.

*Figure 16: FPC and CFPCs Installed in an M120 Router Chassis*

Faceplates on FPCs for the M120 router are labeled with the FPC type (FPC1, FPC2, or FPC3). The faceplates on the CFPCs are labeled with their CFPC type, Ethernet 10GBase XFP or OC192.

*Figure 17 on page 53* shows the three types of FPCs that the M120 router supports.
Each FPC consists of the following components:

- FPC card carrier, which includes the PIC slots.
- HSL2 conversion FPGA, a bridge between the HSL2 interface and the interface required by the types of supported PICs (either BD8, BD32 or HSL1).
- HSL2 crossbar connection to the FEBs.
- PIC CPU complex.
- Physical PIC connectors.
- Midplane connectors and power circuitry.
- Processor subsystem, which includes a 667-MHz CPU, system controller, 128 MB of SDRAM, and two Fast Ethernet links to the Control Board.
- An LED, located on the craft interface above the FPC, that displays the status of the FPC.
- FPC online/offline button, located on the craft interface above the FPC.

Regardless of whether you are holding an FPC vertically or horizontally, the documentation uses the same terms for all four edges of the FPC:

- Faceplate—Edge of the FPC that has slots into which you insert the PICs
- Connector edge—Edge opposite the faceplate; this edge has the connectors that attach to the midplane
- Top edge—Edge at the top of the FPC when it is vertical
- Bottom edge—Edge at the bottom of the FPC when it is vertical
M120 Flexible PIC Concentrators (FPCs) LED

Bicolor LEDs located along the bottom of the craft interface displays the status of each FPC and are labeled FPC0 through FPC5. For more information about the FPC LEDs located on the craft interface, see “FPC LEDs on the M120 Craft Interface” on page 15.

M120 Compact FPCs (CFPCs) Description

A CFPC is a combination of a PIC and an FPC. It contains the interface circuitry and the FPC as a single assembly. The WAN interface enables interconnection directly to SONET transport facilities, eliminating the need for a separate SONET interface device.

The CFPCs install vertically in two slots on the left side of the chassis in the front of the router (see Figure 18 on page 55). The CFPC slots are numbered top to bottom CFPC0 and CFPC1. The CFPC slots feature a smaller form factor than the Type 1, 2, and 3 FPC slots, to provide higher density for M120 10-gigabit interfaces.
Two CFPCs are available for the M120 router: a 10-Gigabit Ethernet CFPC and an OC192 CFPC. Each CFPC is rated at 10 Gbps full duplex. Both CFPCs provide receptacles for XFP optical transceivers. Each CFPC weighs approximately 2 lbs. (0.9 kg.) You can install any combination of CFPC types. Figure 19 on page 55 shows the Ethernet 10GBase XFP CFPC.

Figure 19: Ethernet 10GBase XFP CFPC for the M120 Router

• CFPC Components on page 56
CFPC Components

Both CFPC types consist of the following components:

- CFPC card carrier.
- Midplane connectors and power circuitry.
- Processor subsystem, which includes a 667-MHz CPU, system controller, 128 MB of SDRAM, and two Fast Ethernet links to the Control Board.
- Crosspoint switches for redundancy.
- A metal bracket that enhances airflow and serves as a guide for removing and installing the CFPC.
- An LED located on the CFPC faceplate that displays the status of the CFPC.

The 10-Gigabit Ethernet CFPC also contains the following components:

- S2H FPGA—Bridge between HSL2 and one SPI-4.2 interface.
- 10GE MAC interface circuitry.
- XFP optical transceiver (LAN/WAN PHY).

The OC192 CFPC also contains the following components:

- H2H FPGA—Bridge between HSLA and HSL1 interface.
- Juniper Networks D4P framer.
- XFP optical transceiver.

Related Documentation

- M120 FPCs and CFPCs Supported on page 56
- Maintaining M120 FPCs and CFPCs on page 270
- Troubleshooting M120 FPCs and CFPCs on page 287
- Replacing an M120 CFPC on page 219

M120 FPCs and CFPCs Supported

M120 routers support the FPCs listed in Table 39 on page 56.

You can install any combination of these FPCs in the M120 router.

Table 39: FPCs Supported by the M120 Router

<table>
<thead>
<tr>
<th>FPC Type</th>
<th>FPC Name</th>
<th>FPC Model Number</th>
<th>Maximum Number of PICs Supported per FPC</th>
<th>Maximum Throughput per FPC</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FPC1</td>
<td>M120-FPC1</td>
<td>4</td>
<td>4 Gbps</td>
<td>8.0R2</td>
</tr>
</tbody>
</table>
Table 39: FPCs Supported by the M120 Router (continued)

<table>
<thead>
<tr>
<th>FPC Type</th>
<th>FPC Name</th>
<th>FPC Model Number</th>
<th>Maximum Number of PICs Supported per FPC</th>
<th>Maximum Throughput per FPC</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>FPC2</td>
<td>M120-FPC2</td>
<td>4</td>
<td>10 Gbps</td>
<td>8.0R2</td>
</tr>
<tr>
<td>3</td>
<td>FPC3</td>
<td>M120-FPC3</td>
<td>1</td>
<td>10 Gbps</td>
<td>8.0R2</td>
</tr>
</tbody>
</table>

A CFPC is a combination of a PIC and an FPC. It contains the interface circuitry and the FPC as a single assembly. The CFPCs provide receptacles for XFP optical transceivers. The M120 chassis provides two slots for CFPCs, and supports any combination of CFPC types. M120 routers support the CFPCs listed in Table 40 on page 57.

Table 40: CFPCs Supported by the M120 Router

<table>
<thead>
<tr>
<th>CFPC Name</th>
<th>CFPC Model Number</th>
<th>Maximum Throughput per CFPC</th>
<th>First Junos OS Release Support</th>
<th>Connector</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-Gigabit Ethernet</td>
<td>M120-cFPC-1XGE-XFP</td>
<td>10 Gbps</td>
<td>8.0R2</td>
<td>Duplex LC/PC (Rx and Tx)</td>
</tr>
<tr>
<td>SONET/SDH OC192/STM64</td>
<td>M120-cFPC-1OCl92-XFP</td>
<td>10 Gbps</td>
<td>8.0R2</td>
<td>Duplex LC/PC (Rx and Tx)</td>
</tr>
</tbody>
</table>

Related Documentation
- M120 Compact FPCs (CFPCs) Description on page 54
- M120 Flexible PIC Concentrators (FPCs) Description on page 51

M120 PICs Description

PICs provide the physical connection to various network media types, receiving incoming packets from the network and transmitting outgoing packets to the network. During this process, each PIC performs framing and line-speed signaling for its media type. Before transmitting outgoing data packets, the PICs encapsulate the packets received from the FPCs. Each PIC is equipped with an ASIC that performs control functions specific to the media type of that PIC.

The PIC slots are labeled PIC0, PIC1, PIC2, and PIC3, top to bottom and left to right. You can install up to four PICs into the slots in a Type 1 or Type 2 FPC or one PIC in a Type 3 FPC. Type 1 and Type 2 PICs have captive screws at their upper and lower corners, and Type 3 PICs have an upper ejector handle and a lower captive screw.

The router supports various PICs, including ATM, Channelized, Gigabit Ethernet, IP Services, and SONET/SDH interfaces. Blank PICs resemble other PICs but do not provide any physical connection or activity. When a slot is not occupied by a PIC, you must insert a blank PIC to fill the empty slot and ensure proper cooling of the system. PICs are hot-removable and hot-insertable.
M120 PIC LEDs

Each PIC has LEDs located on the faceplate. For more information about LEDs on the PIC faceplate, see the “LEDs” section for each PIC in the *M120 Multiservice Edge Router Interface Module Reference*.

M120 PICs Supported

Table 41 on page 58 lists the PICs supported in the M120 router. The PICs are listed alphabetically by PIC family.

<table>
<thead>
<tr>
<th>PIC Family and Type</th>
<th>Ports</th>
<th>Model Number</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM2 IQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATM2 DS3 IQ PIC (M120 Router)</td>
<td>4</td>
<td>PB-4DS3-ATM2</td>
<td>8.0R2</td>
</tr>
<tr>
<td>ATM2 E3 IQ PIC (M120 Router)</td>
<td>4</td>
<td>PB-4E3-ATM2</td>
<td>8.0R2</td>
</tr>
</tbody>
</table>

**NOTE:** The M120 router is now end-of-life. See the JTAC support bulletin TSB16809 for additional information about the PICs and other associated FRUs that moved to end-of-life with the router. The “M120 End-of-Life PICs Supported” on page 63 topic lists PICs that moved to end-of-life before the M120 router itself moved to end-of-life.
### Table 41: PICs Supported in the M120 Router (continued)

<table>
<thead>
<tr>
<th>PIC Family and Type</th>
<th>Ports</th>
<th>Model Number</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM2 OC3/STM1 IQ PIC (M120 Router)</td>
<td>2</td>
<td>PB-2OC3-ATM2-MM</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PB-2OC3-ATM2-SMIR</td>
<td></td>
</tr>
<tr>
<td>ATM2 OC12/STM4 IQ PICs (M120 Router)</td>
<td>1</td>
<td>PB-1OC12-ATM2-MM</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PB-1OC12-ATM2-SMIR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>PB-2OC12-ATM2-SMIR</td>
<td>8.0R2</td>
</tr>
<tr>
<td>ATM2 OC12/STM4 IQ PICs (M120 Router)</td>
<td>2</td>
<td>PB-2OC12-ATM2-MM</td>
<td>8.0R2</td>
</tr>
<tr>
<td>ATM2 OC48/STM16 IQ EOL PIC with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1OC48-ATM2-SFP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Channelized Circuit Emulation</td>
<td>4</td>
<td>PB-4CHOC3-CE-SFP</td>
<td>9.4</td>
</tr>
<tr>
<td>Channelized DS3 IQ EOL PIC (M120 Router)</td>
<td>4</td>
<td>PB-4CHDS3-QPP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Channelized E1 IQ EOL PIC (M120 Router)</td>
<td>10</td>
<td>PB-10CHE1-RJ48-QPP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Channelized E1 IQ EOL PIC (M120 Router)</td>
<td>10</td>
<td>PB-10CHE1-RJ48-QPP-N</td>
<td>9.1R4 9.2R3 9.3R1</td>
</tr>
<tr>
<td>Channelized T1 IQ EOL PIC (M120 Router)</td>
<td>10</td>
<td>PB-10CHT1-RJ48-QPP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Channelized STMI IQ EOL PIC (M120 Router)</td>
<td>1</td>
<td>PB-1CHSTMI-SMIR-QPP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Channelized OC3 IQ EOL PIC (M120 Router)</td>
<td>1</td>
<td>PB-1CHOC3-SMIR-QPP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Channelized OC12 IQ EOL PIC (M120 Router)</td>
<td>1</td>
<td>PB-1CHOC12-SMIR-QPP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Channelized OC48/STM16 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1CHOC48-STM16-IQE-SFP</td>
<td>9.4</td>
</tr>
<tr>
<td>Channelized DS3/E3 Enhanced IQ (IQE) PIC (M120 Router)</td>
<td>4</td>
<td>PB-4CHDS3-E3-IQE-BNC</td>
<td>9.3</td>
</tr>
<tr>
<td><strong>NOTE:</strong> Only DS3 is channelized.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channelized E1/T1 Enhanced IQ (IQE) PIC (M120 Router)</td>
<td>10</td>
<td>PB-10CHE1-T1-IQE-RJ48</td>
<td>9.5</td>
</tr>
</tbody>
</table>
Table 41: PICs Supported in the M120 Router (continued)

<table>
<thead>
<tr>
<th>PIC Family and Type</th>
<th>Ports</th>
<th>Model Number</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channelized OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M120 Router)</td>
<td>2</td>
<td>PB-2CHOC3-STM1-IQE-SFP</td>
<td>9.3</td>
</tr>
<tr>
<td>Channelized OC12/STM4 Enhanced IQ (IQE) PIC with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1CHOC12-STM4-IQE-SFP</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>PB-4CHOC12-STM4-IQE-SFP</td>
<td>9.4</td>
</tr>
<tr>
<td>Channelized OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1CHOC48-STM16-IQE</td>
<td>9.4</td>
</tr>
<tr>
<td>DS3, E1, E3, and T1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DS3/E3 Enhanced IQ (IQE) PIC (M120 Router)</td>
<td>4</td>
<td>PB-4DS3-E3-IQE-BNC</td>
<td>9.3R2</td>
</tr>
<tr>
<td>E3 IQ PIC (M120 Router)</td>
<td>4</td>
<td>PB-4E3-QPP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>E1/T1 Circuit Emulation PIC (M120 Router)</td>
<td>12</td>
<td>PB-12T1E1-CE-TELCO</td>
<td>9.4</td>
</tr>
<tr>
<td>DS3 EOL PIC (M120 Router)</td>
<td>4</td>
<td>PB-4DS3</td>
<td>8.0R2</td>
</tr>
<tr>
<td>E1 EOL PICs (M120 Router)</td>
<td>4</td>
<td>PB-4E1-COAX, PB-4E1-RJ48</td>
<td>8.0R2</td>
</tr>
<tr>
<td>T1 EOL PIC (M120 Router)</td>
<td>4</td>
<td>PB-4T1-RJ48</td>
<td>8.0R2</td>
</tr>
<tr>
<td>EIA-530</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIA-530 PIC (M120 Router)</td>
<td>2</td>
<td>PB-2EIA530</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Ethernet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fast Ethernet PICs (M120 Router)</td>
<td>4</td>
<td>PB-4FE-TX</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Gigabit Ethernet PICs with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1GE-SFP</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>PB-4GE-SFP</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>PC-10GE-SFP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Fast Ethernet PICs (M120 Router)</td>
<td>8</td>
<td>PB-8FE-FX</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>PB-12FE-TX-MDI, PB-12FE-TX-MDIX</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td>48</td>
<td>PB-48FE-TX</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Gigabit Ethernet PICs with SFP (M120 Router)</td>
<td>2</td>
<td>PB-2GE-SFP</td>
<td>8.0R2</td>
</tr>
</tbody>
</table>

Ethernet IQ

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Table 41: PICs Supported in the M120 Router (continued)

<table>
<thead>
<tr>
<th>PIC Family and Type</th>
<th>Ports</th>
<th>Model Number</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gigabit Ethernet IQ EOL PICs with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1GGE-SFP-QPP, PB-2GGE-SFP-QPP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Ethernet IQ2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gigabit Ethernet IQ2 EOL PICs with SFP (M120 Router)</td>
<td>4</td>
<td>PB-4GGE-TYPE1-SFP-IQ2</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>PB-8GGE-TYPE2-SFP-IQ2</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>PB-8GGE-TYPE3-SFP-IQ2</td>
<td>8.5</td>
</tr>
<tr>
<td>Ethernet Enhanced IQ2 (IQ2E)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs with SFP (M120 Router)</td>
<td>4</td>
<td>PB-4GGE-TYPE1-SFP-IQ2E</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>PB-8GGE-TYPE2-SFP-IQ2E</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>PC-8GGE-TYPE3-SFP-IQ2E</td>
<td>9.4</td>
</tr>
<tr>
<td>10-Gigabit Ethernet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-Gigabit Ethernet PIC with XENPAK (M120 Router)</td>
<td>1</td>
<td>PC-1XGEXENPAK</td>
<td>8.0R2</td>
</tr>
<tr>
<td>10-Gigabit Ethernet DWDM EOL PIC (M120 Router)</td>
<td>1</td>
<td>PC-1XGEDWDM-CBAND</td>
<td>8.0R2</td>
</tr>
<tr>
<td>10-Gigabit Ethernet DWDM OTN EOL PIC (M120 Router)</td>
<td>1</td>
<td>PC-1XGEDWDM-OTN</td>
<td>9.4</td>
</tr>
<tr>
<td>10-Gigabit Ethernet IQ2 EOL PIC with XFP (M120 Router)</td>
<td>1</td>
<td>PC-1XGETYPE3-XFP-IQ2</td>
<td>8.2</td>
</tr>
<tr>
<td>10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PIC with XFP (M120 Router)</td>
<td>1</td>
<td>PC-1XGETYPE3-XFP-IQ2E</td>
<td>9.4</td>
</tr>
<tr>
<td>Services</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiservices PICs (M120 Router)</td>
<td>–</td>
<td>PB-MS-100-1</td>
<td>8.2R2</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>PB-MS-400-2</td>
<td>8.2</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>PC-MS-500-3</td>
<td>8.3</td>
</tr>
<tr>
<td>Tunnel Services PIC (M120 Router)</td>
<td>–</td>
<td>PB-TUNNEL-1</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>PB-TUNNEL</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td>–</td>
<td>PC-TUNNEL</td>
<td>8.0R2</td>
</tr>
</tbody>
</table>
### Table 41: PICs Supported in the M120 Router (continued)

<table>
<thead>
<tr>
<th>PIC Family and Type</th>
<th>Ports</th>
<th>Model Number</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adaptive Services II EOL PIC (M120 Router)</td>
<td>–</td>
<td>PB-AS2</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Adaptive Services II Layer 2 Services EOL PIC (M120 Router)</td>
<td>–</td>
<td>PB-AS2-LAYER2SERVICES</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Adaptive Services II FIPS EOL PIC (M120 Router)</td>
<td>–</td>
<td>PB-AS2-FIPS</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Link Services EOL PIC (M120 Router)</td>
<td>–</td>
<td>PE-LS-4, PE-LS-32, PE-LS-128</td>
<td>6.1</td>
</tr>
</tbody>
</table>

#### SONET/SDH

- **SONET/SDH OC3/STM1 Enhanced IQ (IQE) PIC with SFP (M120 Router)**  
  4 Ports  
  Model Number: PB-4OC3-STM1-IQE-SFP  
  First Junos OS Release Support: 9.3R2

- **SONET/SDH OC3/STM1 (Multi-Rate) PICs with SFP (M120 Router)**  
  4 Ports  
  Model Number: PB-4OC3-1OC12-SON-SFP, PB-4OC3-1OC12-SON2-SFP  
  First Junos OS Release Support: 8.3

- **SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M120 Router)**  
  4 Ports  
  Model Number: PB-4OC3-4OC12-SON-SFP  
  First Junos OS Release Support: 8.3

- **SONET/SDH OC48/STM16 Enhanced IQ (IQE) PIC with SFP (M120 Router)**  
  4 Ports  
  Model Number: PC-4OC48-STM16-IQE-SFP  
  First Junos OS Release Support: 11.2

- **SONET/SDH OC48c/STM16 PIC with SFP (M120 Router)**  
  4 Ports  
  Model Number: PC-4OC48-SON-SFP  
  First Junos OS Release Support: 8.0R2

- **SONET/SDH OC48/STM16 (Multi-Rate) PIC with SFP (M120 Router)**  
  1 Port  
  Model Number: PB-1OC48-SON-B-SFP  
  First Junos OS Release Support: 8.3

- **SONET/SDH OC192/STM64 PIC with XFP (M120 Router)**  
  1 Port  
  Model Number: PC-1OC192-SON-XFP  
  First Junos OS Release Support: 8.3

- **SONET/SDH OC3c/STM1 EOL PICs (M120 Router)**  
  4 Ports  
  Model Number: PB-4OC3-SON-MM, PB-4OC3-SON-SMIR  
  First Junos OS Release Support: 8.0R2

- **SONET/SDH OC12c/STM4 EOL PICs (M120 Router)**  
  1 Port  
  Model Number: PB-1OC12-SON-MM, PB-1OC12-SON-SMIR  
  First Junos OS Release Support: 8.0R2

  4 Ports  
  Model Number: PB-4OC12-SON-MM, PB-4OC12-SON-SMIR  
  First Junos OS Release Support: 8.0R2

- **SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M120 Router)**  
  1 Port  
  Model Number: PB-1OC12-SON-SFP  
  First Junos OS Release Support: 8.4

- **SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router)**  
  1 Port  
  Model Number: PB-1OC12-STM4-IQE-SFP  
  First Junos OS Release Support: 9.3
Table 41: PICs Supported in the M120 Router (continued)

<table>
<thead>
<tr>
<th>PIC Family and Type</th>
<th>Ports</th>
<th>Model Number</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>SONET/SDH OC48c/STM16 EOL PIC with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1OC48-SON-SFP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>SONET/SDH OC192c/STM64 EOL PIC (M120 Router)</td>
<td>1</td>
<td>PC-1OC192-SON-LR</td>
<td>5.4</td>
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</tbody>
</table>

Related Documentation
- M120 PICs Description on page 57
- M120 End-of-Life PICs Supported on page 63
- M120 PIC/FPC Compatibility on page 66

M120 End-of-Life PICs Supported

Table 42 on page 63 lists the end-of-life PICs supported in the M120 router. The PICs are listed alphabetically by PIC family.

NOTE: The M120 router is now end-of-life. See the JTAC support bulletin TSB16809 for additional information about the PICs and other associated FRUs that moved to end-of-life with the router. The “M120 PICs Supported” on page 58 topic lists PICs that had not moved to end-of-life before the M120 router itself moved to end-of-life.

Table 42: End-of-Life PICs Supported in the M120 Router

<table>
<thead>
<tr>
<th>PIC Family and Type</th>
<th>Ports</th>
<th>Model Number</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM2 IQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATM2 OC12/STM4 IQ PICs (M120 Router)</td>
<td>2</td>
<td>PB-2OC12-ATM2-MM</td>
<td>8.0R2</td>
</tr>
<tr>
<td>ATM2 OC48/STM16 IQ EOL PIC with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1OC48-ATM2-SFP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Channelized IQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channelized DS3 IQ EOL PIC (M120 Router)</td>
<td>4</td>
<td>PB-4CHDS3-QPP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Channelized E1 IQ EOL PIC (M120 Router)</td>
<td>10</td>
<td>PB-10CHE1-RJ48-QPP</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Channelized E1 IQ EOL PIC (M120 Router)</td>
<td>10</td>
<td>PB-10CHE1-RJ48-QPP-N</td>
<td>9.1R4 9.2R3 9.3R1</td>
</tr>
<tr>
<td>Channelized T1 IQ EOL PIC (M120 Router)</td>
<td>10</td>
<td>PB-10CHT1-RJ48-QPP</td>
<td>8.0R2</td>
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</table>
Table 42: End-of-Life PICs Supported in the M120 Router (continued)

<table>
<thead>
<tr>
<th>PIC Family and Type</th>
<th>Ports</th>
<th>Model Number</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channelized STM1 IQ EOL PIC (M120 Router)</td>
<td>1</td>
<td>PB-1CHSTM1-SMIR-QPP</td>
<td>8.0R2</td>
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<tr>
<td>Channelized OC3 IQ EOL PIC (M120 Router)</td>
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<td>PB-1CHOC3-SMIR-QPP</td>
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<tr>
<td>Channelized OC12 IQ EOL PIC (M120 Router)</td>
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<td>PB-1CHOC12-SMIR-QPP</td>
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<tr>
<td>Channelized OC48/STM16 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1CHOC48-STM16-IQE-SFP</td>
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</tr>
<tr>
<td>DS3, E1, and T1</td>
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<td></td>
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<tr>
<td>DS3 EOL PIC (M120 Router)</td>
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<td>PB-4DS3</td>
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<tr>
<td>E1 EOL PICs (M120 Router)</td>
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<td>PB-4E1-COAX</td>
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<td>PB-4E1-RJ48</td>
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</tr>
<tr>
<td>T1 EOL PIC (M120 Router)</td>
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<td>PB-4T1-RJ48</td>
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<tr>
<td>Ethernet</td>
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<tr>
<td>Fast Ethernet PICs (M120 Router)</td>
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<td>PB-8FE-FX</td>
<td>8.0R2</td>
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<tr>
<td></td>
<td>12</td>
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<tr>
<td>Gigabit Ethernet PICs with SFP (M120 Router)</td>
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<td>PB-2GE-SFP</td>
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<td>Ethernet IQ</td>
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<tr>
<td>Gigabit Ethernet IQ EOL PICs with SFP (M120 Router)</td>
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<tr>
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<td></td>
<td>PB-2GE-SFP-QPP</td>
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<tr>
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<tr>
<td>Gigabit Ethernet IQ2 EOL PICs with SFP (M120 Router)</td>
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<td>PB-4GE-TYPE1-SFP-IQ2</td>
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<td>8</td>
<td>PB-8GE-TYPE2-SFP-IQ2</td>
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<td></td>
<td>8</td>
<td>PB-8GE-TYPE3-SFP-IQ2</td>
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<tr>
<td>10-Gigabit Ethernet</td>
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<tr>
<td>10-Gigabit Ethernet DWDM EOL PIC (M120 Router)</td>
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<td>10-Gigabit Ethernet DWDM OTN EOL PIC (M120 Router)</td>
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<td>PIC Family and Type</td>
<td>Ports</td>
<td>Model Number</td>
<td>First Junos OS Release Support</td>
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<tr>
<td>10-Gigabit Ethernet IQ2 EOL PIC with XFP (M120 Router)</td>
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</table>

**Services**

<table>
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<th>PIC Family and Type</th>
<th>Ports</th>
<th>Model Number</th>
<th>First Junos OS Release Support</th>
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</thead>
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<tr>
<td>Adaptive Services II EOL PIC (M120 Router)</td>
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<td>PB-AS2</td>
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</tr>
<tr>
<td>Adaptive Services II Layer 2 Services EOL PIC (M120 Router)</td>
<td>–</td>
<td>PB-AS2-LAYER2SERVICES</td>
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</tr>
<tr>
<td>Adaptive Services II FIPS EOL PIC (M120 Router)</td>
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<td>PB-AS2-FIPS</td>
<td>8.0R2</td>
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<tr>
<td>Link Services EOL PIC (M120 Router)</td>
<td>–</td>
<td>PE-LS-4 PE-LS-32 PE-LS-12B</td>
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**SONET/SDH**

<table>
<thead>
<tr>
<th>PIC Family and Type</th>
<th>Ports</th>
<th>Model Number</th>
<th>First Junos OS Release Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>SONET/SDH OC3c/STM1 EOL PICs (M120 Router)</td>
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<td>PB-4OC3-SON-MM PB-4OC3-SON-SMIR</td>
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</tr>
<tr>
<td>SONET/SDH OC12c/STM4 EOL PICs (M120 Router)</td>
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<td>PB-1OC12-SON-MM PB-1OC12-SON-SMIR</td>
<td>8.0R2</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>PB-4OC12-SON-MM PB-4OC12-SON-SMIR</td>
<td>8.0R2</td>
</tr>
<tr>
<td>SONET/SDH OC12/STM4 (Multi-Rate) PICs with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1OC12-SON-SFP</td>
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</tr>
<tr>
<td>SONET/SDH OC12/STM4 Enhanced IQ (IQE) EOL PIC with SFP (M120 Router)</td>
<td>1</td>
<td>PB-1OC12-STM4-IQE-SFP</td>
<td>9.3</td>
</tr>
<tr>
<td>SONET/SDH OC48c/STM16 EOL PIC with SFP (M120 Router)</td>
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</tr>
<tr>
<td>SONET/SDH OCl92c/STM64 EOL PIC (M120 Router)</td>
<td>1</td>
<td>PC-1OC192-SON-LR PC-1OC192-SON-SR2</td>
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</tr>
</tbody>
</table>

**Related Documentation**

- M120 PICs Description on page 57
- M120 PICs Supported on page 58
- M120 PIC/FPC Compatibility on page 66
**M120 PIC/FPC Compatibility**

Table 43 on page 66 provides a PIC/FPC compatibility matrix that indicates the first Junos OS Release in which an FPC supports each PIC currently supported for the M120 router. For example, Junos OS Release 8.0R2 is the first release in which the FPC1 supports the ATM2 DS3 IQ PIC.

**NOTE:** A – indicates that the PIC is not supported by the FPC.

### Table 43: M120 PIC/FPC Compatibility

<table>
<thead>
<tr>
<th>PIC Type</th>
<th>Number of Ports</th>
<th>PIC Model Number</th>
<th>FPC1</th>
<th>FPC2</th>
<th>FPC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATM2 IQ PICs</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATM2 DS3 IQ</td>
<td>4</td>
<td>PB-4DS3-ATM2</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>ATM2 E3 IQ</td>
<td>4</td>
<td>PB-4E3-ATM2</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>ATM2 OC3/STM1 IQ</td>
<td>2</td>
<td>PB-2OC3-ATM2-MM</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PB-2OC3-ATM2-SMIR</td>
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<tr>
<td>ATM2 OC12/STM4 IQ</td>
<td>1</td>
<td>PB-1OC12-ATM2-MM</td>
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</tr>
<tr>
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<td></td>
<td>PB-1OC12-ATM2-SMIR</td>
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<td></td>
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<tr>
<td>ATM2 OC12/STM4 IQ</td>
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<td>PB-2OC12-ATM2-MM</td>
<td>–</td>
<td>8.0R2</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>PB-2OC12-ATM2-SMIR</td>
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<tr>
<td>ATM2 OC48/STM16 IQ, SFP</td>
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<td>PB-1OC48-ATM2-SFP</td>
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<td>8.0R2</td>
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<tr>
<td>Channelized Circuit Emulation PICs</td>
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<td>ChOC3/STM1 Circuit Emulation</td>
<td>4</td>
<td>PB-4CHOC3-CE-SFP</td>
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<tr>
<td>Channelized IQ PICs</td>
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<tr>
<td>ChDS3 IQ</td>
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<td>PB-4CHDS3-QPP</td>
<td>8.0R2</td>
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<tr>
<td>ChE1 IQ EOL</td>
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<td>PB-10CHE1-RJ48-QPP</td>
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<td>ChE1 IQ</td>
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<td>PB-10CHE1-RJ48-QPP-N</td>
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</table>
## Table 43: M120 PIC/FPC Compatibility (continued)

<table>
<thead>
<tr>
<th>PIC Type</th>
<th>Number of Ports</th>
<th>PIC Model Number</th>
<th>FPC1</th>
<th>FPC2</th>
<th>FPC3</th>
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<tbody>
<tr>
<td>ChSTM1 IQ</td>
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<td>PB-ICSTM1-SMIR-QPP</td>
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<td>ChT1 IQ</td>
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<td>PB-10CHT1-RJ48-QPP</td>
<td>8.0R2</td>
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<td>–</td>
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<tr>
<td><strong>Channelized Enhanced IQ (IQE) PICs</strong></td>
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<tr>
<td>ChDS3/E3 IQE with SFP</td>
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<td>PB-4CHDS3-E3-IQE-BNC</td>
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<td>ChE1/T1 IQE</td>
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<td>PB-10CHE1-T1-IQE-RJ48</td>
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<tr>
<td>ChOC3/STM1 IQE with SFP</td>
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<td>ChOC12/STM4 IQE with SFP</td>
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<td>ChOC12/STM4 IQE with SFP</td>
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<td>PB-4CHOC12-STM4-IQE-SFP</td>
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<tr>
<td><strong>T1, DS3, E1, E3 PICs</strong></td>
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<td>E1</td>
<td>4</td>
<td>PB-4E1-COAX</td>
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<td><strong>Fast Ethernet PICs</strong></td>
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<tr>
<td>Fast Ethernet</td>
<td>12</td>
<td>PB-12FE-TX</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Table 43: M120 PIC/FPC Compatibility (continued)

<table>
<thead>
<tr>
<th>PIC Type</th>
<th>Number of Ports</th>
<th>PIC Model Number</th>
<th>FPC1</th>
<th>FPC2</th>
<th>FPC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast Ethernet</td>
<td>48</td>
<td>PB-48FE-TX</td>
<td>–</td>
<td>8.0R2</td>
<td>–</td>
</tr>
<tr>
<td>Gigabit Ethernet PICs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gigabit Ethernet, SFP</td>
<td>1</td>
<td>PB-1GE-SFP</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Gigabit Ethernet, SFP</td>
<td>2</td>
<td>PB-2GE-SFP</td>
<td>–</td>
<td>8.0R2</td>
<td>–</td>
</tr>
<tr>
<td>Gigabit Ethernet, SFP</td>
<td>4</td>
<td>PB-4GE-SFP</td>
<td>–</td>
<td>8.0R2</td>
<td>–</td>
</tr>
<tr>
<td>Gigabit Ethernet, SFP</td>
<td>10</td>
<td>PC-10GE-SFP</td>
<td>–</td>
<td>–</td>
<td>8.0R2</td>
</tr>
<tr>
<td>Gigabit Ethernet IQ PICs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gigabit Ethernet IQ, SFP</td>
<td>1</td>
<td>PB-1GE-SFP-QPP</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Gigabit Ethernet IQ, SFP</td>
<td>2</td>
<td>PB-2GE-SFP-QPP</td>
<td>–</td>
<td>8.0R2</td>
<td>–</td>
</tr>
<tr>
<td>Gigabit Ethernet IQ2 PICs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gigabit Ethernet IQ2, SFP</td>
<td>4</td>
<td>PB-4GE-TYPE1-SFP-IQ2</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Gigabit Ethernet IQ2, SFP</td>
<td>8</td>
<td>PB-8GE-TYPE2-SFP-IQ2</td>
<td>–</td>
<td>8.0R2</td>
<td>–</td>
</tr>
<tr>
<td>Gigabit Ethernet IQ2, SFP</td>
<td>8</td>
<td>PC-8GE-TYPE3-SFP-IQ2</td>
<td>–</td>
<td>–</td>
<td>8.5</td>
</tr>
<tr>
<td>Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gigabit Ethernet IQ2E, SFP</td>
<td>4</td>
<td>PB-4GE-TYPE1-SFP-IQ2E</td>
<td>9.4</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Gigabit Ethernet IQ2E, SFP</td>
<td>8</td>
<td>PB-8GE-TYPE2-SFP-IQ2E</td>
<td>–</td>
<td>9.4</td>
<td>–</td>
</tr>
<tr>
<td>Gigabit Ethernet IQ2E, SFP</td>
<td>8</td>
<td>PC-8GE-TYPE3-SFP-IQ2E</td>
<td>–</td>
<td>–</td>
<td>9.4</td>
</tr>
<tr>
<td>10-Gigabit Ethernet PICs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-Gigabit Ethernet, XENPAK</td>
<td>1</td>
<td>PC-1XGE-XENPAK</td>
<td>–</td>
<td>–</td>
<td>8.0R2</td>
</tr>
<tr>
<td>10-Gigabit Ethernet, DWDM</td>
<td>1</td>
<td>PC-1XGE-DWDM-CBAND</td>
<td>–</td>
<td>–</td>
<td>8.0R2</td>
</tr>
<tr>
<td>10-Gigabit Ethernet, DWDM OTN</td>
<td>1</td>
<td>PC-1XGE-DWDM-OTN</td>
<td>–</td>
<td>–</td>
<td>9.4</td>
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<tr>
<td>10-Gigabit Ethernet IQ2 PICs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-Gigabit Ethernet IQ2 PIC, XFP</td>
<td>1</td>
<td>PC-1XGE-TYPE3-XFP-IQ2</td>
<td>–</td>
<td>–</td>
<td>8.2</td>
</tr>
<tr>
<td>10-Gigabit Ethernet Enhanced IQ2 (IQ2E) PICs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 43: M120 PIC/FPC Compatibility (continued)

<table>
<thead>
<tr>
<th>PIC Type</th>
<th>Number of Ports</th>
<th>PIC Model Number</th>
<th>FPC1</th>
<th>FPC2</th>
<th>FPC3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Services PICs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adaptive Services II (AS) EOL</td>
<td>0</td>
<td>PB-AS2</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Adaptive Services II (AS) Layer 2 Services</td>
<td>0</td>
<td>PB-AS2-LAYER2SERVICES</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Adaptive Services II (AS) FIPS EOL</td>
<td>0</td>
<td>PB-AS2-FIPS</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Link Services EOL</td>
<td>0</td>
<td>PE-LS-4</td>
<td>6.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PE-LS-32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PE-LS-128</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Multiservices 100</strong></td>
<td>0</td>
<td>PB-MS-100-1</td>
<td>8.2R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td><strong>NOTE:</strong> This PIC requires a FPC1 with the 710-017980 version or later of the mezzanine board.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiservices 400</td>
<td>0</td>
<td>PB-MS-400-2</td>
<td>–</td>
<td>8.2</td>
<td>–</td>
</tr>
<tr>
<td>Multiservices 500</td>
<td>0</td>
<td>PC-MS-500-3</td>
<td>–</td>
<td>–</td>
<td>8.3</td>
</tr>
<tr>
<td>Tunnel Services (Type 1)</td>
<td>0</td>
<td>PB-TUNNEL-1</td>
<td>8.0R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Tunnel Services (Type 2)</td>
<td>0</td>
<td>PB-TUNNEL</td>
<td>–</td>
<td>8.0R2</td>
<td>–</td>
</tr>
<tr>
<td>Tunnel Services (Type 3)</td>
<td>0</td>
<td>PC-TUNNEL</td>
<td>–</td>
<td>–</td>
<td>8.0R2</td>
</tr>
<tr>
<td><strong>SONET/SDH PICs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OC3/STM1 EOL</td>
<td>4</td>
<td>PB-4OC3-SON-MM</td>
<td>8.0R2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>PB-4OC3-SON-SMIR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OC3/STM1 IQE, SFP</td>
<td>4</td>
<td>PB-4OC3-STM1-IQE-SFP</td>
<td>9.3R2</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>OC3/STM1 (Multi-Rate), SFP (Type 1)</td>
<td>4</td>
<td>PB-4OC3-1OC12-SON-SFP</td>
<td>8.4</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>OC3/STM1 (Multi-Rate), SFP (Type 2)</td>
<td>4</td>
<td>PB-4OC3-1OC12-SON2-SFP</td>
<td>–</td>
<td>8.3</td>
<td>–</td>
</tr>
<tr>
<td>OC12c/STM4 EOL</td>
<td>1</td>
<td>PB-1OC12-SON-MM</td>
<td>8.0R2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>PB-1OC12-SON-SMIR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OC12/STM4 IQE, SFP</td>
<td>1</td>
<td>PB-1OC12-STM4-IQE-SFP</td>
<td>9.3</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>OC12/STM4 (Multi-Rate), SFP</td>
<td>1</td>
<td>PB-1OC12-SON-SFP</td>
<td>8.4</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

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Table 43: M120 PIC/FPC Compatibility (continued)

<table>
<thead>
<tr>
<th>PIC Type</th>
<th>Number of Ports</th>
<th>PIC Model Number</th>
<th>FPC1</th>
<th>FPC2</th>
<th>FPC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>OC12/STM4 (Multi-Rate), SFP</td>
<td>4</td>
<td>PB-4OC12-SON-SFP</td>
<td>–</td>
<td>8.3</td>
<td>–</td>
</tr>
<tr>
<td>OC48c/STM16, SFP</td>
<td>4</td>
<td>PC-4OC48-SON-SFP</td>
<td>–</td>
<td>–</td>
<td>8.0R2</td>
</tr>
<tr>
<td>OC48c/STM16 SFP EOL</td>
<td>4</td>
<td>PB-1OC48-SON-SFP</td>
<td>8.0R2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OC48/STM16, SFP</td>
<td>4</td>
<td>PC-4OC48-STM16-IQE-SFP</td>
<td>–</td>
<td>–</td>
<td>11.2</td>
</tr>
<tr>
<td>OC48/STM16 (Multi-Rate), SFP</td>
<td>1</td>
<td>PB-1OC48-SON-B-SFP</td>
<td>–</td>
<td>8.3</td>
<td>–</td>
</tr>
<tr>
<td>OC192/STM64, XFP</td>
<td>1</td>
<td>PC-1OC192-SON-XFP</td>
<td>–</td>
<td>–</td>
<td>8.3</td>
</tr>
<tr>
<td>OC192c/STM64 EOL</td>
<td>1</td>
<td>PC-1OC192-SON-LR PC-1OC192-SON-SR2</td>
<td>5.4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Related Documentation
- M120 PICs Description on page 57
- M120 PICs Supported on page 58
CHAPTER 7

Power System Components and Descriptions

- M120 Power Supplies Description on page 71
- M120 DC Power Supply Description on page 72
- M120 AC Power Supply Description on page 72
- M120 Power Supply LEDs on page 73

M120 Power Supplies Description

The M120 router is configurable with either one or two AC or DC power supplies. The power supplies connect to the midplane, which distributes the different output voltages produced by the power supplies to the router components, depending on their voltage requirements.

All power supplies are hot-removable and hot-insertable.

NOTE: To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.

CAUTION: Mixing AC and DC power supplies is not supported. The first power supply powered on will electrically disable the second power supply without damaging any components in the system.

Related Documentation

- M120 AC Power Supply Description on page 72
- M120 DC Power Supply Description on page 72
- Connecting Power to an AC-Powered M120 Router on page 167
- Connecting Power to a DC-Powered M120 Router on page 169
- Maintaining the M120 Power Supplies on page 277
M120 DC Power Supply Description

In the DC power configuration, the router contains two DC power supplies (see Figure 20 on page 72), located in the right rear of the chassis in slots PEM0 and PEM1 (left to right). A single DC power supply provides sufficient power for a fully configured router.

Two DC power supplies share power almost equally within a fully populated system. If either power supply fails, the remaining power supply takes over without interruption.

Each DC power supply has a single DC input (–48 VDC and return) that requires a dedicated 60 A (–48 VDC) circuit breaker for the maximum router hardware configuration.

 figure: M120 DC Power Supply

Related Documentation
- M120 Power Supply LEDs on page 73
- M120 Router Power Requirements on page 88
- Connecting Power to a DC-Powered M120 Router on page 169
- Maintaining the M120 Power Supplies on page 277
- Replacing an M120 DC Power Supply on page 245
- M120 DC Power, Connection, and Cable Specifications on page 97

M120 AC Power Supply Description

In the AC power configuration, the router contains two AC power supplies (see Figure 21 on page 73), located vertically at the rear of the chassis in slots PEM0 through PEM1 (left to right). Each AC power supply provides power to all components in the router.
When two power supplies are present, they share power almost equally within a fully populated system.

Two AC power supplies provide full power redundancy. If one power supply fails or is removed, the remaining power supply instantly assumes the entire electrical load without interruption. One power supply provides the maximum configuration with full power for as long as the router is operational.

Each AC power supply has two AC appliance inlets. Each requires a dedicated AC power feed. For 100-120 VAC, both inlets are used and the bottom inlet cover must be removed prior to installation. For 200–240 VAC, only the top inlet is used.

Figure 21: M120 AC Power Supply

M120 Power Supply LEDs

The LED on each power supply faceplate indicates the status of the power supply (see Table 44 on page 74, which applies to the AC and DC power supply). The power supply status is also reflected in two LEDs on the craft interface (see “Power Supply LEDs on the M120 Craft Interface” on page 15). In addition, a power supply failure triggers the red alarm LED on the craft interface.
### Table 44: M120 Power Supply LED

<table>
<thead>
<tr>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue</td>
<td>Off</td>
<td>No power applied to power supply.</td>
</tr>
<tr>
<td></td>
<td>Blinking</td>
<td>• Power supply blinks for 5 seconds after initial power on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Power supply is installed, but not powered on.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Input voltage is invalid.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Power supply has failed.</td>
</tr>
<tr>
<td></td>
<td>On steadily</td>
<td>Power supply is functioning normally.</td>
</tr>
</tbody>
</table>

**Related Documentation**
- M120 Router Power Requirements on page 88
- Connecting Power to an AC-Powered M120 Router on page 167
- Connecting Power to a DC-Powered M120 Router on page 169
CHAPTER 8

Switch Fabric Components and Descriptions

- M120 Forwarding Engine Boards (FEBs) Description on page 75
- M120 Forwarding Engine Boards (FEBs) LEDs on page 77

M120 Forwarding Engine Boards (FEBs) Description

The M120 router provides redundant Forwarding Engine Boards (FEBs). The FPC (the board that hosts the PICs) is separate from the FEB (the board that handles the packets). FEBs provide route lookup and forwarding functions from FPCs and CFPCs. FPCs and CFPCs are located on the front of the chassis, and provide power and management to the PICs through the midplane. The midplane relays signals to the FEB (inserted from the rear of the chassis, which processes the packets.

The midplane architecture allows any FEB to carry traffic for any FPC. You can configure the mapping of FPCs to FEBs. If a FEB fails, a backup FEB can quickly take over packet forwarding.
Each FEB consists of the following components:

- I-chip ASIC, which provides multiple paths for PFE to PIC communication.
- H2S—Bridge between HSLA and one SPI4 interface.
- A crossbar switch that provides connection between the FEB WAN links and the FPC WAN links.
- Three LEDs located on the FEB faceplate that display the status of the FEB.
  “M120 Forwarding Engine Boards (FEBs) LEDs” on page 77 describes the functions of the FEB LEDs.
- Six LEDs located on the FEB faceplate indicate which FPC the FEB is connected to, labeled 0 through 5. The illuminated green LED corresponds to the FPC connected to the FEB.
- Midplane connectors and power circuitry.
- Online/offline button.

Related Documentation:
- Replacing an M120 FEB on page 255
- Troubleshooting M120 FEBs on page 289
- Maintaining the M120 FEBs on page 278
# M120 Forwarding Engine Boards (FEBs) LEDs

## Table 45: M120 FEB LEDs

<table>
<thead>
<tr>
<th>Label</th>
<th>Color</th>
<th>State</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>OK</td>
<td>Green</td>
<td>On steadily</td>
<td>FEB is online and is functioning normally.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinking</td>
<td>FEB is powering up, but not online.</td>
</tr>
<tr>
<td>FAIL</td>
<td>Yellow</td>
<td>On steadily</td>
<td>FEB has failed and is not carrying traffic.</td>
</tr>
<tr>
<td>ACTIVE</td>
<td>Green</td>
<td>On steadily</td>
<td>FEB is on and mapped to an FPC. This LED is unlit if a FEB is designated as a backup and has not been failed over to.</td>
</tr>
</tbody>
</table>

## Related Documentation
- M120 Forwarding Engine Boards (FEBs) Description on page 75
- Replacing an M120 FEB on page 255
- Troubleshooting M120 FEBs on page 289
- Maintaining the M120 FEBs on page 278
PART 2

Site Planning, Preparation, and Specifications

- Preparation Overview on page 81
- AC Power Requirements and Specifications on page 93
- DC Power Requirements and Specifications on page 97
- Network Cable and Transceiver Planning on page 101
- Management Cable and Transceiver Specifications and Pinouts on page 105
CHAPTER 9

Preparation Overview

- M120 Site Preparation Checklist on page 81
- M120 Router Physical Specifications on page 82
- M120 Cabinet Size and Clearance Requirements on page 82
- M120 Cabinet Airflow Requirements on page 83
- M120 Rack Mounting Requirements on page 83
- M120 Clearance Requirements for Airflow and Hardware Maintenance on page 85
- M120 Router Environmental Specifications on page 86
- M120 Chassis Grounding Specifications on page 87
- M120 Router Power Requirements on page 88

**M120 Site Preparation Checklist**

The checklist in Table 46 on page 81 summarizes the tasks you need to perform when preparing a site for router installation.

<table>
<thead>
<tr>
<th>Item or Task</th>
<th>Performed By</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verify that environmental factors such as temperature and humidity do not exceed router tolerances (see “M120 Router Environmental Specifications” on page 86).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure distance between external power sources and router installation site.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select the type of rack or cabinet.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan rack or cabinet location, including required space clearances.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>If a rack is used, secure rack to floor and building structure.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquire cables and connectors.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 46: M120 Site Preparation Checklist (continued)

<table>
<thead>
<tr>
<th>Item or Task</th>
<th>Performed By</th>
<th>Date</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locate sites for connection of system grounding.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculate power budget and power margin.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Related Documentation
- M120 Router Chassis Description on page 7
- M120 Router Physical Specifications on page 82
- General Safety Warnings for Juniper Networks Devices on page 314
- Installation Safety Warnings for Juniper Networks Devices on page 322
- M120 Chassis Lifting Guidelines on page 321

M120 Router Physical Specifications

Table 47 on page 82 summarizes the physical specifications for the router chassis.

Table 47: M120 Physical Specifications

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
</table>
| Chassis dimensions | • 20.75 in. (52.71 cm) high  
                      | • 17.43 in. (44.3 cm) wide  
                      | • 24.3 in. (61.7 cm) deep (from front-mounting flange to chassis rear)  
                      | • Total depth (including cable management system)  
                      | 29.85 in. (75.8 cm) |
| Router weight      | • Chassis with midplane and fans: 110 lb (49 kg)  
                      | • Maximum configuration: 225 lb (102.1 kg) |

Related Documentation
- M120 Router Description on page 3
- M120 Router Chassis Description on page 7
- M120 Router Environmental Specifications on page 86

M120 Cabinet Size and Clearance Requirements

The minimum size cabinet that can accommodate the router is 600 mm wide and 800 mm deep. A cabinet larger than the minimum requirement provides better airflow and reduces the chance of overheating. To accommodate a single router, the cabinet must be at least 12 U (21 in. or 53.4 cm) high. If you provide adequate cooling air and airflow clearance, you can stack four routers in a cabinet that has at least 48 U (84 in. or 2.1 m) of usable vertical space.
The minimum front and rear clearance requirements depend on the mounting configuration you choose. The minimum total clearance inside the cabinet is 30.70 in. between the inside of the front door and the inside of the rear door.

**NOTE:** If you mount the router in a cabinet, be sure that sufficient room is provided for cable management and cables.

**M120 Cabinet Airflow Requirements**

When you mount the router in a cabinet, you must ensure that ventilation through the cabinet is sufficient to prevent overheating. Following is a list of requirements to consider when planning for chassis cooling:

- Ensure that the cool air supply you provide through the cabinet can adequately dissipate the thermal output of the router. Table 49 on page 86 lists the router's environmental specifications, including its operating temperature and thermal output.

- Ensure that the cabinet allows the chassis hot exhaust air to exit from the cabinet without recirculating into the router. An open cabinet (without a top or doors) that employs hot air exhaust extraction from the top allows the best airflow through the chassis. If the cabinet contains a top or doors, perforations in these elements assist with removing the hot air exhaust. For an illustration of chassis airflow, see Figure 7 on page 20.

- Route and dress all cables to minimize the blockage of airflow to and from the chassis.

**M120 Rack Mounting Requirements**

The router can be installed in a rack. Many types of racks are acceptable, including four-post (telco) racks and open-frame racks. An example of an open-frame rack appears in Figure 23 on page 85. Table 48 on page 84 summarizes rack requirements and specifications for the M120 router.
### Table 48: M120 Rack Requirements and Specifications

<table>
<thead>
<tr>
<th>Rack Requirement</th>
<th>Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rack type and mounting bracket hole spacing</td>
<td>Use a four-post rack or a two-post rack. You can mount the router on any four-post or two-post rack that provides bracket holes or hole patterns spaced at 1 U (1.75-in./4.44-cm) increments and that meets the size and strength requirements specified in this table.</td>
</tr>
</tbody>
</table>

| Rack size and strength                        | • Ensure that the rack is a 19-in. rack as defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Components Industry Association ([http://www.ecianow.org/](http://www.ecianow.org/)). |
|                                              | • Ensure that the rack is one of the following standard lengths:                                                                                                                                                                                                                                                                       |
|                                              |   • 23.62 in. (600 mm)                                                                                                                                                                                                                                                                                                                |
|                                              |   • 30.0 in. (762 mm)                                                                                                                                                                                                                                                                                                                  |
|                                              |   • 21.5 in. (800 mm)                                                                                                                                                                                                                                                                                                                  |
|                                              | • The rack rails must be spaced widely enough to accommodate the router chassis's external dimensions: 20.75 in. (52.71 cm) high, 24.3 in. (61.7 cm) deep, and 1743 in. (44.3 cm) wide. The outer edges of the mounting brackets extend the width to 19 in. (48.3 cm). The spacing of rails and adjacent racks must also allow for the clearances around the router and rack that are specified in “M120 Clearance Requirements for Airflow and Hardware Maintenance” on page 85. |
|                                              | • All mounting options require you to install the supplied large mounting shelf. The supplied small mounting shelf is needed for a front-mount four-post rack or cabinet.                                                                                           |
|                                              | • If a front-mount rack is used, you must support the back of the router with the large mounting shelf included with your shipment, or some other structure.                                                                                                                   |
|                                              | • For a front-mount rack, you use the front-mounting flanges on the front of the chassis instead of the mounting brackets. The flanges have holes for rack-mounting screws, spaced at 3.5 in. (8.89 cm). In addition, if you are mounting the router in a four-post rack or cabinet, you must install the spacer bars on the rack before you mount the chassis. For instructions about installing the mounting hardware, see “Installing the Mounting Hardware for a Front-Mount Four-Post Rack or Cabinet” on page 119, “Installing the Mounting Hardware for a Front-Mount Open-Frame Rack” on page 121, or “Installing the Mounting Hardware for a Center-Mount Open-Frame Rack” on page 123. |
|                                              | • The chassis height of 20.75 in. (52.71 cm) is approximately 12 U. A U is the standard rack unit defined in *Cabinets, Racks, Panels, and Associated Equipment* (document number EIA-310–D) published by the Electronics Components Industry Association. You can stack four M120 routers in a rack that has at least 48 U (84 in. or 2.1 m) of usable vertical space. |
|                                              | • The rack must be strong enough to support the weight of the fully configured router, up to 225 lb (102.1 kg). If you stack four fully configured routers in one rack, it must be capable of supporting about 900 lb (408.4 kg).                                                                 |
|                                              | • Ensure that the spacing of rails and adjacent racks allows for the proper clearance around the switch and rack as specified in “M120 Clearance Requirements for Airflow and Hardware Maintenance” on page 85.                                                                 |

| Rack connection to the building structure     | • Secure the rack to the building structure.                                                                                                                                                                                                                                                                                           |
|                                              | • If earthquakes are a possibility in your geographical area, secure the rack to the floor.                                                                                                                                                                                                                                         |
|                                              | • Secure the rack to the ceiling brackets as well as wall or floor brackets for maximum stability.                                                                                                                                                                                                                                  |
Figure 23: Typical Open-Frame Rack

When planning the installation site, you need to allow sufficient clearance around the rack (see Figure 24 on page 86):

- For the cooling system to function properly, the airflow around the chassis must be unrestricted. Figure 7 on page 20 depicts the airflow in the router.

Related Documentation
- M120 Clearance Requirements for Airflow and Hardware Maintenance on page 85
- Installing the Mounting Hardware for a Center-Mount Open-Frame Rack on page 123
- Installing the Mounting Hardware for a Front-Mount Four-Post Rack or Cabinet on page 119
- Installing the Mounting Hardware for a Front-Mount Open-Frame Rack on page 121
- Installation Safety Warnings for Juniper Networks Devices on page 322
- Installing the M120 Router Without Using a Mechanical Lift on page 139
For service personnel to remove and install hardware components, there must be adequate space at the front and back of the router. Allow at least 30 in. (76.2 cm) both in front of and behind the router.

Airflow vents provided along the sides of the chassis must remain open and uncovered for proper cooling.

Figure 24: M120 Chassis Dimensions and Clearance Requirements

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altitude</td>
<td>No performance degradation to 10,000 ft (4038 m)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>Normal operation ensured in relative humidity range of 5% to 90%, noncondensing</td>
</tr>
</tbody>
</table>
Table 49: M120 Router Environmental Specifications (continued)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>Normal operation ensured in temperature range of 32°F (0°C) to 104°F (40°C)</td>
</tr>
<tr>
<td></td>
<td>Nonoperating storage temperature in shipping container: −40°F (−40°C) to 158°F (70°C)</td>
</tr>
<tr>
<td>Seismic</td>
<td>Designed to meet Telcordia Technologies Zone 4 earthquake requirements</td>
</tr>
<tr>
<td>Maximum thermal output</td>
<td>AC power: 7,923 BTU/hour (2322 W)</td>
</tr>
<tr>
<td></td>
<td>DC power: 8,299 BTU/hour (2432 W)</td>
</tr>
</tbody>
</table>

NOTE: Install the router only in restricted areas, such as dedicated equipment rooms and equipment closets, in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code, ANSI/NFPA 70.

Related Documentation

- M120 Router Description on page 3
- M120 Router Chassis Description on page 7
- M120 Router Physical Specifications on page 82

M120 Chassis Grounding Specifications

To meet safety and electromagnetic interference (EMI) requirements and to ensure proper operation, the router must be adequately grounded before power is connected. Two pairs of threaded inserts (PEM nuts) are provided on the right rear of the chassis for connecting the router to earth ground.

CAUTION: Before router installation begins, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the router.

To ground AC-powered and DC-powered routers, connect a grounding cable to earth ground and then attach it to the chassis grounding points using two screws. The left pair of grounding points fits M6 screws (European), and the right pair fits UNC 1/4–20 screws (American). The grounding points are spaced at 0.625-in. (15.86-mm) centers. The accessory box shipped with the router includes the cable lug that attaches to the grounding cable (see Figure 25 on page 88) and two UNC 1/4–20 screws used to secure the grounding cable to the right pair of grounding points. (The cable lug shown in Figure 25 on page 88 is also used for the DC power cables.)
If the 48 VDC facility is equipped with a circuit breaker rated at 60 A (-48 VDC), then the grounding cable must be minimum 10 AWG, or as permitted by the local code. If the 48 VDC facility is equipped with a circuit breaker rated more than 60 A (-48 VDC) up to 100 A (-48 VDC), then the grounding cable must be minimum 8 AWG, or as permitted by the local code.

**NOTE:** Additional grounding is provided to an AC-powered router when you plug its power supplies into grounded AC power receptacles.

**Related Documentation**
- M120 Router Chassis Description on page 7
- Connecting the Grounding Cable to the M120 Router on page 151

**M120 Router Power Requirements**

Table 50 on page 88 lists the AC and DC power system electrical specifications. Table 51 on page 89 lists the AC power supply electrical specifications. Table 52 on page 89 lists the DC power supply electrical specifications. Table 53 on page 89 lists the power requirements for various hardware components when the router is operating under typical voltage conditions. For PIC power requirements, see the M120 Multiservice Edge Router Interface Module Reference.

**Table 50: Power System Electrical Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC input voltage</td>
<td>Operating range: 100 to 240 VAC</td>
</tr>
<tr>
<td>AC input line frequency</td>
<td>47 to 63 Hz</td>
</tr>
<tr>
<td>AC system current rating</td>
<td>28 A @ 100 VAC (15 A top inlet, 13 A bottom inlet)</td>
</tr>
<tr>
<td>(per power supply)</td>
<td>14 A @ 240 VAC</td>
</tr>
</tbody>
</table>
### Table 50: Power System Electrical Specifications (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC input voltage</td>
<td>Operating range: (-40.0 \text{ to } -72) VDC</td>
</tr>
<tr>
<td><strong>NOTE:</strong> If the input voltage from the DC power source drops below (-37.5 \text{ to } -39.5) VDC, the router automatically shuts down. During automatic shutdown, the circuit remains active. When the input voltage returns to (-43.0 \text{ to } -44.00) VDC, the router automatically starts up again and the system returns to normal operation within 30 minutes. No operator intervention is required.</td>
<td></td>
</tr>
<tr>
<td>DC system current rating (per power supply)</td>
<td>48 A @ –48 VDC (nominal)</td>
</tr>
</tbody>
</table>

### Table 51: AC Power Supply Electrical Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum output power</td>
<td>2100 W</td>
</tr>
<tr>
<td>AC input voltage</td>
<td>Operating range: 100 to 240 VAC (nominal)</td>
</tr>
<tr>
<td>AC input line frequency</td>
<td>47 to 63 Hz</td>
</tr>
<tr>
<td>AC input current rating</td>
<td>28 A @ 100 VAC (15 A top inlet, 13 A bottom inlet)</td>
</tr>
<tr>
<td></td>
<td>14 A @ 240 VAC</td>
</tr>
</tbody>
</table>

### Table 52: DC Power Supply Electrical Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum output power</td>
<td>2100 W</td>
</tr>
<tr>
<td>DC input voltage</td>
<td>Nominal: –48 VDC, –60 VDC</td>
</tr>
<tr>
<td></td>
<td>Operating range: (-40.0 \text{ to } -72) VDC</td>
</tr>
<tr>
<td>DC input current rating</td>
<td>60 A @ –48 VDC</td>
</tr>
<tr>
<td>Internal Supplementary Protector</td>
<td>60 A</td>
</tr>
</tbody>
</table>

### Table 53: Component Power Requirements

<table>
<thead>
<tr>
<th>Component</th>
<th>DC Power Requirement (Watts)</th>
<th>DC Current Requirement (Amps @ –48 VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling system (normal speed)</td>
<td>187 W</td>
<td>3.90 A</td>
</tr>
</tbody>
</table>
Table 53: Component Power Requirements (continued)

<table>
<thead>
<tr>
<th>Component</th>
<th>DC Power Requirement (Watts)</th>
<th>DC Current Requirement (Amps @ –48VDC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooling system (full speed)</td>
<td>245 W</td>
<td>5.11 A</td>
</tr>
<tr>
<td>AC power supply</td>
<td>114 W</td>
<td>Not applicable</td>
</tr>
<tr>
<td>DC power supply</td>
<td>17 W</td>
<td>0.35 A</td>
</tr>
<tr>
<td>FEB</td>
<td>86 W</td>
<td>1.79 A</td>
</tr>
<tr>
<td>Type 1 FPC (without PICs)</td>
<td>27 W</td>
<td>0.56 A</td>
</tr>
<tr>
<td>Type 2 FPC (without PICs)</td>
<td>44 W</td>
<td>0.92 A</td>
</tr>
<tr>
<td>Type 3 FPC (without PICs)</td>
<td>34 W</td>
<td>0.72 A</td>
</tr>
<tr>
<td>CFPCs</td>
<td>54 W</td>
<td>1.12 A</td>
</tr>
<tr>
<td>CB (and craft interface)</td>
<td>38 W</td>
<td>0.78 A</td>
</tr>
<tr>
<td>Routing Engine 1000</td>
<td>35 W</td>
<td>0.74 A</td>
</tr>
<tr>
<td>Routing Engine 1800</td>
<td>110 W</td>
<td>2.3 A</td>
</tr>
<tr>
<td>Routing Engine 2000</td>
<td>71 W</td>
<td>1.48 A</td>
</tr>
</tbody>
</table>

You can use the information in Table 53 on page 89 to calculate power consumption for various hardware configurations, input current from a different source voltage, and thermal output, as shown in the following examples for a DC-powered router. These examples use generalized values for PICs. For PIC power requirements, see the M120 Multiservice Edge Router Interface Module Reference.

- Power consumption for minimum configuration:
  
  \[
  \text{Cooling system (normal speed)} + 1 \text{ host subsystem with RE1000} + 1 \text{ Type 1 FPC} + 1 \text{ FEB} + 1 \text{ Type 1 PIC} = \\
  3.90 \text{ A} + 1.52 \text{ A} + 0.69 \text{ A} + 1.79 \text{ A} + 0.56 \text{ A} = 8.46 \text{ A @ } -48 \text{ VDC} = 406 \text{ W DC}
  \]

- Power consumption for maximum DC-powered configuration:
  
  \[
  \text{Cooling system (high speed)} + 2 \text{ host subsystems with RE2000} + 2 \text{ CFPC} + 4 \text{ Type 2 FPCs} + 6 \text{ FEBs} + 16 \text{ Type 2 PICs} = \\
  5.11 \text{ A} + 2 \left( 1.48 \text{ A} + 0.78 \text{ A} \right) + 2 \left( 1.12 \right) + 4 \left( 0.92 \text{ A} \right) + 6 \left( 1.79 \text{ A} \right) + 16 \left( 1.05 \text{ A} \right) = \\
  5.11 \text{ A} + 4.52 \text{ A} + 2.24 \text{ A} + 3.68 \text{ A} + 10.74 \text{ A} + 16.8 \text{ A} = 43.09 \text{ A @ } -48 \text{ VDC} = 2,068 \text{ W DC}
  \]

- System thermal output for maximally configured DC-powered router:
  
  \[
  \text{Watts DC} \times 3.41 = \text{BTU/hr} \\
  2,068 \times 3.41 = 7052 \text{ BTU/hr}
  \]
• System thermal output for maximally configured AC-powered router:
  \[(\text{Watts DC / AC power supply 110V input 85% efficiency}) \times 3.41 = \text{BTU/hr}\]
  \[(2,068 / 0.85) \times 3.41 = 8296 \text{ BTU/hr}\]
  \[(\text{Watts DC / AC power supply 220V input 89% efficiency}) \times 3.41 = \text{BTU/hr}\]
  \[(2,068 / 0.89) \times 3.41 = 7923 \text{ BTU/hr}\]

• Current requirement adjustment for fans running at full speed (high temperature environment or cooling component failure):
  \[\text{Calculated system current} (X) = \text{Cooling (normal)} + \text{Cooling (full speed)} = X A + 3.90 A + 5.11 A = X A + 1.21 A\]

• Input current from a DC source other than -48 VDC (based on maximum configuration; applies to DC power supply only):
  \[(-54 \text{ VDC input}) \times (\text{input current} X) = (-48 \text{ VDC input}) \times (\text{input current} Y)\]
  \[54 \times X = 48 \times 43.1 A\]
  \[X = 48 \times 43.1 A / 54 = 38.3 A\]

Related Documentation
  • M120 Power Supplies Description on page 71
  • Replacing an M120 AC Power Supply on page 239
  • Replacing an M120 DC Power Supply on page 245
  • M120 Router Chassis Description on page 7
CHAPTER 10

AC Power Requirements and Specifications

- M120 AC Power, Connection, and Power Cord Specifications on page 93
- Electrical Specifications for the M120 AC Power Supply on page 95

M120 AC Power, Connection, and Power Cord Specifications

In the AC power configuration, the router can have up to two load-sharing AC power supplies (see Figure 21 on page 73), located at the rear of the chassis in slots PEM0 and PEM1 (left to right). Each AC power supply provides power to all components in the router. When two power supplies are present, they share power almost equally within a fully populated system. The AC power supplies are fully redundant. If one power supply fails or is removed, the remaining power supply instantly assumes the entire electrical load without interruption. One power supply provides the maximum configuration with full power.

Each AC power supply has two AC appliance inlets. Each requires a dedicated AC power feed. For 100-120 VAC, both inlets are used. For 200-240 VAC, only the top inlet is used. Most sites distribute power through a main conduit that leads to frame-mounted power distribution panels, one of which can be located at the top of the rack that houses the router. An AC power cord connects each power supply to the power distribution panel.

Detachable AC power cords, each 2.5 m (approximately 8 ft) long, are supplied with the router. The C19W (right angle) appliance coupler at the female end of the cord inserts into the appliance inlet coupler, type C13, as described by International Electrotechnical Commission (IEC) standard 60320. The plug at the male end of the power cord fits into the power source receptacle that is standard for your geographical location.

WARNING: The AC power cord for the router is intended for use with the router only and not for any other use.
WARNING:

附属の電源コードセットはこの製品専用です。他の電気機器には使用しないでください。

Translation from Japanese: The attached power cable is only for this product. Do not use the cable for another product.

NOTE: In North America, AC power cords must not exceed 4.5 m (approximately 14.75 ft) in length, to comply with National Electrical Code (NEC) Sections 400-8 (NFPA 75, 5-2.2) and 210-52, and Canadian Electrical Code (CEC) Section 4-010(3). The cords supplied with the router are in compliance.

Table 54 on page 94 provides specifications and Figure 26 on page 95 depicts the plug on the AC power cord provided for each country or region.

Table 54: AC Power Cord Specifications

<table>
<thead>
<tr>
<th>Country</th>
<th>Model Number</th>
<th>Electrical Specification</th>
<th>Plug Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>CBL-M-PWR-RA-AU</td>
<td>240 VAC, 50 Hz AC</td>
<td>SAA/3</td>
</tr>
<tr>
<td>China</td>
<td>CBL-M-PWR-RA-CH</td>
<td>220 VAC, 50 Hz AC</td>
<td>PSB-10</td>
</tr>
<tr>
<td>Europe (except Denmark, Italy, Switzerland, and United Kingdom)</td>
<td>CBL-M-PWR-RA-EU</td>
<td>220 or 230 VAC, 50 Hz AC</td>
<td>CEE 7/7</td>
</tr>
<tr>
<td>Italy</td>
<td>CBL-M-PWR-RA-IT</td>
<td>230 VAC, 50 Hz AC</td>
<td>CEI 23-16/VII</td>
</tr>
<tr>
<td>Japan</td>
<td>CBL-PWR-RA-JP15</td>
<td>125 VAC, 50 or 60 Hz AC</td>
<td>JIS 8303</td>
</tr>
<tr>
<td></td>
<td>CBL-M-PWR-RA-JP</td>
<td>220 VAC, 50 or 60 Hz AC</td>
<td>NEMA L6-20P</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>One required</td>
</tr>
<tr>
<td>North America</td>
<td>CBL-PWR-RA-US15</td>
<td>120 VAC, 60 Hz AC</td>
<td>NEMA 5-15P</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Two required</td>
</tr>
<tr>
<td></td>
<td>CBL-M-PWR-RA-TWLK-US</td>
<td>250 VAC, 60 Hz AC</td>
<td>NEMA L6-20P</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>One required</td>
</tr>
</tbody>
</table>
### Table 54: AC Power Cord Specifications (continued)

<table>
<thead>
<tr>
<th>Country</th>
<th>Model Number</th>
<th>Electrical Specification</th>
<th>Plug Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>CBL-M-PWR-RA-UK</td>
<td>240 VAC, 50 Hz AC</td>
<td>BS89/13</td>
</tr>
</tbody>
</table>

#### Figure 26: M120 AC Plug Types

- Australia (SAA/3)
- China (PSB-10)
- Europe (CEE 7/7)
- Italy (CEI 23-16/VII)
- Japan (L6-20P)
- North America (L6-20P)
- North America NEMA (L6-20)
- UK (BS89/13)

---

**NOTE:** If you plan to operate a maximally configured AC-powered router, we recommend that you provision at least 33 A @ 240 VAC (11 A per inlet) for the system, or at least 11 A maximum @ 240 VAC for each power supply. Use a facility circuit breaker rated for 20 A, 125/250 VAC minimum for each AC power supply. Doing so enables you to operate the router in any configuration without upgrading the power infrastructure.

In North America and Japan, use both inlets for 125 VAC.

---

**CAUTION:** Power cords and cables must not block access to router components or drape where people could trip on them.

---

**Related Documentation**
- M120 AC Power Supply Description on page 72
- Replacing an M120 AC Power Supply on page 239
- Replacing an M120 AC Power Supply Cord on page 244
- Connecting Power to an AC-Powered M120 Router on page 167

**Electrical Specifications for the M120 AC Power Supply**

Table 55 on page 96 lists the AC power supply electrical specifications.
### Table 55: AC Power Supply Electrical Specifications

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum output power</td>
<td>2100 W</td>
</tr>
<tr>
<td>AC input voltage</td>
<td>Operating range: 100 to 240 VAC (nominal)</td>
</tr>
<tr>
<td>AC input line frequency</td>
<td>47 to 63 Hz</td>
</tr>
<tr>
<td>AC input current rating</td>
<td>28 A @ 100 VAC (15 A top inlet, 13 A bottom inlet)</td>
</tr>
<tr>
<td></td>
<td>14 A @ 240 VAC</td>
</tr>
</tbody>
</table>

**Related Documentation**
- M120 AC Power Supply Description on page 72
- M120 Power Supply LEDs on page 73
- Replacing an M120 AC Power Supply on page 239
CHAPTER 11

DC Power Requirements and Specifications

- M120 DC Power, Connection, and Cable Specifications on page 97
- Electrical Specifications for the M120 DC Power Supply on page 100

M120 DC Power, Connection, and Cable Specifications

In the DC power configuration, the router contains two DC power supplies (see Figure 20 on page 72), located in the right rear of the chassis in slots PEM0 and PEM1 (left to right). A single DC power supply provides sufficient power for a fully configured router.

Two DC power supplies share power almost equally within a fully populated system. If either power supply fails, the remaining power supply takes over without interruption.

Each DC power supply has a single DC input (–48 VDC and return) that requires a dedicated 60 A (–48 VDC) circuit breaker for the maximum router hardware configuration.

Most sites distribute DC power through a main conduit that leads to frame-mounted DC power distribution panels, one of which might be located at the top of the rack that houses the router. A pair of cables (one input and one return) connects each set of terminal studs to the power distribution panel.

NOTE: If you plan to operate a maximally configured DC-powered router, we recommend that you provision at least 60 A @ –48 VDC for the system. Use a facility circuit breaker rated for 60 A (–48 VDC) minimum for each DC power supply. Doing so enables you to operate the router in any configuration without upgrading the power infrastructure.

If you plan to operate a DC-powered router at less than the maximum configuration and do not provision a 60 A (–48 VDC) circuit breaker, we recommend that you provision a circuit breaker for each DC power supply rated for at least 125% of the continuous current that the system draws at –48 VDC.
CAUTION: You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (−) to indicate their polarity. There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines the color coding for the leads on the power cables that attach to the terminal studs on the power supply faceplate.

Figure 27 on page 98 shows a typical DC source cabling arrangement.

WARNING: Power plant ground and chassis ground must be connected to the same building ground.

Table 56 on page 99 summarizes the specifications for the grounding and power cables, which you supply. The accessory box shipped with the router includes the cable lugs that attach to the terminal studs of each power supply (see Figure 25 on page 88). (The cable lug shown in Figure 25 on page 88 is also used for the grounding the chassis.)

The DC return terminal must be connected to the central office (CO) ground. This common DC return connection (DC-C), and the −48 VDC connection must both be 8 AWG single-strand wire cable (minimum).

CAUTION: Before router installation begins, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the router.
### Table 56: M120 DC Power and Grounding Cable Specifications

<table>
<thead>
<tr>
<th>Cable Type</th>
<th>Quantity and Specification</th>
<th>Maximum Equal Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>Four 6-AWG (13.3 mm$^2$), minimum 75°C wire, or as permitted by the local code</td>
<td>None</td>
</tr>
<tr>
<td>Grounding</td>
<td>One 10-AWG (5.27 mm$^2$), minimum 75°C wire, or as permitted by the local code</td>
<td>None</td>
</tr>
<tr>
<td>Grounding—If the 48 VDC facility is equipped with a circuit breaker rated 80 A (−48 VDC) up to 100 A (−48 VDC), then the grounding cable must be minimum 6 AWG, or as permitted by the local code</td>
<td>One 6-AWG (13.3 mm$^2$), minimum 75°C wire, or as permitted by the local code</td>
<td>None</td>
</tr>
</tbody>
</table>

**WARNING:** For field-wiring connections, use copper conductors only.

For other electrical safety information, see “General Electrical Safety Warnings for Juniper Networks Devices” on page 339.

**CAUTION:** Power cords and cables must not block access to router components or drape where people could trip on them.

The accessory box shipped with the router includes the cable lugs that attach to the terminal studs of each power supply (see Figure 25 on page 88). (The cable lug shown in Figure 25 on page 88 is also used for the grounding the chassis.)

**CAUTION:** Before router installation begins, a licensed electrician must attach a cable lug to the grounding and power cables that you supply. A cable with an incorrectly attached lug can damage the router.

**CAUTION:** Power cords and cables must not block access to router components or drape where people could trip on them.

For information about the DC power supply, see “M120 DC Power Supply Description” on page 72. For instructions on connecting the DC power and grounding cables during initial installation, see “Connecting Power to a DC-Powered M120 Router” on page 169. For instructions on replacing a DC power cable, see “Replacing an M120 DC Power Supply Cable” on page 251.

**Related Documentation**
- Connecting Power to a DC-Powered M120 Router on page 169
- Replacing an M120 DC Power Supply on page 245
Electrical Specifications for the M120 DC Power Supply

Table 57 on page 100 lists the DC power supply electrical specifications.

**Table 57: DC Power Supply Electrical Specifications**

<table>
<thead>
<tr>
<th>Item</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum output power</td>
<td>2100 W</td>
</tr>
<tr>
<td>DC input voltage</td>
<td>Nominal: −48 VDC, −60 VDC</td>
</tr>
<tr>
<td></td>
<td>Operating range: −40.0 to −72 VDC</td>
</tr>
<tr>
<td></td>
<td><strong>NOTE:</strong> If the input voltage from the DC power source drops below −37.5 to −39.5 VDC, the router automatically shuts down. During automatic shutdown, the circuit remains active. When the input voltage returns to −43.0 to −44.00 VDC, the router automatically starts up again and the system returns to normal operation within 30 minutes. No operator intervention is required.</td>
</tr>
<tr>
<td>DC input current rating</td>
<td>60 A @ −48 VDC</td>
</tr>
<tr>
<td>Internal Supplementary Protector</td>
<td>60 A</td>
</tr>
</tbody>
</table>

Related Documentation

- M120 DC Power Supply Description on page 72
- M120 Power Supply LEDs on page 73
- Replacing an M120 DC Power Supply on page 245
- DC Power Electrical Safety Guidelines for the M120 Router on page 347
CHAPTER 12

Network Cable and Transceiver Planning

- Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion on page 101
- Calculating Power Budget and Power Margin for Fiber-Optic Cables on page 102

Understanding Fiber-Optic Cable Signal Loss, Attenuation, and Dispersion

This topic describes signal loss, attenuation, and dispersion in fiber-optic cable.

- Signal Loss in Multimode and Single-Mode Fiber-Optic Cable on page 101
- Attenuation and Dispersion in Fiber-Optic Cable on page 101

Signal Loss in Multimode and Single-Mode Fiber-Optic Cable

Multimode fiber is large enough in diameter to allow rays of light to reflect internally (bounce off the walls of the fiber). Interfaces with multimode optics typically use LEDs as light sources. However, LEDs are not coherent sources. They spray varying wavelengths of light into the multimode fiber, which reflects the light at different angles. Light rays travel in jagged lines through a multimode fiber, causing signal dispersion. When light traveling in the fiber core radiates into the fiber cladding, higher-order mode loss results. Together these factors limit the transmission distance of multimode fiber compared with single-mode fiber.

Single-mode fiber is so small in diameter that rays of light can reflect internally through one layer only. Interfaces with single-mode optics use lasers as light sources. Lasers generate a single wavelength of light, which travels in a straight line through the single-mode fiber. Compared with multimode fiber, single-mode fiber has higher bandwidth and can carry signals for longer distances.

Exceeding the maximum transmission distances can result in significant signal loss, which causes unreliable transmission.

Attenuation and Dispersion in Fiber-Optic Cable

Correct functioning of an optical data link depends on modulated light reaching the receiver with enough power to be demodulated correctly. Attenuation is the reduction in power of the light signal as it is transmitted. Attenuation is caused by passive media components, such as cables, cable splices, and connectors. Although attenuation is significantly lower for optical fiber than for other media, it still occurs in both multimode
and single-mode transmission. An efficient optical data link must have enough light available to overcome attenuation.

Dispersion is the spreading of the signal over time. The following two types of dispersion can affect an optical data link:

- Chromatic dispersion—Spreading of the signal over time resulting from the different speeds of light rays.
- Modal dispersion—Spreading of the signal over time resulting from the different propagation modes in the fiber.

For multimode transmission, modal dispersion, rather than chromatic dispersion or attenuation, usually limits the maximum bit rate and link length. For single-mode transmission, modal dispersion is not a factor. However, at higher bit rates and over longer distances, chromatic dispersion rather than modal dispersion limits maximum link length.

An efficient optical data link must have enough light to exceed the minimum power that the receiver requires to operate within its specifications. In addition, the total dispersion must be less than the limits specified for the type of link in Telcordia Technologies document GR-253-CORE (Section 4.3) and International Telecommunications Union (ITU) document G.957.

When chromatic dispersion is at the maximum allowed, its effect can be considered as a power penalty in the power budget. The optical power budget must allow for the sum of component attenuation, power penalties (including those from dispersion), and a safety margin for unexpected losses.

**Calculating Power Budget and Power Margin for Fiber-Optic Cables**

Use the information in this topic and the specifications for your optical interface to calculate the power budget and power margin for fiber-optic cables.

**TIP:** You can use the Hardware Compatibility Tool to find information about the pluggable transceivers supported on your Juniper Networks device.

To calculate the power budget and power margin, perform the following tasks:

1. Calculating Power Budget for Fiber-Optic Cable on page 102
2. Calculating Power Margin for Fiber-Optic Cable on page 103

**Calculating Power Budget for Fiber-Optic Cable**

To ensure that fiber-optic connections have sufficient power for correct operation, you need to calculate the link’s power budget, which is the maximum amount of power it can transmit. When you calculate the power budget, you use a worst-case analysis to provide a margin of error, even though all the parts of an actual system do not operate at the worst-case levels. To calculate the worst-case estimate of power budget ($P_{PB}$), you assume minimum transmitter power ($P_{T}$) and minimum receiver sensitivity ($P_{R}$):
The following hypothetical power budget equation uses values measured in decibels (dB) and decibels referred to one milliwatt (dBm):

\[ P_B = P_T - P_R \]

The following example uses a power budget \( P_B \) of 13 dB m:

\[ P_B = -15 \text{ dBm} - (-28 \text{ dBm}) \]

\[ P_B = 13 \text{ dB} \]

**Calculating Power Margin for Fiber-Optic Cable**

After calculating a link’s power budget, you can calculate the power margin \( P_M \), which represents the amount of power available after subtracting attenuation or link loss (LL) from the power budget \( P_B \). A worst-case estimate of \( P_M \) assumes maximum LL:

\[ P_M = P_B - LL \]

A power margin \( P_M \) greater than zero indicates that the power budget is sufficient to operate the receiver.

Factors that can cause link loss include higher-order mode losses, modal and chromatic dispersion, connectors, splices, and fiber attenuation. Table 58 on page 103 lists an estimated amount of loss for the factors used in the following sample calculations. For information about the actual amount of signal loss caused by equipment and other factors, refer to vendor documentation.

### Table 58: Estimated Values for Factors Causing Link Loss

<table>
<thead>
<tr>
<th>Link-Loss Factor</th>
<th>Estimated Link-Loss Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher-order mode losses</td>
<td>Single-mode—None</td>
</tr>
<tr>
<td></td>
<td>Multimode—0.5 dB</td>
</tr>
<tr>
<td>Modal and chromatic dispersion</td>
<td>Single-mode—None</td>
</tr>
<tr>
<td></td>
<td>Multimode—None, if product of bandwidth and distance is less than 500 MHz-km</td>
</tr>
<tr>
<td>Connector</td>
<td>0.5 dB</td>
</tr>
<tr>
<td>Splice</td>
<td>0.5 dB</td>
</tr>
<tr>
<td>Fiber attenuation</td>
<td>Single-mode—0.5 dB/km</td>
</tr>
<tr>
<td></td>
<td>Multimode—1 dB/km</td>
</tr>
</tbody>
</table>

The following sample calculation for a 2-km-long multimode link with a power budget \( P_B \) of 13 dB uses the estimated values from Table 58 on page 103 to calculate link loss (LL) as the sum of fiber attenuation (2 km @ 1 dB/km, or 2 dB) and loss for five connectors (0.5 dB per connector, or 2.5 dB) and two splices (0.5 dB per splice, or 1 dB) as well as higher-order mode losses (0.5 dB). The power margin \( P_M \) is calculated as follows:
\[ P_M = P_B - LL \]

\[ P_M = 13 \text{ dB} - 2 \text{ km (1 dB/km)} - 5 (0.5 \text{ dB}) - 2 (0.5 \text{ dB}) - 0.5 \text{ dB} \]

\[ P_M = 13 \text{ dB} - 2 \text{ dB} - 2.5 \text{ dB} - 1 \text{ dB} - 0.5 \text{ dB} \]

\[ P_M = 7 \text{ dB} \]

The following sample calculation for an 8-km-long single-mode link with a power budget \( P_B \) of 13 dB uses the estimated values from Table 58 on page 103 to calculate link loss (LL) as the sum of fiber attenuation (8 km @ 0.5 dB/km, or 4 dB) and loss for seven connectors (0.5 dB per connector, or 3.5 dB). The power margin \( P_M \) is calculated as follows:

\[ P_M = P_B - LL \]

\[ P_M = 13 \text{ dB} - 8 \text{ km (0.5 dB/km)} - 7(0.5 \text{ dB}) \]

\[ P_M = 13 \text{ dB} - 4 \text{ dB} - 3.5 \text{ dB} \]

\[ P_M = 5.5 \text{ dB} \]

In both examples, the calculated power margin is greater than zero, indicating that the link has sufficient power for transmission and does not exceed the maximum receiver input power.
Management Cable and Transceiver Specifications and Pinouts

- Routing Engine Interface Cable and Wire Specifications for the M120 Router on page 105
- RJ-45 Connector Pinouts for the M120 Routing Engine ETHERNET Port on page 106
- RJ-45 Connector Pinouts for the Routing Engine AUX and CONSOLE Ports on page 106
- RJ-45 Connector Pinouts for the External Clock Ports on page 107

**Routing Engine Interface Cable and Wire Specifications for the M120 Router**

For management and service operations, you connect the Routing Engine to an external console or management network. (For more information, see “M120 Routing Engine Description” on page 22.)

Table 59 on page 105 lists the specifications for the cables that connect to management ports and the wires that connect to the alarm relay contacts.

**Table 59: Routing Engine Interface Cable and Wire Specifications**

<table>
<thead>
<tr>
<th>Port</th>
<th>Cable Specification</th>
<th>Cable/Wire Supplied</th>
<th>Maximum Length</th>
<th>Router Receptacle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Routing Engine console or auxiliary interface</td>
<td>RS-232 (EIA-232) serial cable</td>
<td>One 6-ft (1.83-m) length with DB-9/DB-9 connectors</td>
<td>6 ft (1.83 m)</td>
<td>DB-9 male</td>
</tr>
<tr>
<td>Routing Engine Ethernet interface</td>
<td>Category 5 cable or equivalent suitable for 100Base-T operation</td>
<td>One 15-ft (4.57-m) length with RJ-45/RJ-45 connectors</td>
<td>328 ft (100 m)</td>
<td>RJ-45 autosensing</td>
</tr>
<tr>
<td>Alarm relay contacts</td>
<td>Wire with gauge between 24-AWG and 12-AWG (0.20 and 3.33 mm²)</td>
<td>No</td>
<td>None</td>
<td>—</td>
</tr>
</tbody>
</table>

**Related Documentation**

- Replacing Connections to M120 Routing Engine Interface Ports on page 206
- M120 Routing Engine Description on page 22
RJ-45 Connector Pinouts for the M120 Routing Engine ETHERNET Port

The port on the craft interface labeled ETHERNET is an autosensing 10/100-Mbps Ethernet RJ-45 receptacle that accepts an Ethernet cable for connecting the Routing Engine to a management LAN (or other device that supports out-of-band management). Table 60 on page 106 describes the RJ-45 connector pinout.

### Table 60: RJ-45 Connector Pinout for the Routing Engine ETHERNET Port

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX+</td>
</tr>
<tr>
<td>2</td>
<td>TX–</td>
</tr>
<tr>
<td>3</td>
<td>RX+</td>
</tr>
<tr>
<td>4</td>
<td>Termination network</td>
</tr>
<tr>
<td>5</td>
<td>Termination network</td>
</tr>
<tr>
<td>6</td>
<td>RX–</td>
</tr>
<tr>
<td>7</td>
<td>Termination network</td>
</tr>
<tr>
<td>8</td>
<td>Termination network</td>
</tr>
</tbody>
</table>

**Related Documentation**
- M120 Routing Engine Description on page 22
- Maintaining M120 PICs and PIC Cables on page 275
- Installing an M120 PIC Cable on page 229
- M120 PICs Description on page 57

RJ-45 Connector Pinouts for the Routing Engine AUX and CONSOLE Ports

The ports on the craft interface labeled AUX and CONSOLE are autosensing 10/100-Mbps Ethernet RJ-45 receptacles that accept an RJ-45/DB-9 cable for connecting the Routing Engine to a management LAN (or other device that supports out-of-band management). Table 61 on page 106 describes the RJ-45 connector pinouts.

### Table 61: RJ-45 Connector Pinout for the Routing Engine AUX and CONSOLE Ports

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>RTS</td>
<td>Request to Send</td>
</tr>
<tr>
<td>2</td>
<td>DTR</td>
<td>Data Terminal Ready</td>
</tr>
</tbody>
</table>
Table 61: RJ-45 Connector Pinout for the Routing Engine AUX and CONSOLE Ports (continued)

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>TXD</td>
<td>Transmit Data</td>
</tr>
<tr>
<td>4</td>
<td>Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>5</td>
<td>Ground</td>
<td>Signal Ground</td>
</tr>
<tr>
<td>6</td>
<td>RXD</td>
<td>Receive Data</td>
</tr>
<tr>
<td>7</td>
<td>DSR/DCD</td>
<td>Data Set Ready</td>
</tr>
<tr>
<td>8</td>
<td>CTS</td>
<td>Clear to Send</td>
</tr>
</tbody>
</table>

Related Documentation
- Replacing the Console or Auxiliary Cable on the M120 Routing Engine on page 207
- Maintaining M120 PICs and PIC Cables on page 275
- Installing an M120 PIC Cable on page 229
- M120 PICs Description on page 57

**RJ-45 Connector Pinouts for the External Clock Ports**

The External Interface clock connector uses an RJ-45 connector. Table 62 on page 107 describes the pinouts for the RJ-45 connector.

Table 62: RJ-45 Connector Pinout for the External Interface Ports

<table>
<thead>
<tr>
<th>Pin</th>
<th>Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Receive — Ring</td>
</tr>
<tr>
<td>2</td>
<td>Receive + TIP</td>
</tr>
<tr>
<td>3</td>
<td>Not used</td>
</tr>
<tr>
<td>4</td>
<td>Transmit — ring</td>
</tr>
<tr>
<td>5</td>
<td>Transmit + TIP</td>
</tr>
<tr>
<td>6</td>
<td>Not connected</td>
</tr>
<tr>
<td>7</td>
<td>Not connected</td>
</tr>
<tr>
<td>8</td>
<td>Not connected</td>
</tr>
</tbody>
</table>
Related Documentation

- M120 External Clock Interface Ports on the Craft Interface on page 16
- Maintaining M120 PICs and PIC Cables on page 275
- Installing an M120 PIC Cable on page 229
- M120 PICs Description on page 57
PART 3

Initial Installation and Configuration

• Installation Overview on page 111
• Unpacking the M120 on page 113
• Installing the Mounting Hardware on page 119
• Installing the M120 With a Mechanical Lift on page 125
• Installing the M120 Without a Mechanical Lift on page 129
• Connecting the M120 to Ground on page 151
• Connecting the M120 to External Devices on page 153
• Providing Power to the M120 on page 167
• Configuring the Junos Software on page 173
Installation Overview

To install the M120 router:

1. Prepare your installation site.
   See “M120 Site Preparation Checklist” on page 81.

2. Review the safety guidelines.
   See “General Laser Safety Guidelines for the M120 Router” on page 329.

3. Unpack the router and verify the parts.
   - Unpacking the M120 Router on page 113
   - Verifying M120 Parts Received on page 115

4. Install the mounting hardware.
   - Installing the Mounting Hardware for a Front-Mount Four-Post Rack or Cabinet on page 119
   - Installing the Mounting Hardware for a Front-Mount Open-Frame Rack on page 121
   - Installing the Mounting Hardware for a Center-Mount Open-Frame Rack on page 123

5. Install the router.
   - Installing the M120 Router Using a Mechanical Lift on page 125
   - Installing the M120 Router Without Using a Mechanical Lift on page 139

6. Connect cables to the network and external devices.
   See “Connecting the M120 Router to Management and Alarm Devices” on page 153.

7. Connect the grounding cable.
   See “Connecting the Grounding Cable to the M120 Router” on page 151.
8. Connect the AC power cord or DC power cables:
   - Connecting Power to an AC-Powered M120 Router on page 167
   - Connecting Power to a DC-Powered M120 Router on page 169

   See “Powering On the M120 Router” on page 170.

10. Perform the initial system configuration.
    See “Initially Configuring Junos OS on the M120 Router” on page 173.

Related Documentation
   - M120 Router Chassis Description on page 7
   - Installation Safety Warnings for Juniper Networks Devices on page 322
   - M120 Chassis Lifting Guidelines on page 321
CHAPTER 15

Unpacking the M120

- Tools and Parts Required to Unpack the M120 Router on page 113
- Unpacking the M120 Router on page 113
- Verifying M120 Parts Received on page 115

Tools and Parts Required to Unpack the M120 Router

To unpack the router and prepare for installation, you need:

- Phillips (+) screwdriver, number 2
- 1/2-in. or 13-mm open-end or socket wrench to remove bracket bolts from the shipping pallet
- Blank panels to cover any slots not occupied by a component

Related Documentation

- M120 Router Chassis Description on page 7
- M120 Router Installation Summary on page 111
- M120 Site Preparation Checklist on page 81

Unpacking the M120 Router

The router is shipped in a cardboard box strapped securely to a wood pallet. Plastic straps secure the top and bottom in place. The router chassis is bolted to this pallet. Quick Start installation instructions and a cardboard accessory box are also included in the shipping container.

The shipping container measures 32.5 in. (82.6 cm) high, 35 in. (88.9 cm) wide, and 27 in. (68.6 cm) deep. The total weight of the container containing the router and accessories can range from 149 lb (63.5 kg) to 280 lb (127 kg).

NOTE: The router is maximally protected inside the shipping crate. Do not unpack it until you are ready to begin installation.

To unpack the router, (see Figure 28 on page 115):
1. Move the shipping container to a staging area as close to the installation site as possible, where you have enough room to remove the components from the chassis. While the chassis is bolted to the pallet, you can use a forklift or pallet jack to move it.

2. Position the shipping container with the wooden pallet on the bottom and the corrugated cardboard facing up.

3. Remove the plastic straps that hold the top and bottom of the shipping container in place.

4. Remove the corrugated container cover and set it aside.

5. Remove the foam covering the top of the router.

6. Remove the accessory box and the Quick Start documentation.

7. Verify the parts received against the lists in Table 63 on page 115 and Table 64 on page 116.

8. Remove the vapor corrosion inhibitor (VCI) packs attached to the pallet, being careful not to break the VCI packs open.

9. To remove the brackets holding the chassis on the pallet, use a 1/2-in. socket wrench and a number 2 Phillips screwdriver to remove the bolts and screws from the brackets.

10. Store the brackets and bolts inside the accessory box.

11. Save the corrugated shipping container cover, pallet, and packing materials in case you need to move or ship the router later. The packaging utilizes recyclable materials in the design and should be disposed of properly. Recycle packaging per your local, state or country specific laws and regulations.

12. To proceed with the installation, see “Installing the M120 Router Using a Mechanical Lift” on page 125 or “Installing the M120 Router Without Using a Mechanical Lift” on page 139.
Verifying M120 Parts Received

A packing list is included in each shipment. Check the parts in the shipment against the items on the packing list. The packing list specifies the part numbers and descriptions of each part in your order.

If any part is missing, contact a customer service representative.

A fully configured router contains the router chassis with installed components, listed in Table 63 on page 115, and an accessory box, which contains the parts listed in Table 64 on page 116. The parts shipped with your router can vary.

Table 63: Parts List for a Fully Configured M120 Router

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis, including midplane, craft interface</td>
<td>1</td>
</tr>
<tr>
<td>FPCs</td>
<td>Up to 6</td>
</tr>
<tr>
<td></td>
<td>Up to four Type 1, 2, or 3 FPCs</td>
</tr>
<tr>
<td></td>
<td>Up to two CFPCs</td>
</tr>
</tbody>
</table>
Table 63: Parts List for a Fully Configured M120 Router (continued)

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PICs</td>
<td>Up to sixteen Type 1 PICs</td>
</tr>
<tr>
<td></td>
<td>Up to sixteen Type 2 PICs</td>
</tr>
<tr>
<td></td>
<td>Up to four Type 3 PICs</td>
</tr>
<tr>
<td>FEBs</td>
<td>Up to 6</td>
</tr>
<tr>
<td>Routing Engines</td>
<td>1 or 2</td>
</tr>
<tr>
<td>CBs</td>
<td>1 or 2</td>
</tr>
<tr>
<td>Power supplies</td>
<td>1 or 2</td>
</tr>
<tr>
<td>Front fan tray</td>
<td>2</td>
</tr>
<tr>
<td>Rear fan tray</td>
<td>2</td>
</tr>
<tr>
<td>Front air filter</td>
<td>1</td>
</tr>
<tr>
<td>Quick Start installation instructions</td>
<td>1</td>
</tr>
<tr>
<td>Large mounting shelf</td>
<td>1</td>
</tr>
<tr>
<td>Small mounting shelf</td>
<td>1</td>
</tr>
<tr>
<td>Spacer bars</td>
<td>2</td>
</tr>
<tr>
<td>Blank panels for slots without components installed</td>
<td>One blank panel for each slot not occupied by a component</td>
</tr>
</tbody>
</table>

Table 64: Accessory Box Parts List

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screws to mount chassis</td>
<td>14</td>
</tr>
<tr>
<td>Screws, Pan hd, Phil, 1/4-20 x .50, Steel, Zinc Plated</td>
<td>2</td>
</tr>
<tr>
<td>Split washers, 1/4, Steel, Zinc Plated</td>
<td>2</td>
</tr>
<tr>
<td>Terminal lugs, 6-AWG, for grounding and DC power</td>
<td>5</td>
</tr>
<tr>
<td>DB-9 (male) to DB-25 (female) serial adapter</td>
<td>1</td>
</tr>
<tr>
<td>Serial cable, with RJ-45 jack to female DB-9, to connect the router through the serial port</td>
<td>1</td>
</tr>
</tbody>
</table>
### Table 64: Accessory Box Parts List (continued)

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal block plug, 3 pole, 5.08 mm spacing, 12A, to connect the router alarms</td>
<td>2</td>
</tr>
<tr>
<td>Label, accessories contents, M120</td>
<td>1</td>
</tr>
<tr>
<td>USB flash drive with Junos OS.</td>
<td>1</td>
</tr>
<tr>
<td>Read me first document</td>
<td>1</td>
</tr>
<tr>
<td>Affidavit for T1 connection</td>
<td>1</td>
</tr>
<tr>
<td>Juniper Networks Product Warranty</td>
<td>1</td>
</tr>
<tr>
<td>End User License Agreement</td>
<td>1</td>
</tr>
<tr>
<td>Document sleeve</td>
<td>1</td>
</tr>
<tr>
<td>3&quot; x 5&quot; pink bag</td>
<td>2</td>
</tr>
<tr>
<td>9&quot; x 12&quot; pink bag, ESD</td>
<td>2</td>
</tr>
<tr>
<td>Accessory box, 19 x 12 x 3&quot;</td>
<td>1</td>
</tr>
<tr>
<td>Ethernet cable, RJ-45/RJ-45, 4-pair stranded UTP, Category 5E, 15'</td>
<td>1</td>
</tr>
<tr>
<td>ESD wrist strap with cable</td>
<td>1</td>
</tr>
</tbody>
</table>

**Related Documentation**
- M120 Router Chassis Description on page 7
- M120 Router Installation Summary on page 111
- M120 Site Preparation Checklist on page 81
CHAPTER 16

Installing the Mounting Hardware

- Installing the Mounting Hardware for a Front-Mount Four-Post Rack or Cabinet on page 119
- Installing the Mounting Hardware for a Front-Mount Open-Frame Rack on page 121
- Installing the Mounting Hardware for a Center-Mount Open-Frame Rack on page 123

Installing the Mounting Hardware for a Front-Mount Four-Post Rack or Cabinet

If you are installing the router in a front-mount four-post rack or cabinet, you must first install the large mounting shelf, followed by the small mounting shelf and then the spacer bars on the rack. In addition, you must remove the mounting brackets from the chassis.

Table 65 on page 119 specifies the holes in which you insert cage nuts and screws to install the mounting hardware required in a four-post or cabinet rack (an X indicates a mounting hole location). The hole distances are relative to one of the standard U divisions on the rack. The bottom of all mounting shelves is at 0.04 in. (0.02 U) above a U division.

Table 65: Four-Post Rack or Cabinet Mounting Hole Locations for the M120 Router

<table>
<thead>
<tr>
<th>Hole</th>
<th>Distance Above U Division</th>
<th>Large Shelf</th>
<th>Spacer Bars</th>
<th>Small Shelf</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>15.5 in. (39.4 cm)</td>
<td>8.86 U</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>12.0 in. (30.5 cm)</td>
<td>6.86 U</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>6.75 in. (17.1 cm)</td>
<td>3.86 U</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>3.25 in. (8.3 cm)</td>
<td>1.86 U</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1.51 in. (3.8 cm)</td>
<td>0.86 U</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.88 in. (2.2 cm)</td>
<td>0.50 U</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>1</td>
<td>0.25 in. (0.6 cm)</td>
<td>0.14 U</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

To install the mounting shelves and spacer bars (see Figure 29 on page 121):
1. On the front rack rails, install cage nuts in the holes specified in Table 65 on page 119 for the large shelf and the spacer bars.

2. On the front of each front rack rail, partially insert a mounting screw into the hole containing the lowest cage nut.

3. Install the large shelf on the front rack rails. Rest the bottom slot of each ear on a mounting screw.

4. Partially insert a mounting screw into the top hole in each ear of the large shelf.

5. Tighten all the screws completely.

6. The router is shipped with each spacer bar attached to the rear of each front-mounting flange. Remove each spacer bar by removing the five screws that fasten the spacer bar to the front-mounting flange.

7. Place one of the spacer bars over an ear of the installed large shelf. Position the spacer bar so that its lower edge is just above the installed screw holding the large shelf.

8. Insert a mounting screw into each of the nonthreaded holes in the recesses of the spacer bar to secure the spacer bar. Each hole should have a cage nut behind it.

9. Repeat Steps 7 and 8 for the other spacer bar.

10. Tighten all the screws completely.

11. On the rear rack rails, install cage nuts in the holes specified in Table 65 on page 119 for the small shelf.

12. On the back of each rear rack rail, partially insert a mounting screw into the hole containing the lowest cage nut.

13. Install the small shelf on the back rack rails. Rest the bottom slot of each ear on a mounting screw. The small shelf installs on the back of the rear rails, extending toward the center of the rack. The bottom of the small shelf should align with the bottom of the large shelf.

14. Partially insert screws into the open holes in the ears of the small shelf.

15. Tighten all the screws completely.
Installing the Mounting Hardware for a Front-Mount Open-Frame Rack

If you are installing the router in a front-mount open-frame rack, you must first install the large mounting shelf on the rack and remove the mounting brackets from the chassis. The small mounting shelf and the spacer bars are not needed.

Table 66 on page 121 specifies the holes in which you insert screws to install the mounting hardware in an open-frame rack (an X indicates a mounting hole location). The hole distances are relative to one of the standard U divisions on the rack. For reference, the bottom of all mounting shelves is at 0.04 in. (0.02 U) above a U division.

Table 66: Open-Frame Rack Mounting Hole Locations for the M120 Router

<table>
<thead>
<tr>
<th>Hole</th>
<th>Distance Above U Division</th>
<th>Large Shelf</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>17.26 in. (43.8 cm)</td>
<td>9.86 U</td>
</tr>
</tbody>
</table>
Table 66: Open-Frame Rack Mounting Hole Locations for the M120 Router (continued)

<table>
<thead>
<tr>
<th>Hole</th>
<th>Distance Above U Division</th>
<th>Large Shelf</th>
</tr>
</thead>
<tbody>
<tr>
<td>27</td>
<td>15.51 in. (39.4 cm)</td>
<td>8.86 U</td>
</tr>
<tr>
<td>24</td>
<td>13.76 in. (34.9 cm)</td>
<td>7.86 U</td>
</tr>
<tr>
<td>21</td>
<td>12.01 in. (30.5 cm)</td>
<td>6.86 U</td>
</tr>
<tr>
<td>18</td>
<td>10.26 in. (26.0 cm)</td>
<td>5.86 U</td>
</tr>
<tr>
<td>15</td>
<td>8.51 in. (21.6 cm)</td>
<td>4.86 U</td>
</tr>
<tr>
<td>12</td>
<td>6.76 in. (17.1 cm)</td>
<td>3.86 U</td>
</tr>
<tr>
<td>9</td>
<td>5.01 in. (12.7 cm)</td>
<td>2.86 U</td>
</tr>
<tr>
<td>6</td>
<td>3.26 in. (8.3 cm)</td>
<td>1.86 U</td>
</tr>
<tr>
<td>3</td>
<td>1.51 in. (3.8 cm)</td>
<td>0.86 U</td>
</tr>
<tr>
<td>2</td>
<td>0.88 in. (2.2 cm)</td>
<td>0.50 U</td>
</tr>
<tr>
<td>1</td>
<td>0.25 in. (0.6 cm)</td>
<td>0.14 U</td>
</tr>
</tbody>
</table>

To install the large mounting shelf (see Figure 30 on page 123):

1. On the rear of each rack rail, partially insert a mounting screw into the highest hole specified in Table 66 on page 121 for the large shelf.

2. Install the large shelf on the rack. Hang the shelf over the mounting screws using the keyhole slots located near the top of the large shelf flanges.

3. Partially insert screws into the open holes in the ears of the large shelf.

4. Tighten all the screws completely.
Installing the Mounting Hardware for a Center-Mount Open-Frame Rack

If you are installing the router in a center-mount open-frame rack, you must first install the large mounting shelf on the rack. The spacer bars are not needed for this mounting option; however, you can leave them attached to the front-mounting flanges.

Table 66 on page 121 specifies the holes in which you insert screws to install the mounting hardware in an open-frame rack (an X indicates a mounting hole location). The hole distances are relative to one of the standard U divisions on the rack. For reference, the bottom of all mounting shelves is at 0.04 in. (0.02 U) above a U division.

To install the large mounting shelf (see Figure 30 on page 123):
1. On the rear of each rack rail, partially insert a mounting screw into the highest hole specified in Table 66 on page 121 for the large shelf.

2. Install the large shelf on the rack. Hang the shelf over the mounting screws using the keyhole slots located near the top of the large shelf flanges.

3. Partially insert screws into the open holes in the ears of the large shelf.

4. Tighten all the screws completely.

Related Documentation

- M120 Rack Mounting Requirements on page 83
- M120 Site Preparation Checklist on page 81
- Installation Safety Warnings for Juniper Networks Devices on page 322
CHAPTER 17

Installing the M120 With a Mechanical Lift

Tools Required to Install the M120 Router Using a Mechanical Lift

To install the router, you need the following tools:

- Mechanical lift
- Phillips (+) screwdrivers, number 2

Related Documentation

- M120 Router Chassis Description on page 7
- M120 Router Installation Summary on page 111
- M120 Chassis Lifting Guidelines on page 321
- General Safety Warnings for Juniper Networks Devices on page 314

Installing the M120 Router Using a Mechanical Lift

Because of the router’s size and weight—up to 225 lb (102.1 kg) depending on the configuration—we strongly recommend you install the router using a mechanical lift. If you do not use a lift to install the router, refer to “Installing the M120 Router Without Using a Mechanical Lift” on page 139 for complete instructions to safely install the router.

Before installing the router:

1. Read the safety information in “M120 Chassis Lifting Guidelines” on page 321.

2. Prepare your site and review the guidelines in “M120 Site Preparation Checklist” on page 81.
3. Remove the router from the shipping container as described in “Unpacking the M120 Router” on page 113.

4. Install the mounting hardware as described in “Installing the Mounting Hardware for a Front-Mount Four-Post Rack or Cabinet” on page 119, “Installing the Mounting Hardware for a Front-Mount Open-Frame Rack” on page 121, or “Installing the Mounting Hardware for a Center-Mount Open-Frame Rack” on page 123.

CAUTION: Before front mounting the router in a rack, have a qualified technician verify that the rack is strong enough to support the router’s weight and is adequately supported at the installation site.

To install the router using a lift (see Figure 31 on page 127):

1. Ensure that the rack is in its permanent location and is secured to the building. Ensure that the installation site allows adequate clearance for both airflow and maintenance. For details, see “M120 Clearance Requirements for Airflow and Hardware Maintenance” on page 85.

2. Load the router onto the lift, making sure it rests securely on the lift platform.

3. Using the lift, position the router in front of the rack or cabinet, centering it in front of the mounting shelves.

4. Lift the chassis approximately 0.75 in. above the surface of the mounting shelves and position it as close as possible to the shelves.

5. Carefully slide the router onto the mounting shelves so that the bottom of the chassis and the mounting shelves overlap by approximately two inches.

6. Slide the router onto the mounting shelves until the mounting brackets or front-mounting flanges contact the rack rails or spacer bars (depending on your type of installation). The shelves ensure that the holes in the mounting brackets and the front-mounting flanges of the chassis align with the holes in the rack rails.

7. Move the lift away from the rack.

8. If you are installing the router in a four-post rack or cabinet, install a mounting screw into each of the holes aligned with the threaded holes in the spacer bars. If you are
installing the router in an open-frame rack, install a mounting screw into each of the open mounting holes aligned with the rack, starting from the bottom.

9. Visually inspect the alignment of the router. If the router is installed properly in the rack, all the mounting screws on one side of the rack should be aligned with the mounting screws on the opposite side and the router should be level.

*Figure 31: Installing the M120 Router in the Rack*

**NOTE:** This illustration depicts the router being installed in an open-frame rack. For an illustration of the mounting hardware required for a four-post rack or cabinet, see Figure 29 on page 121.

**Related Documentation**
- M120 Router Chassis Description on page 7
- M120 Router Physical Specifications on page 82
- General Safety Warnings for Juniper Networks Devices on page 314
- General Safety Guidelines for Juniper Networks Devices on page 313
Installing the M120 Without a Mechanical Lift

To install the router, you need the following tools and parts:

- Phillips (+) screwdrivers, numbers 1 and 2
- 3/8-in. nut driver
- ESD grounding wrist strap

Removing Components from the Chassis Before Installing the M120 Router Without a Mechanical Lift

To make the router light enough to install manually, you first remove most components from the chassis. The procedures in this section for removing components from the chassis are for initial installation only, and assume that you have not connected power...
cables to the router. Remove components from the chassis, first from the rear and then from the front.

- Removing the Power Supplies on page 130
- Removing FEBs on page 131
- Removing CBs on page 132
- Removing a Fan Tray on page 133
- Removing the Cable Management System on page 135
- Removing FPCs on page 136
- Removing a CFPC on page 137

Removing the Power Supplies

The power supplies are located vertically at the rear of the chassis to the right of CB1. Each power supply weighs approximately 8.4 lb (3.8 kg).

Remove the left power supply first and then the right power supply. To remove the AC or DC power supplies:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. Switch the circuit breaker on a DC power supply faceplate to the off position (O). For an AC power supply, switch the power switch to the standby position. We recommend this even though the power supplies are not connected to power sources.

3. Loosen the captive screw on each flange at the top and bottom of the power supply faceplate completely.

4. Grasp the handle on the power supply and pull firmly. Slide it halfway out of the chassis (see Figure 32 on page 131, which shows the removal of DC power supplies).

5. Place one hand underneath the power supply to support it and slide it completely out of the chassis.

6. Repeat the procedure for the remaining power supply.

CAUTION: Each power supply weighs approximately 8.4 lb (3.8 kg). Be prepared to support the full weight of the power supply as you remove it from the router.
Removing FEBs

Six FEBs are installed in the router. The FEBs are located in the rear of the chassis in the slots marked FEB0 through FEB5. Each FEB weighs approximately 4.5 lb (2.0 kg).

To remove the FEBs (see Figure 33 on page 132):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

3. Loosen the captive screws (using a Phillips (+) screwdriver, number 2) on the ejector handles on each side of the FEB faceplate.

4. Flip the ejector handles outward to unseat the FEB.

5. Grasp both ejector handles, pull firmly, and slide the FEB about three-quarters of the way out of the chassis.

6. Place one hand underneath the FEB to support it and slide it completely out of the chassis. Place it on the antistatic mat.
CAUTION: Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

7. Repeat the procedure for each of the remaining FEBs.

Figure 33: Removing a FEB Before Installing the M120 Router

Removing CBs

The router can have one or two CBs. They are located in the right rear of the chassis in the slots marked CB0 and CB1. Each CB weighs approximately 6.9 lb (3.1 kg).

To remove the CBs (see Figure 34 on page 133):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

3. Loosen the captive screws on the ejector handles on both sides of the CB faceplate.

4. Simultaneously rotate the ejector handles counterclockwise to unseat the CB.
5. Grasp the ejector handles and slide the CB about halfway out of the chassis.

6. Place one hand underneath the CB to support it and slide it completely out of the chassis. Place it on the antistatic mat.

   **CAUTION:** Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

7. Repeat the procedure for the second CB.

   *Figure 34: Removing a CB Before Installing the M120 Router*

---

**Removing a Fan Tray**

In the front of the chassis, the upper fan tray is located above the FPC card cage, and the lower fan tray is located below the FPC card cage. Each fan tray weighs about 7 lb (3.2 kg). In the rear of the chassis, the upper fan tray is located above the rear card cage, and the lower fan tray is located below the rear card cage. Each fan tray weighs about 5.3 lb (2.4 kg).

To remove any fan tray (see *Figure 35 on page 134* and *Figure 36 on page 135*, which illustrate the upper front fan tray and lower rear fan tray):
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. If removing the lower front fan tray, simultaneously pull the two releases labeled PULL on the cable management system. Lift it up and outward to lock it in place.

3. Loosen the captive screw on each side of the fan tray faceplate.

4. Grasp the handle and pull the fan tray out approximately 1 to 3 inches.

   **WARNING:** To avoid injury, keep tools and your fingers away from the fans as you slide the fan tray out of the chassis. The fans might still be spinning.

5. Pause for approximately 15 seconds to allow the fans to stop spinning.

6. When the fans stop spinning, place one hand under the fan tray to support it and pull the fan tray completely out of the chassis.

*Figure 35: Removing an Upper Front Fan Tray Before Installing the MI20 Router*
Removing the Cable Management System

The cable management system is located below the FPC card cage. The cable management system weighs approximately 5 lb (2.3 kg).

To remove the cable management system (see Figure 37 on page 136):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. Using a 3/8-in. nut driver, unscrew the nuts on the corners of the cable management system.

3. Grasp the bottom of the cable management system and pull it straight out from the studs on the front of the chassis.
Removing FPCs

The router holds up to four FPCs, which are installed vertically in the front of the router. An empty FPC weighs 9.0 lb (4.0 kg). A fully configured FPC can weigh up to 12.3 lb (5.6 kg).

Each FPC slot not occupied by an FPC must be covered by an FPC blank panel. An FPC blank panel weighs 7.7 lb (3.5 kg).

To remove an FPC (see Figure 38 on page 137):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

3. Before removing the FPCs, record their location in the chassis so that you can reinstall each FPC in the correct slot.

4. Simultaneously turn both the ejector handles counterclockwise to unseat the FPC.

5. Grasp the handles and slide the FPC straight out of the card cage halfway.
6. Place one hand around the front of the FPC (the PIC housing) and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

**CAUTION:** The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 12.3 lb (5.6 kg)—as you slide the FPC out of the chassis.

When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

Do not stack FPCs on top of one another after removal. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.

7. Repeat the procedure for each remaining FPC.

*Figure 38: Removing an FPC Before Installing the M120 Router*

**Removing a CFPC**

The router holds up to two CFPCs, which are installed vertically in the front of the router.

To remove a CFPC (see Figure 39 on page 138):
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

3. Pull the lower end of the ejector lever away from the CFPC faceplate to unseat the CFPC.

4. Continue to pull the lever toward you and slide the CFPC straight out of the card cage halfway.

5. Place one hand around the front of the CFPC and the other hand under it to support it. Slide the CFPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

---

**CAUTION:** When the CFPC is out of the chassis, do not hold it by the ejector handle, bus bars, or edge connectors. They cannot support its weight.

Place each individual CFPC in an individual electrostatic bag or on its own antistatic mat on a flat, stable surface.

---

*Figure 39: Removing a CFPC Before Installing the M120 Router*
Installing the M120 Router Without Using a Mechanical Lift

If you cannot use a mechanical lift to install the router (the preferred method), you can install it manually.

Before installing the router manually:

1. Read the safety information in "M120 Chassis Lifting Guidelines" on page 321.

2. Prepare your site and review the guidelines in "M120 Site Preparation Checklist" on page 81.

3. Remove the router from the shipping container as described in "Unpacking the M120 Router" on page 113.

4. Install the mounting hardware as described in "Installing the Mounting Hardware for a Front-Mount Four-Post Rack or Cabinet" on page 119, "Installing the Mounting Hardware for a Front-Mount Open-Frame Rack" on page 121, or "Installing the Mounting Hardware for a Center-Mount Open-Frame Rack" on page 123.

5. Remove components from the chassis.

To install the router in the rack (see Figure 40 on page 141):

CAUTION: If you are installing two or three routers in one rack, install the lowest one first. Installing a router in the upper position in a rack or cabinet requires a lift.

CAUTION: Before front mounting the router in a rack, have a qualified technician verify that the rack is strong enough to support the router's weight and is adequately supported at the installation site.

CAUTION: Lifting the chassis and mounting it in a rack requires three people. The empty chassis weighs approximately 110 lb (49 kg).
1. Ensure that the rack is in its permanent location and is secured to the building. Ensure that the installation site allows adequate clearance for both airflow and maintenance. For details, see “M120 Clearance Requirements for Airflow and Hardware Maintenance” on page 85.

2. Position the router in front of the rack or cabinet, centering it in front of the mounting shelves. Use a pallet jack if one is available.

3. With one person on each side and one person in the front, hold onto the bottom of the chassis and carefully lift it onto the large and small (if installed) mounting shelves.

   **WARNING:** To prevent injury, keep your back straight and lift with your legs, not your back. Avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

4. Slide the router onto the mounting shelves until the mounting brackets or front-mounting flanges contact the rack rails or spacer bars (depending on your type of installation). The shelves ensure that the holes in the mounting brackets and the front-mounting flanges of the chassis align with the holes in the rack rails.

5. If you are installing the router in a four-post rack or cabinet, install a mounting screw into each of the holes aligned with the threaded holes in the spacer bars. If you are installing the router in an open-frame rack, install a mounting screw into each of the open mounting holes aligned with the rack, starting from the bottom.

6. Visually inspect the alignment of the router. If the router is installed properly in the rack, all the mounting screws on one side of the rack should be aligned with the mounting screws on the opposite side and the router should be level.
Figure 40: Installing the M120 Router in the Rack

NOTE: This illustration depicts the router being installed in an open-frame rack. For an illustration of the mounting hardware required for a four-post rack or cabinet, see Figure 29 on page 121.

Related Documentation
- M120 Router Chassis Description on page 7
- M120 Router Physical Specifications on page 82
- General Safety Warnings for Juniper Networks Devices on page 314
- General Safety Guidelines for Juniper Networks Devices on page 313
Reinstalling Components in the Chassis After Installing the M120 Router Without a Mechanical Lift

After the router is installed in the rack, you reinstall the removed components before booting and configuring the router. Reinstall the components in the chassis, first in the rear and then in the front:

1. Reinstalling CBs on page 142
2. Reinstalling the FEBs on page 143
3. Reinstalling the Power Supplies on page 144
4. Reinstalling FPCs on page 145
5. Reinstalling a CFPC on page 146
6. Reinstalling the Fan Trays on page 148
7. Reinstalling the Cable Management System on page 149

Reinstalling CBs

To reinstall CBs (see Figure 41 on page 143):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. Carefully align the sides of the CB with the guides inside the chassis.

3. Slide the CB into the chassis, carefully ensuring that it is correctly aligned.

4. Grasp both ejector handles and rotate them simultaneously clockwise until the CB is fully seated.

5. Tighten the captive screws on the ejector handles, using a Phillips (+) screwdriver, number 2.

6. Repeat the procedure to reinstall the remaining CB.
Reinstalling the FEBs

To reinstall the FEBs (see Figure 42 on page 144):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. Place one hand underneath the FEB to support it. With the other hand, hold one of the ejector handles on the FEB faceplate.

3. Carefully align the sides of the FEB with the guides inside the chassis.

4. Carefully slide the FEB into the chassis, ensuring that it is correctly aligned.

5. Grasp both ejector handles and press them inward to seat the FEB.

6. Tighten the captive screws on the ejector handles.

7. Repeat the procedure for each of the remaining FEBs.
Reinstalling the Power Supplies

Reinstall the left power supply first and then the right power supply. To reinstall AC or DC power supplies (see Figure 43 on page 145):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. Move the power switch on the power supply faceplate to the standby position, for the AC power supply. For a DC power supply, switch the circuit breaker on the power supply faceplate to the off position (O).

3. Using both hands, slide the power supply into the chassis until you feel resistance.

4. Firmly push the power supply into the chassis until it comes to a stop. The power supply faceplate should be flush with any adjacent power supply faceplates.

5. Tighten the captive screws on the top and bottom flanges of the power supply faceplate to secure the power supply in the chassis.

6. Repeat the procedure for the remaining power supply.
Reinstalling FPCs

To reinstall an FPC (see Figure 44 on page 146):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. Using the list you created when you removed the FPCs, locate the slot in the FPC card cage in which you plan to install the FPC.

3. Ensure that the FPC is right-side up, with the text on the faceplate of the FPC facing upward.

4. Lift the FPC into place and carefully align first the bottom, then the top of the FPC with the guides inside the card cage.

CAUTION: When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.
5. Slide the FPC all the way into the card cage until you feel resistance.

6. Grasp both ejector handles and rotate them simultaneously clockwise until the FPC is fully seated.

7. Repeat the procedure to reinstall each remaining FPC.

Figure 44: Reinstalling an FPC After Installing the M120 Router

Reinstalling a CFPC

To reinstall a CFPC (see Figure 45 on page 148):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. Identify the slot in which the CFPC will be installed.

3. Verify that the transceiver has a rubber safety cap covering the PIC transceiver. If it does not, cover the transceiver with a safety cap.

4. Ensure that the CFPC is right-side up, with the text on the faceplate of the CFPC facing upward.
5. Lift the CFPC into place and carefully align first the bottom, then the top of the CFPC with the guides inside the card cage.

6. Slide the CFPC all the way into the card cage until you feel resistance.

7. Pull the end of the ejector lever away from the CFPC faceplate, and hold the lever out while continuing to push on the CFPC faceplate to further install it into the chassis.

8. When the CFPC is about 0.5 in (1 cm) from being fully inserted, release the ejector lever and gently push on the CFPC faceplate until you hear a click as the CFPC contacts the midplane. The ejector lever engages and closes automatically.

9. Remove the rubber safety cap from the transceiver on the CFPC faceplate.

10. Insert the appropriate cable into the transceiver on the CFPC faceplate.

11. Use one of the following methods to bring the CFPC online:

   • Press and hold the CFPC online/offline button until the green STATUS LED next to the button lights steadily, in about 5 seconds. The LEDs and online/offline button for each CFPC are located directly above it on the craft interface.

   • Issue the following CLI command:

     ```
     user@host> request chassis fpc slot slot-number online
     ```

     For more information about the command, see the CLI Explorer.

   ! CAUTION: After the OK LED lights steadily, wait at least 30 seconds before removing the CFPC again or removing the CFPC from the other slot.

   You can also verify correct CFPC functioning by issuing the `show chassis fpc` command as described in "Maintaining M120 FPCs and CFPCs" on page 270.
Reinstalling the Fan Trays

To reinstall the fan trays (see Figure 46 on page 149):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. Grasp the fan tray by its handle and insert it straight into the chassis. Note the correct orientation by the “this side up” label on the top surface of the fan tray.

3. Tighten the captive screw on each side of the fan tray faceplate to secure it in the chassis.

4. Lower the cable management system back into position, if necessary.

5. Repeat the procedure to reinstall the remaining fan trays.
Reinstalling the Cable Management System

To reinstall the cable management system:

1. Position the cable management system on the studs on the lower front of the chassis.

2. Insert the nuts on the corners in the cable management system onto the studs on the chassis.

3. Using a 3/8-in. nut driver, tighten the nuts securely.

Related Documentation

- M120 Router Chassis Description on page 7
- M120 Router Installation Summary on page 111
- Removing Components from the Chassis Before Installing the M120 Router Without a Mechanical Lift on page 129
CHAPTER 19

Connecting the M120 to Ground

- Connecting the Grounding Cable to the M120 Router on page 151

Connecting the Grounding Cable to the M120 Router

You ground the router by connecting a grounding cable to earth ground and then attaching it to the chassis grounding points using two screws. You must provide the grounding cables (the cable lugs are supplied with the router).

1. Connect the grounding cable to a proper earth ground.

2. Verify that a licensed electrician has attached the cable lug provided with the router to the grounding cable.

3. Make sure that grounding surfaces are clean and brought to a bright finish before grounding connections are made.

4. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

5. Place the grounding cable lug over the grounding points. The left pair is sized for M6 screws, and the right pair is sized for UNC 1/4-20 screws.

6. Secure the grounding cable lug to the grounding points, first with the washers, then with the screws.

7. Verify that the grounding cabling is correct, that the grounding cable does not touch or block access to router components, and that it does not drape where people could trip on it.
Figure 47: Connecting the Grounding Cable to the M120 Router

Related Documentation
- M120 Chassis Grounding Specifications on page 87
- General Electrical Safety Warnings for Juniper Networks Devices on page 339
CHAPTER 20

Connecting the M120 to External Devices

Tools and Parts Required to Connect the M120 Router

To connect the router to management devices and PICs and to power on the router, you need:

- Phillips (+) screwdrivers, numbers 1 and 2
- 2.5-mm flat-blade (-) screwdriver
- 7/16-in. hexagonal-head external drive socket wrench, or nut driver, with a torque range between 23 lb-in. (2.6 Nm) and 25 lb-in. (2.8 Nm), for tightening nuts to terminal studs on the circuit breaker box (on a DC-powered router)
- Wire cutters
- Electrostatic discharge (ESD) grounding wrist strap

Related Documentation

- M120 Power Supplies Description on page 71
- Connecting the Grounding Cable to the M120 Router on page 151
- General Electrical Safety Warnings for Juniper Networks Devices on page 339
- Connecting the M120 Router to Management and Alarm Devices on page 153
- Connecting PIC Cables to the M120 Router on page 164

Connecting the M120 Router to Management and Alarm Devices

For management and service operations, you connect the Routing Engine to an external console or management network through ports on the Craft Interface. You can also
connect the router to external alarm-reporting devices through the alarm relay contacts on the CIP. (For more information, see “M120 Craft Interface Description” on page 11.)

After you have installed the router into the rack, attach one or more external devices to the ports on the CIP that connect to the Routing Engines for management and service operations (see Figure 48 on page 154). For specifications for the cable accepted by the Routing Engine management ports, see “Routing Engine Interface Cable and Wire Specifications for the M120 Router” on page 105.

Figure 48: M120 Routing Engine Management Ports and Alarm Relay Contacts

- Connecting the M120 Router to a Management Console or Auxiliary Device on page 155
- Connecting the M120 Router to a Network for Out-of-Band Management on page 156
- Connecting the M120 Router to an External Alarm-Reporting Device on page 158
Connecting the M120 Router to a Management Console or Auxiliary Device

To use a system console to configure and manage the Routing Engine, connect it to the appropriate CONSOLE port on the craft interface. To use a laptop, modem, or other auxiliary device, connect it to the appropriate AUX port on the craft interface. Both ports accept a cable with an RJ-45 connector. One RJ-45/DB-9 cable is provided with the router. To connect a device to the other port, you must supply another cable. For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M120 Router” on page 105.

To connect a management console or auxiliary device:

1. Turn off the power to the console or auxiliary device.

2. Plug the female end (shown in Figure 49 on page 155) of the provided serial cable into the appropriate CONSOLE or AUX port. Figure 50 on page 156 shows the external device ports on the CIP. The ports labeled HOST 0 connect to the Routing Engine in the upper Routing Engine slot (RE 0), and the ports labeled HOST 1 connect to the Routing Engine in the lower Routing Engine slot (RE 1).

3. Using a 2.5-mm flat-blade screwdriver, tighten the screws on the connector.

4. Attach the other end of the cable to the console or auxiliary device.

*Figure 49: M120 Console and Auxiliary Serial Port Connector*
Connecting the M120 Router to a Network for Out-of-Band Management

To connect the Routing Engine to a network for out-of-band management, connect an Ethernet cable with RJ-45 connectors to the ETHERNET port on the craft interface. One such cable is provided with the router. For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M120 Router” on page 105. To connect the Routing Engine to a network for out-of-band management:

1. Turn off the power to the management device.

2. Plug one end of the Ethernet cable (Figure 51 on page 157 shows the connector) into the appropriate ETHERNET port on the CIP. Figure 52 on page 157 shows the external device ports on the CIP. The ports labeled HOST 0 connect to the Routing Engine in the upper Routing Engine slot (RE 0), and the ports labeled HOST 1 connect to the Routing Engine in the lower Routing Engine slot (RE 1).
3. Plug the other end of the cable into the network device.

*Figure 51: M120 Routing Engine Ethernet Cable Connector*

*Figure 52: M120 Routing Engine External Device Ports*

**See Also**
- M120 Power Supplies Description on page 71
- Connecting the Grounding Cable to the M120 Router on page 151
- Powering On the M120 Router on page 170
- General Electrical Safety Warnings for Juniper Networks Devices on page 339
Connecting the M120 Router to an External Alarm-Reporting Device

To connect the router to external alarm-reporting devices, attach wires to the **RED ALARM** and **YELLOW ALARM** relay contacts on the craft interface. A system condition that triggers the red or yellow alarm LED on the craft interface also activates the corresponding alarm relay contact.

The terminal blocks that plug into the alarm relay contacts are supplied with the router. They accept wire of any gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²), which is not provided. Use the wire gauge appropriate for the external device you are connecting.

To connect an external device to an alarm relay contact (see Figure 53 on page 159):

1. Prepare the required length of wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²).

2. While the terminal block is not plugged into the relay contact, use a 2.5-mm flat-blade screwdriver to loosen the small screws on its side. With the small screws on its side facing left, insert wires into the slots in the front of the block based on the wiring for the external device. Tighten the screws to secure the wire.

3. Orient the terminal block according to the labels to the left of the appropriate relay contact (**NC** means “normally closed,” **C** means “common,” and **NO** means “normally open”).

4. Plug the terminal block into the relay contact and use a 2.5-mm flat-blade screwdriver to tighten the screws on the face of the block.

5. Attach the other end of the wires to the external device.
If attaching a reporting device for the other kind of alarm, repeat the procedure.

See Also

- M120 Power Supplies Description on page 71
- Connecting the Grounding Cable to the M120 Router on page 151
- Powering On the M120 Router on page 170
- General Electrical Safety Warnings for Juniper Networks Devices on page 339

Related Documentation

- M120 Power Supplies Description on page 71
- Connecting the Grounding Cable to the M120 Router on page 151
- Connecting PIC Cables to the M120 Router on page 164
- General Electrical Safety Warnings for Juniper Networks Devices on page 339
Connecting the M120 Router to a Network for Out-of-Band Management

To connect the Routing Engine to a network for out-of-band management, connect an Ethernet cable with RJ-45 connectors to the ETHERNET port on the craft interface. One such cable is provided with the router. For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M120 Router” on page 105. To connect the Routing Engine to a network for out-of-band management:

1. Turn off the power to the management device.

2. Plug one end of the Ethernet cable (Figure 51 on page 157 shows the connector) into the appropriate ETHERNET port on the CIP. Figure 52 on page 157 shows the external device ports on the CIP. The ports labeled HOST 0 connect to the Routing Engine in the upper Routing Engine slot (RE 0), and the ports labeled HOST 1 connect to the Routing Engine in the lower Routing Engine slot (RE 1).

3. Plug the other end of the cable into the network device.

*Figure 54: M120 Routing Engine Ethernet Cable Connector*
Connecting the M120 Router to an External Alarm-Reporting Device

To connect the router to external alarm-reporting devices, attach wires to the RED ALARM and YELLOW ALARM relay contacts on the craft interface. A system condition that triggers the red or yellow alarm LED on the craft interface also activates the corresponding alarm relay contact.
The terminal blocks that plug into the alarm relay contacts are supplied with the router. They accept wire of any gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²), which is not provided. Use the wire gauge appropriate for the external device you are connecting.

To connect an external device to an alarm relay contact (see Figure 53 on page 159):

1. Prepare the required length of wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²).

2. While the terminal block is not plugged into the relay contact, use a 2.5-mm flat-blade screwdriver to loosen the small screws on its side. With the small screws on its side facing left, insert wires into the slots in the front of the block based on the wiring for the external device. Tighten the screws to secure the wire.

3. Orient the terminal block according to the labels to the left of the appropriate relay contact (NC means “normally closed, C means “common,” and NO means “normally open”).

4. Plug the terminal block into the relay contact and use a 2.5-mm flat-blade screwdriver to tighten the screws on the face of the block.

5. Attach the other end of the wires to the external device.
If attaching a reporting device for the other kind of alarm, repeat the procedure.

**Related Documentation**
- M120 Power Supplies Description on page 71
- Connecting the Grounding Cable to the M120 Router on page 151
- Powering On the M120 Router on page 170
- General Electrical Safety Warnings for Juniper Networks Devices on page 339

**Connecting the M120 Router to an External Clocking Device**

The M120 router contains two external clock input (EXT CLOCK) ports on the front panel of the craft interface labeled A or B.
To connect the router to external clocking devices, connect a cable with RJ-45 connectors to each external clock input port:

1. Attach an electrostatic discharge (ESD) grounding trap on your bare wrist, and connect the strap to one of the ESD points on the chassis.

2. Plug one end of the RJ-45 cable into the internal clock port on the craft interface.

3. Plug the other end of the RJ-45 cable into the T1 or E1 external clocking device.

4. Verify that the LEDs for the external clock inputs are lit steadily green.

5. Configure the port. See the `synchronization` statement for M Series and T Series in the *Junos OS Administration Library*.

6. Issue the `show chassis synchronization` command to check the status of the port.

```
user@host> show chassis synchronization
Clock Synchronization Status :
Clock module on CB 0
    Current state       : master
    Current clock state : internal
    Selected for        : 13 days, 23 hours, 15 minutes, 17 seconds
    Selected since      : 2012-10-29 18:28:35 EDT
    Deviation (in ppm)  : +0.00
    Last deviation (in ppm): +0.00

Clock Synchronization Status :
Clock module on CB 1
    Current state       : backup
    Current clock state : locked to master CB
    Selected for        : 13 days, 23 hours, 14 minutes, 23 seconds
    Selected since      : 2012-10-29 18:29:29 EDT
```

**Related Documentation**
- M120 Control Board (CB) Description on page 47
- M120 External Clock Interface Ports on the Craft Interface on page 16

**Connecting PIC Cables to the M120 Router**

After installing the router into the rack as described in “Installing the M120 Router Using a Mechanical Lift” on page 125 or “Installing the M120 Router Without Using a Mechanical Lift” on page 139, complete the installation by connecting management and alarm devices, PICs, and power cables.

Now connect PICs to the network by plugging in network cables. To connect cable to the PICs (see Figure 57 on page 166, which shows a fiber-optic PIC):
1. Have ready a length of the type of cable used by the PIC. For cable specifications, see the M20 PIC Reference.

2. If the PIC cable connector port is covered by a rubber safety plug, remove the plug.

   **WARNING:** Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

   **CAUTION:** Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

3. Insert the cable connector into the cable connector port on the PIC faceplate.

4. Arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

   **CAUTION:** Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

   **CAUTION:** Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.
Figure 57: Attaching a Cable to an M120 PIC

- M120 Power Supplies Description on page 71
- Connecting the Grounding Cable to the M120 Router on page 151
- Tools and Parts Required to Connect the M120 Router on page 153
- General Electrical Safety Warnings for Juniper Networks Devices on page 339
CHAPTER 21

Providing Power to the M120

- Connecting Power to an AC-Powered M120 Router on page 167
- Connecting Power to a DC-Powered M120 Router on page 169
- Powering On the M120 Router on page 170
- Powering Off the M120 Router on page 171

Connecting Power to an AC-Powered M120 Router

You connect AC power to the router by attaching power cords from the AC power sources to the AC appliance inlets on the power supply faceplates. For power cord and grounding cable specifications, see “M120 AC Power, Connection, and Power Cord Specifications” on page 93 and “Connecting the Grounding Cable to the M120 Router” on page 151.

To connect the AC power cords to the router for each power supply (see Figure 58 on page 168):

1. Locate the power cords shipped with the router, which should have a plug appropriate for your geographical location (see “M120 AC Power, Connection, and Power Cord Specifications” on page 93).

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Move the power switch on the power supply faceplate to the standby position.

4. Insert the appliance coupler end of each power cord into the appliance inlet on the power supply faceplate.

5. Remove the cable restraint from the lower edge of the power supply faceplate by removing its retainer screw.

6. Wrap the cable restraint around the power cord, then slide it along the power cord to a position that enables you to reinstall it in the power supply faceplate.
7. Reinstall the cable restraint by tightening its retainer screw part of the way into the power supply faceplate.

8. Carefully pull the AC power cords through the cable restraint until you have the desired amount of slack in the power cord.

9. Tighten the cable restraint retainer screw to hold the power cords in place.

10. Insert the power cord plugs into an AC power source receptacle. Verify that the power cord does not block access to router components or drape where people could trip on it.

**NOTE:** Each AC power supply has two AC appliance inlets. Each power supply must be connected to a dedicated AC power feed. For 100-120 VAC, both inlets are used. For 200-240 VAC, only the top inlet is used. For information about site power preparations, see “M120 Router Power Requirements” on page 88.

*Figure 58: Connecting AC Power to the M120 Router*
Connecting Power to a DC-Powered M120 Router

You connect DC power to the router by attaching power cables from the DC power sources to the terminal studs on the power supply faceplates. To connect power to the router, you must provide power cables (cable lugs are supplied with the router). For power cable specifications, see “M120 DC Power, Connection, and Cable Specifications” on page 97.

To connect the DC source power cables to the router:

1. Ensure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cable leads might become active during installation.

2. Secure the power cable lugs to the terminal studs, first with the flat washer, then with the nut (see Figure 59 on page 170). Apply between 12 lb-in. (1.4 Nm) and 15 lb-in. (1.7 Nm) of torque to each nut.
   a. Attach the positive (+) DC source power cable lug to the RETURN (return) terminal.
   b. Attach the negative (–) DC source power cable lug to the –48V (input) terminal.

3. Loosen the captive screw on the cable restraint on the lower edge of the power supply faceplate.

4. Connect each DC power cable to the appropriate external DC power source.

NOTE: For information about connecting to external DC power sources, see “M120 DC Power, Connection, and Cable Specifications” on page 97.
Figure 59: Connecting DC Power to the M120 Router

Powering On the M120 Router

To power on the router:

1. Verify that the power supplies are fully inserted in the chassis and that the captive screws on their faceplates are tightened.

2. For each power supply on an AC-powered router, verify that the source power cord is securely inserted into the appliance inlet. For each power supply on a DC-powered router, verify that the source power cables are connected to the appropriate terminal: the positive (+) source cable to the return terminal (labeled RETURN) and the negative (–) source cable to the input terminal (labeled –48V).

3. Verify that an external management device is connected to one of the Routing Engine ports on the craft interface (AUX, CONSOLE, or ETHERNET). For more information about connecting management devices, see “Connecting the M120 Router to Management and Alarm Devices” on page 153.

4. Turn on the power to the external management device.

5. For the DC power supply, switch the circuit breaker on one of the power supplies to the on position (I). For the AC power supply, move the power switch to the standby position.
position and observe the output status LED on the power supply faceplate. If the power supply is correctly installed and functioning properly, the status LED on the power supply faceplate blinks, then lights steadily approximately one minute after you switch the power supply on.

**NOTE:** After powering off a power supply, wait at least 60 seconds before turning it back on. After powering on a power supply, wait at least 60 seconds before turning it off.

If the system is completely powered off when you power on the power supply, the Routing Engine boots as the power supply completes its startup sequence. If the Routing Engine finishes booting and you need to power off the system again, see “Powering Off the M120 Router” on page 171.

After a power supply is powered on, it can take up to 60 seconds for status indicators—such as the status LEDs on the power supply and the command display output—to indicate that the power supply is functioning normally. Ignore error indicators that appear during the first 60 seconds.

6. Repeat Step 5 for the second power supply.

**NOTE:** If any of the output status LEDs does not light steadily, repeat the installation and cabling procedures.

7. On the external management device connected to the Routing Engine, monitor the startup process to verify that the system has booted properly.

### Related Documentation
- M120 AC Power Supply Description on page 72
- Connecting Power to an AC-Powered M120 Router on page 167
- Connecting Power to a DC-Powered M120 Router on page 169
- General Electrical Safety Warnings for Juniper Networks Devices on page 339

### Powering Off the M120 Router

To power off the router:

1. On the external management device connected to the Routing Engine, issue the `request system halt both-routing-engines` operational mode command. The command shuts down the Routing Engines cleanly, so their state information is preserved. (If the router contains only one Routing Engine, issue the `request system halt` command.)

   ```
   user@host> request system halt both-routing-engines
   ```
Wait until a message appears on the console confirming that the operating system has halted. For more information about the command, see the CLI Explorer.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Switch the circuit breaker on each DC power supply faceplate to the off position (O). For the AC power supply, move the power switch to the standby position.

**Related Documentation**
- General Electrical Safety Warnings for Juniper Networks Devices on page 339
- M120 AC Power Supply Description on page 72
- Powering On the M120 Router on page 170
The MX240 router is shipped with Junos OS preinstalled and ready to be configured when the MX240 router is powered on. There are three copies of the software: one on a CompactFlash card in the Routing Engine, one on a rotating hard disk in the Routing Engine, and one on a USB flash drive that can be inserted into the slot in the Routing Engine faceplate.

When the router boots, it first attempts to start the image on the USB flash drive. If a USB flash drive is not inserted into the Routing Engine or the attempt otherwise fails, the router next tries the CompactFlash card (if installed), and finally the hard disk.

You configure the router by issuing Junos OS command-line interface (CLI) commands, either on a console device attached to the CONSOLE port on the Routing Engine, or over a telnet connection to a network connected to the ETHERNET port on the Routing Engine.

Gather the following information before configuring the router:

- Name the router will use on the network
- Domain name the router will use
- IP address and prefix length information for the Ethernet interface
- IP address of a default router
- IP address of a DNS server
- Password for the root user

This procedure connects the router to the network but does not enable it to forward traffic. For complete information about enabling the router to forward traffic, including examples, see the Junos OS configuration guides.

To configure the software:

1. Verify that the router is powered on.
2. Log in as the "root" user. There is no password.
3. Start the CLI.
   root# cli
   root@>

4. Enter configuration mode.
   cli> configure
   [edit]
   root@#

5. Configure the name of the router. If the name includes spaces, enclose the name in quotation marks (" ").
   [edit]
   root@# set system host-name host-name

6. Create a management console user account.
   [edit]
   root@# set system login-user user-name authentication plain-text-password
   New password: password
   Retype new password: password

7. Set the user account class to super-user.
   [edit]
   root@# set system login-user user-name class super-user

8. Configure the router’s domain name.
   [edit]
   root@# set system domain-name domain-name

9. Configure the IP address and prefix length for the router’s Ethernet interface.
   [edit]
   root@# set interfaces fxp0 unit 0 family inet address address/prefix-length

10. Configure the IP address of a backup router, which is used only while the routing protocol is not running.
    [edit]
    root@# set system backup-router address

11. Configure the IP address of a DNS server.
    [edit]
    root@# set system name-server address

12. Set the root authentication password by entering either a clear-text password, an encrypted password, or an SSH public key string (DSA or RSA).
[edit]
root@# set system root-authentication plain-text-password
New password: password
Retype new password: password

or

[edit]
root@# set system root-authentication encrypted-password encrypted-password

or

[edit]
root@# set system root-authentication ssh-dsa public-key

or

[edit]
root@# set system root-authentication ssh-rsa public-key

13. (Optional) Configure the static routes to remote subnets with access to the management port. Access to the management port is limited to the local subnet. To access the management port from a remote subnet, you need to add a static route to that subnet within the routing table. For more information about static routes, see the Junos OS Administration Library.

[edit]
root@# set routing-options static route remote-subnet next-hop destination-IP retain no-readvertise

14. Configure the telnet service at the [edit system services] hierarchy level.

[edit]
root@# set system services telnet

15. (Optional) Display the configuration to verify that it is correct.

[edit]
root@# show
system {
  host-name host-name;
  domain-name domain-name;
  backup-router address;
  root-authentication {
    authentication-method (password | public-key);
  }
  name-server {
    address;
  }
}
interfaces {
  fxp0 {
    unit 0 {
      family inet {
        address address/prefix-length;
      }
    }
  }
}
16. Commit the configuration to activate it on the router.

[edit]
root@# commit

17. (Optional) Configure additional properties by adding the necessary configuration statements. Then commit the changes to activate them on the router.

[edit]
root@host# commit

18. When you have finished configuring the router, exit configuration mode.

[edit]
root@host# exit
root@host>

---

**NOTE:** To reinstall Junos OS, you boot the router from the removable media. Do not insert the removable media during normal operations. The router does not operate normally when it is booted from the removable media.

When the router boots from the storage media (removable media, CompactFlash card, or hard disk) it expands its search in the /config directory of the routing platform for the following files in the following order: juniper.conf (the main configuration file), rescue.conf (the rescue configuration file), and juniper.conf.1 (the first rollback configuration file). When the search finds the first configuration file that can be loaded properly, the file loads and the search ends. If none of the file can be loaded properly, the routing platform does not function properly. If the router boots from an alternate boot device, Junos OS displays a message indication this when you log in to the router.

---

**Related Documentation**
- M120 Router Description on page 3
- M120 Router Physical Specifications on page 82
PART 4

Installing and Replacing Components

- Overview of Installing and Replacing Components on page 179
- Replacing Chassis Components on page 183
- Replacing Cooling System Components on page 187
- Replacing Host Subsystem Components on page 195
- Replacing Line Card Components on page 213
- Replacing Power System Components on page 239
- Replacing Switch Fabric Components on page 255
Overview of Installing and Replacing Components

- M120 Field-Replaceable Units (FRUs) on page 179
- Tools and Parts Required to Replace M120 Components on page 180

M120 Field-Replaceable Units (FRUs)

Field-replaceable units (FRUs) are router components that can be replaced at the customer site. Replacing most FRUs requires minimal router downtime. The router uses the following types of FRUs:

- Hot-removable and hot-insertable FRUs—You can remove and replace these components without powering off the router or disrupting the routing functions.
- Hot-pluggable FRUs—You can remove and replace these components without powering down the router, but the routing functions of the system are interrupted when the component is removed.

Table 67 on page 180 lists the FRUs for the M120 router. If the router contains a redundant host subsystem, the Control Board (CB) and the Routing Engine are hot-removable and hot-insertable. Before you replace a CB or a Routing Engine, you must take the host subsystem offline (see “Taking the M120 Host Subsystem Offline” on page 267).
Table 67: M120 Field-Replaceable Units

<table>
<thead>
<tr>
<th>Hot-Removable and Hot-Insertable FRUs</th>
<th>Hot-Pluggable FRUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air filter</td>
<td>Control Board (CB) (if not redundant)</td>
</tr>
<tr>
<td>Craft interface</td>
<td>Routing Engine (if not redundant)</td>
</tr>
<tr>
<td>Control Board (CB) (if redundant)</td>
<td>Forwarding Engine Boards (FEBs) (if not redundant)</td>
</tr>
<tr>
<td>Routing Engine (if redundant)</td>
<td></td>
</tr>
<tr>
<td>Forward Engine Boards (FEBs)</td>
<td></td>
</tr>
<tr>
<td>Flexible PIC Concentrators (FPCs)</td>
<td></td>
</tr>
<tr>
<td>Compact Flexible PIC Concentrators (CFPCs)</td>
<td></td>
</tr>
<tr>
<td>AC and DC power supplies (if redundant)</td>
<td></td>
</tr>
<tr>
<td>Front and rear fan trays</td>
<td></td>
</tr>
<tr>
<td>Physical Interface Cards (PICs)</td>
<td></td>
</tr>
</tbody>
</table>

Related Documentation
- M120 Router Chassis Description on page 7
- Overview of Troubleshooting Resources for the M120 Router on page 283

Tools and Parts Required to Replace M120 Components

To replace hardware components, you need the tools and parts listed in Table 68 on page 180.

Table 68: Tools and Parts Required

<table>
<thead>
<tr>
<th>Tool or part</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8–in. nut driver or pliers</td>
<td>Cables and connectors</td>
</tr>
<tr>
<td></td>
<td>DC power supply</td>
</tr>
<tr>
<td></td>
<td>Craft interface</td>
</tr>
<tr>
<td>Blank panels (if component is not</td>
<td>CB</td>
</tr>
<tr>
<td>reinstalled)</td>
<td>FEB</td>
</tr>
<tr>
<td></td>
<td>FPC</td>
</tr>
<tr>
<td></td>
<td>PIC</td>
</tr>
<tr>
<td></td>
<td>Power supply</td>
</tr>
</tbody>
</table>
### Table 68: Tools and Parts Required (continued)

<table>
<thead>
<tr>
<th>Tool or part</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrostatic bag or antistatic mat</td>
<td>Craft Interface</td>
</tr>
<tr>
<td></td>
<td>CB</td>
</tr>
<tr>
<td></td>
<td>FEB</td>
</tr>
<tr>
<td></td>
<td>FPC</td>
</tr>
<tr>
<td></td>
<td>PIC</td>
</tr>
<tr>
<td></td>
<td>Routing Engine</td>
</tr>
<tr>
<td>Electrostatic discharge (ESD) grounding wrist strap</td>
<td>All</td>
</tr>
<tr>
<td>Flat-blade (−) screwdriver</td>
<td>Cables and connectors</td>
</tr>
<tr>
<td></td>
<td>PIC (in an FPC1)</td>
</tr>
<tr>
<td></td>
<td>Routing Engine</td>
</tr>
<tr>
<td>Phillips (+) screwdrivers, numbers 1 and 2</td>
<td>Air filter</td>
</tr>
<tr>
<td></td>
<td>Cables and connectors</td>
</tr>
<tr>
<td></td>
<td>FEB</td>
</tr>
<tr>
<td></td>
<td>Fan tray (front or rear)</td>
</tr>
<tr>
<td></td>
<td>PIC</td>
</tr>
<tr>
<td></td>
<td>Power supply (AC or DC)</td>
</tr>
<tr>
<td>Rubber safety cap</td>
<td>Fiber-optic PIC or PIC cable</td>
</tr>
<tr>
<td>Wire cutters</td>
<td>Cables and connectors</td>
</tr>
<tr>
<td></td>
<td>DC power supply</td>
</tr>
</tbody>
</table>

### Related Documentation
- M120 Field-Replaceable Units (FRUs) on page 179
- M120 Router Chassis Description on page 7
- Overview of Troubleshooting Resources for the M120 Router on page 283
Replacing Chassis Components

- Replacing Alarm Relay Wires on the M120 Craft Interface on page 183
- Replacing the M120 Craft Interface on page 184

Replacing Alarm Relay Wires on the M120 Craft Interface

To connect the router to external alarm-reporting devices, attach wires to the **RED** and **YELLOW** relay contacts on the craft interface. A system condition that triggers the red or yellow alarm LED on the craft interface also activates the corresponding alarm relay contact.

The terminal blocks that plug into the alarm relay contacts are supplied with the router. They accept wire of any gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²), which is not provided. Use the wire gauge appropriate for the external device you are connecting.

To replace the wires connecting to an alarm-reporting device (see Figure 60 on page 184):

1. Disconnect the existing wire at the external device.
2. Prepare the required length of replacement wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²).
3. Using a 2.5-mm flat-blade screwdriver, loosen the small screws on the face of the terminal block and remove the block from the relay contact.
4. Using the 2.5-mm flat-blade screwdriver, loosen the small screws on the side of the terminal block. Remove existing wires from the slots in the front of the block and insert replacement wires. Tighten the screws to secure the wire.
5. Plug the terminal block into the relay contact and use a 2.5-mm flat-blade screwdriver to tighten the screws on the face of the block.
6. Attach the other end of the wires to the external device.
Replacing the M120 Craft Interface

The craft interface is located above the FPC card cage, as shown in Figure 1 on page 8. It houses the Routing Engine interface ports, which accept connections to external management and alarm-reporting devices.

The craft interface is hot-insertable and hot-removable. It weighs approximately 1.6 lb (.73 kg). When the craft interface is removed, you cannot control or communicate with the router using an external device. When you install the craft interface, allow several minutes for the display to reflect the current state of the router.

To replace the craft interface, perform the following procedures:

- Removing the M120 Craft Interface on page 184
- Installing the M120 Craft Interface on page 185

Removing the M120 Craft Interface

The craft interface is located on the front of the chassis above the FPC card cage. The craft interface weighs approximately 1.6 lb (0.73 kg).

To remove the craft interface (see Figure 61 on page 185):

NOTE: Removing the front upper fan tray before you remove the craft interface makes it easier to grasp the craft interface as you remove it. For instructions on removing a front fan tray, see “Replacing an M120 Fan Tray” on page 190.
1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. With a 3/8-inch nut driver or pliers, loosen and remove the two nuts that secure the craft interface to the chassis. Also remove the two washers located behind the nuts.

3. Grasp the craft interface by the left and right flanges and carefully pull it straight out of the chassis.

4. Disconnect attached cable.

Figure 61: Removing the M120 Craft Interface

See Also
- Preparing Electrostatic Discharge Damage to an M120 Router on page 316
- M120 Craft Interface Description on page 11
- M120 Alarm Relay Contacts on the Craft Interface on page 17
- Installing the M120 Craft Interface on page 185

Installing the M120 Craft Interface

To install the craft interface (see Figure 62 on page 186):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Connect attached cable.

3. Align the guide pin on the back side of the craft interface with the receptacle inside the upper left corner of the chassis.

4. Press the craft interface into place.
5. Install a washer and retaining nut over each threaded stud on each craft interface flange.

6. Tighten both retaining nuts.

7. Reinstall the front upper fan tray, if it was removed.

NOTE: When you install the craft interface in an operating router, allow several minutes for the LEDs on the craft interface to reflect the current state of the router.

Figure 62: Installing the M120 Craft Interface

See Also
- Preventing Electrostatic Discharge Damage to an M120 Router on page 316
- M120 Craft Interface Description on page 11
- M120 Alarm Relay Contacts on the Craft Interface on page 17
- Removing the M120 Craft Interface on page 184

Related Documentation
- Preventing Electrostatic Discharge Damage to an M120 Router on page 316
- M120 Craft Interface Description on page 11
- M120 Alarm Relay Contacts on the Craft Interface on page 17
Replacing Cooling System Components

- Replacing an M120 Air Filter on page 187
- Replacing an M120 Fan Tray on page 190

Replacing an M120 Air Filter

The router has one air filter that installs horizontally below the front lower fan tray within the air intake plenum. The air filter is hot-insertable and hot-removable.

To replace an air filter, perform the following procedures:

- Removing the M120 Air Filter on page 187
- Installing the M120 Air Filter on page 188

Removing the M120 Air Filter

The air filter is located in the front of the chassis below the FPC card cage. The air filter weighs approximately 1 lb (0.5 kg).

To remove the air filter (see Figure 63 on page 188):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Unwrap any PIC cables from the spools on the cable management system and remove the cables from the tray. Arrange the cables so that they do not block the front of the cable management system and tray, and secure them with temporary fasteners so that they are not supporting their own weight as they hang from the connector.

   CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

3. Simultaneously pull the two releases labeled PULL on the cable management system. Lift it up and outward to lock it in place to access the air filter.
4. Loosen the captive screws on either side of the air filter faceplate and remove the faceplate.

5. Press back and down on the filter to release it from the hooks, then slide it straight out of the chassis.

Figure 63: Removing the M120 Air Filter

See Also
- M120 Cooling System Description on page 19
- Maintaining the M120 Air Filter on page 263
- Troubleshooting the M120 Cooling System on page 286
- Installing the M120 Air Filter on page 188

Installing the M120 Air Filter

To install the front air filter (see Figure 64 on page 189):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Insert the air filter element into the chassis by sliding it straight into the chassis until it stops.
3. While pushing the air filter straight back into the chassis, lift the front edge of the air filter to secure it under the hooks.

4. Reinstall the air filter faceplate onto the chassis, and fasten the captive screws on both sides.

5. Lower the cable management system back into position.

6. Rearrange the PIC cables in the cable management system. For more information about proper cable arrangement, see “Maintaining M120 PICs and PIC Cables” on page 275.

Figure 64: Installing the M120 Front Air Filter
Slide the filter straight in, then press back on the filter to secure it under the hooks.

See Also
- M120 Cooling System Description on page 19
- Maintaining the M120 Air Filter on page 263
- Troubleshooting the M120 Cooling System on page 286
- Removing the M120 Air Filter on page 187

Related Documentation
- M120 Cooling System Description on page 19
Replacing an M120 Fan Tray

The router has two front fan trays and two rear fan trays. Both the front and rear fan trays install horizontally above and below the FPC card cage. Each front fan tray contains eight fans. The two front fan trays are interchangeable, and the two rear fan trays are interchangeable, but the front and rear fan trays are not interchangeable. The fan trays are hot-insertable and hot-removable.

To replace a fan tray, perform the following procedures:

- Removing an M120 Fan Tray on page 190
- Installing an M120 Fan Tray on page 192

Removing an M120 Fan Tray

In the front of the chassis, the upper fan tray is located above the FPC card cage, and the lower fan tray is located below the FPC card cage. Each fan tray weighs about 7 lb (3.2 kg). In the rear of the chassis, the upper fan tray is located above the rear card cage, and the lower fan tray is located below the rear card cage. Each fan tray weighs about 5.3 lb (2.4 kg).

To remove any fan tray (see Figure 65 on page 191 and Figure 66 on page 191, which illustrate the upper front fan tray and lower rear fan tray):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. If removing the lower front fan tray, simultaneously pull the two releases labeled PULL on the cable management system. Lift it up and outward to lock it in place.

3. Loosen the captive screw on each side of the fan tray faceplate.

4. Grasp the handle and pull the fan tray out approximately 1 to 3 inches.

   **WARNING:** To avoid injury, keep tools and your fingers away from the fans as you slide the fan tray out of the chassis. The fans might still be spinning.

5. Pause for approximately 15 seconds to allow the fans to stop spinning.

6. When the fans stop spinning, place one hand under the fan tray to support it and pull the fan tray completely out of the chassis.
Figure 65: Removing an M120 Upper Front Fan Tray

Figure 66: Removing an M120 Lower Rear Fan Tray
Installing an M120 Fan Tray

To install a fan tray (see Figure 67 on page 192 and Figure 68 on page 193):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Grasp the fan tray by its handle and insert it straight into the chassis. Note the correct orientation by the "this side up" label on the top surface of the fan tray.

3. Tighten the captive screws on each side of the fan tray faceplate to secure it in the chassis.

4. Lower the cable management system back into position, if necessary.

Figure 67: Installing an M120 Upper Front Fan Tray
Figure 68: Installing an M120 Lower Rear Fan Tray

See Also
- M120 Cooling System Description on page 19
- Maintaining the M120 Fan Trays on page 264
- Troubleshooting the M120 Cooling System on page 286
- Removing an M120 Fan Tray on page 190

Related Documentation
- M120 Cooling System Description on page 19
- Maintaining the M120 Fan Trays on page 264
- Troubleshooting the M120 Cooling System on page 286
CHAPTER 26

Replacing Host Subsystem Components

- Replacing an M120 Routing Engine on page 195
- Replacing an SSD Drive on an RE-A-1800 or RE-S-1800 on page 198
- Replacing a DIMM Module in M120 Routing Engines on page 200
- Replacing an M120 CB on page 202
- Replacing Connections to M120 Routing Engine Interface Ports on page 206
- Replacing the Console or Auxiliary Cable on the M120 Routing Engine on page 209
- Replacing the Management Ethernet Cable on the M120 Routing Engine on page 210

Replacing an M120 Routing Engine

To replace a Routing Engine, perform the following procedures:

- Removing an M120 Routing Engine on page 195
- Installing an M120 Routing Engine on page 197

Removing an M120 Routing Engine

The router can have one or two Routing Engines. They are located within the CB in the rear of the chassis on either side of the FEBs in the slots marked CB0 and CB1. Each Routing Engine weighs approximately 2.4 lb (1.1 kg).
CAUTION: Before you replace a Routing Engine, you must take the host subsystem offline. If there is only one host subsystem, taking the host subsystem offline shuts down the router. See “Taking the M120 Host Subsystem Offline” on page 267.

CAUTION: If the Routing Engine to be replaced is currently functioning as the master Routing engine, switch it to be the backup before removing it. See “Taking the M120 Host Subsystem Offline” on page 267.

To remove a Routing Engine from a CB (see Figure 69 on page 197):

1. Take the host subsystem offline as described in “Taking the M120 Host Subsystem Offline” on page 267.

2. Place an electrostatic bag or antistatic mat on a flat, stable surface.

3. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

4. Press the red tabs on the ejector handles on both sides of the Routing Engine faceplate.

5. Flip the ejector handles outward to unseat the Routing Engine.

6. Grasp the Routing Engine by the ejector handles and slide it about halfway out of the chassis.

7. Place one hand underneath the Routing Engine to support it and slide it completely out of the chassis.

8. Place the Routing Engine on the antistatic mat.

NOTE: To maintain proper airflow through the chassis, do not leave a CB installed in the chassis without a Routing Engine for extended periods of time. If a Routing Engine is removed, a replacement Routing Engine should be installed as soon as possible.
Figure 69: Removing an M120 Routing Engine

See Also
- M120 Routing Engine Description on page 22
- M120 Routing Engine Interface Ports and Status Indicators on page 28
- Installing an M120 Routing Engine on page 197

Installing an M120 Routing Engine

To install a Routing Engine into a CB (see Figure 70 on page 198):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Ensure that the ejector handles are not in the locked position. If necessary, press the red tabs and flip the ejector handles outward.

3. Place one hand underneath the Routing Engine to support it. With the other hand, grasp one of the ejector handles on the faceplate.

4. Carefully align the sides of the Routing Engine with the guides inside the opening on the CB.

5. Slide the Routing Engine into the CB until you feel resistance, then press the Routing Engine's faceplate until it engages the connectors.

6. Press both the ejector handles inward to seat the Routing Engine.
   - The Routing Engine might require several minutes to boot.

7. After the Routing Engine boots, verify that it is installed correctly by checking the RE0 and RE1 LEDs on the craft interface. If the router is operational and the Routing Engine is functioning properly, the green OK LED lights steadily. If the red FAIL LED lights steadily instead, remove and install the Routing Engine again. If the red FAIL LED still
lights steadily, the Routing Engine is not functioning properly. Contact your customer support representative.

To check the status of the Routing Engine, use the CLI command:

```
user@host> show chassis routing-engine
Routing Engine status:  Slot 0:  Current state  Master
...
```

For more information about using the CLI, see the Junos OS documentation.

*Figure 70: Installing an M120 Routing Engine*

---

See Also
- M120 Routing Engine Description on page 22
- M120 Routing Engine Interface Ports and Status Indicators on page 28

Related Documentation
- M120 Routing Engine Description on page 22
- M120 Routing Engine Interface Ports and Status Indicators on page 28
- Synchronizing Routing Engines

**Replacing an SSD Drive on an RE-A-1800 or RE-S-1800**

Each RE-1800 Routing Engine supports two solid-state drives (SSD) specified by Juniper Networks. The RE-1800 ships with one SSD installed. The spare SSD is Juniper part number RE-SSD-32G-UPG. Figure 71 on page 199 and Figure 72 on page 199 show the arrangement of storage drive slots on a RE-1800 Routing Engine.
Chapter 26: Replacing Host Subsystem Components

Figure 71: RE-A-1800 Storage Drive Slots

Figure 72: RE-S-1800 Storage Drive Slots
The following drive has been verified to work in the RE-1800 Routing Engines:

- SSD SLC 32 GB

To replace a storage drive:

1. Disable and deactivate the storage drive.

2. Remove the storage drive.
   a. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to an ESD point on the appliance.
      For more information about ESD, see *Prevention of Electrostatic Discharge Damage on VXA Series Content Engines*.
   b. Unfasten the thumbscrew that secures the access door in front of the storage drive slots, and open the door.
   c. Slide the lock on the ejector to the unlocked position.
   d. Carefully slide the drive out of the slot.

3. Reinstall a storage drive.
   a. Carefully align the sides of the drive with the guides in the slot.
   b. Slide the drive into the slot until you feel resistance, carefully ensuring that it is correctly aligned.
   c. Close the access door and tighten the thumbscrew to secure the door.

4. Mount the new storage drive.

**Related Documentation**
- Returning a Hardware Component to Juniper Networks, Inc. on page 305

**Replacing a DIMM Module in M120 Routing Engines**

1. Removing a M120 DIMM Module on page 200
2. Installing a M120 DIMM Module on page 201

**Removing a M120 DIMM Module**

The DIMM modules are located on the top of the Routing Engine. To remove a DIMM module:
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.

2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

3. Remove the Routing Engine.

4. Depending on which Routing Engine you are using, there are two different procedures for ejecting the DIMMs:
   - For Routing Engines with an ejector on one side of the DIMM, press the plastic ejector of the DIMM module. The edge of the module raises upward.
   - For Routing Engines with ejectors on each side of the DIMM, press the plastic ejectors on both sides of the DIMM module.

5. Grasp the DIMM module, being careful not to touch any electrical components on the module, and firmly pull it out of the slot on the Routing Engine.

6. Place the DIMM module on the antistatic mat or in the electrostatic bag.

7. Push the plastic ejectors to close the empty DIMM module slot.

See Also
- M120 Routing Engine Description on page 22
- Replacing an M120 Routing Engine on page 195
- Installing a M120 DIMM Module on page 201

Installing a M120 DIMM Module

NOTE: When installing DIMMs on an RE-1800, make sure that all DIMMs are manufactured by the same vendor. If necessary, replace an existing DIMM with a new DIMM.

To insert a DIMM module into the Routing Engine:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist, and connect the strap to one of the ESD points on the chassis.

2. Remove the DIMM module from its electrostatic bag.

3. To open the empty DIMM slot, press the plastic ejectors open.

4. Grasp the DIMM module by the edges, being careful not to touch any electrical components.

5. Pressing firmly on both ends, push the module into the slot until the ejectors return completely to the closed position.

6. Install the Routing Engine.

7. You can view the the SDRAM configuration and verify the DIMM was installed correctly by issuing the `show chassis routing-engine` command.
Replacing an M120 CB

To replace a CB, perform the following procedures:

- Removing an M120 CB on page 202
- Installing an M120 CB on page 204

Removing an M120 CB

The router can have one or two CBs. They are located on either side of the FEBs in the rear of the chassis in the slots marked CB0 and CB1. With an RE installed, each CB weighs approximately 6.9 lb (3.1 kg).
CAUTION: Before you replace a CB, you must take the host subsystem offline. If there is only one host subsystem, taking the host subsystem offline shuts down the router. See “Taking the M120 Host Subsystem Offline” on page 267.

CAUTION: If the CB to be replaced is associated with the Routing Engine currently functioning as the master Routing engine, switch it to the backup before removing the CB. See “Taking the M120 Host Subsystem Offline” on page 267.

To remove a CB (see Figure 74 on page 204):

1. Take the host subsystem offline. See “Taking the M120 Host Subsystem Offline” on page 267.

2. Place an electrostatic bag or antistatic mat on a flat, stable surface.

3. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

4. Loosen the captive screws on the ejector handles, using a Phillips (+) screwdriver, number 2.

5. Simultaneously rotate the ejector handles counterclockwise to unseat the CB.

6. Grasp the ejector handles and slide the CB about halfway out of the chassis.

7. Place one hand underneath the CB to support it and slide it completely out of the chassis.

8. Place the CB on the antistatic mat.

9. If you are not replacing the CB now, install a blank panel over the empty slot.
Installing an M120 CB

To install a CB (see Figure 75 on page 205):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to an approved site ESD grounding point. See the instructions for your site.

2. Carefully align the sides of the CB with the guides inside the chassis.

3. Slide the CB into the chassis, carefully ensuring that it is correctly aligned.

4. Grasp both ejector handles and rotate them simultaneously clockwise until the CB is fully seated.
5. Tighten the captive screws on the ejector handles, using a Phillips (+) screwdriver, number 2.

6. To verify that the CB is functioning normally, check the LEDs on its faceplate. The green **OK** LED should light steadily a few minutes after the CB is installed. If the **FAIL** LED is lit steadily, remove and install the CB again. If the **FAIL** LED still lights steadily, the CB is not functioning properly. Contact your customer support representative.

To check the status of the CB, use the CLI command:

```
user@host> show chassis environment cb
```

*Figure 75: Installing an M120 CB*
Replacing Connections to M120 Routing Engine Interface Ports

The ports on the craft interface connect the Routing Engine to external management devices (see Figure 76 on page 206).

![Figure 76: M120 Routing Engine Interface Ports and Alarm Relay Contacts](image)

To replace the cables that connect to the ports:

- Replacing the Management Ethernet Cable on the M120 Routing Engine on page 206
- Replacing the Console or Auxiliary Cable on the M120 Routing Engine on page 207
- Replacing Alarm Relay Wires on the M120 Craft Interface on page 208

**Replacing the Management Ethernet Cable on the M120 Routing Engine**

For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M120 Router” on page 105. To replace the management Ethernet Cable:

1. Press the tab on the connector and pull the connector straight out of the **ETHERNET** port. Figure 77 on page 206 shows the connector.

2. Disconnect the cable from the network device.

3. Plug one end of the replacement cable into the appropriate **ETHERNET** port. Figure 78 on page 207 shows the external device ports on the craft interface. The ports labeled 0 connect to the Routing Engine in the left Routing Engine slot (**RE0**), and the ports labeled 1 connect to the Routing Engine in the right Routing Engine slot (**RE1**).

4. Plug the other end of the cable into the network device.

![Figure 77: M120 Ethernet Cable Connectors](image)
Replacing the Console or Auxiliary Cable on the M120 Routing Engine

To use a system console to configure and manage the Routing Engine, connect it to the appropriate **CONSOLE** port on the craft interface. To use a laptop, modem, or other auxiliary device, connect it to the appropriate **AUX** port on the craft interface. Both ports accept a cable with an RJ-45 connector. One RJ-45/DB-9 cable is provided with the router. To connect a device to the other port, you must supply another cable. For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M120 Router” on page 105.

To connect a management console or auxiliary device:

1. Plug one end of the replacement cable into the appropriate **CONSOLE** or **AUX** port. Figure 79 on page 208 shows the external device ports on the craft interface. The ports labeled 0 connect to the Routing Engine in the left Routing Engine slot (RE0), and the ports labeled 1 connect to the Routing Engine in the right Routing Engine slot (RE1).

   **NOTE:**
   For console devices, configure the serial port to the following values:
   - Baud rate—9600
   - Parity—N
   - Data bits—8
   - Stop bits—1
   - Flow control—none

2. Plug the other end of the cable into the device's serial port.
Replacing Alarm Relay Wires on the M120 Craft Interface

To connect the router to external alarm-reporting devices, attach wires to the RED and YELLOW relay contacts on the craft interface. A system condition that triggers the red or yellow alarm LED on the craft interface also activates the corresponding alarm relay contact.

The terminal blocks that plug into the alarm relay contacts are supplied with the router. They accept wire of any gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²), which is not provided. Use the wire gauge appropriate for the external device you are connecting.

To replace the wires connecting to an alarm-reporting device (see Figure 60 on page 184):

1. Disconnect the existing wire at the external device.
2. Prepare the required length of replacement wire with gauge between 28-AWG and 14-AWG (0.08 and 2.08 mm²).
3. Using a 2.5-mm flat-blade screwdriver, loosen the small screws on the face of the terminal block and remove the block from the relay contact.
4. Using the 2.5-mm flat-blade screwdriver, loosen the small screws on the side of the terminal block. Remove existing wires from the slots in the front of the block and insert replacement wires. Tighten the screws to secure the wire.
5. Plug the terminal block into the relay contact and use a 2.5-mm flat-blade screwdriver to tighten the screws on the face of the block.
6. Attach the other end of the wires to the external device.
Replacing the Console or Auxiliary Cable on the M120 Routing Engine

To use a system console to configure and manage the Routing Engine, connect it to the appropriate CONSOLE port on the craft interface. To use a laptop, modem, or other auxiliary device, connect it to the appropriate AUX port on the craft interface. Both ports accept a cable with an RJ-45 connector. One RJ-45/DB-9 cable is provided with the router. To connect a device to the other port, you must supply another cable. For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M120 Router” on page 105.

To connect a management console or auxiliary device:

1. Plug one end of the replacement cable into the appropriate CONSOLE or AUX port. Figure 79 on page 208 shows the external device ports on the craft interface. The ports labeled 0 connect to the Routing Engine in the left Routing Engine slot (RE0), and the ports labeled 1 connect to the Routing Engine in the right Routing Engine slot (RE1).
NOTE:
For console devices, configure the serial port to the following values:

- Baud rate—9600
- Parity—N
- Data bits—8
- Stop bits—1
- Flow control—none

2. Plug the other end of the cable into the device's serial port.

Figure 81: M120 Routing Engine Interface Ports and Alarm Relay Contacts

Related Documentation

- Connecting the M120 Router to an External Alarm-Reporting Device on page 158
- Preventing Electrostatic Discharge Damage to an M120 Router on page 316
- M120 Routing Engine Interface Ports and Status Indicators on page 28

Replacing the Management Ethernet Cable on the M120 Routing Engine

For cable specifications, see “Routing Engine Interface Cable and Wire Specifications for the M120 Router” on page 105. To replace the management Ethernet Cable:

1. Press the tab on the connector and pull the connector straight out of the **ETHERNET** port. Figure 77 on page 206 shows the connector.

2. Disconnect the cable from the network device.

3. Plug one end of the replacement cable into the appropriate **ETHERNET** port.
   Figure 78 on page 207 shows the external device ports on the craft interface. The ports labeled 0 connect to the Routing Engine in the left Routing Engine slot (RE0), and the ports labeled 1 connect to the Routing Engine in the right Routing Engine slot (RE1).

4. Plug the other end of the cable into the network device.
Figure 82: M120 Ethernet Cable Connectors

Figure 83: M120 Routing Engine Interface Ports and Alarm Relay Contacts

Related Documentation

- Connecting the M120 Router to Management and Alarm Devices on page 153
- Preventing Electrostatic Discharge Damage to an M120 Router on page 316
Replacing Line Card Components

• Replacing an M120 FPC on page 213
• Replacing an M120 CFPC on page 219
• Replacing an M120 PIC on page 223
• Replacing an M120 PIC Cable on page 228
• Replacing an M120 XENPAK Module on page 231
• Replacing an SFP or XFP Transceiver on page 234

Replacing an M120 FPC

The FPCs are hot-insertable and hot-removable. When you remove an FPC, the router continues to function, although the PIC interfaces installed on the FPC being removed no longer function. To replace an FPC, perform the following procedures:

• Removing an M120 FPC on page 213
• Installing an M120 FPC on page 216

Removing an M120 FPC

The router holds up to four FPCs, which are installed vertically in the front of the router. An empty FPC weighs 9.0 lb (4.0 kg). A fully configured FPC can weigh up to 12.3 lb (5.6 kg).

To remove an FPC (see Figure 84 on page 215):

1. Have ready a replacement FPC or FPC blank panel and an antistatic mat for the FPC. Also have ready rubber safety caps for each PIC using an optical interface on the FPC that you are removing.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Label the cables connected to each PIC on the FPC so that you can later reconnect the cables to the correct PICs.

4. Use one of the following methods to take the FPC offline:
• Press and hold the FPC online/offline button. The green STATUS LED next to the button begins to blink. Hold the button down until the LED goes out. The LEDs and online/offline button for each FPC are located directly above it on the craft interface.

• Issue the CLI command:

```
user@host> request chassis fpc slot slot-number offline
```

For more information about the command, see the CLI Explorer.

5. Disconnect the cables from the PICs installed in the FPC. If a PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap. Arrange the disconnected cables in the cable management system, to prevent the cables from developing stress points.

**WARNING:** Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

**CAUTION:** Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

**CAUTION:** Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

6. Simultaneously turn both the ejector handles counterclockwise to unseat the FPC.

7. Grasp the handles and slide the FPC straight out of the card cage halfway.

8. Place one hand around the front of the FPC (the PIC housing) and the other hand under it to support it. Slide the FPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

**CAUTION:** The weight of the FPC is concentrated in the back end. Be prepared to accept the full weight—up to 12.3 lb (5.6 kg)—as you slide the FPC out of the chassis.

When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.
Do not stack FPCs on top of one another after removal. Place each one individually in an electrostatic bag or on its own antistatic mat on a flat, stable surface.

9. If necessary, remove each installed PIC from the FPC. For information on removing a PIC, see “Removing an M120 PIC” on page 223.

10. After you remove each PIC, immediately place it on an antistatic mat or in an electrostatic bag.

11. If you are not reinstalling a FPC into the emptied FPC slot within a short time, install a blank FPC panel over the slot to maintain proper airflow in the FPC card cage.

CAUTION: After removing an FPC from the chassis, wait at least 30 seconds before reinserting it, removing an FPC from a different slot, or inserting an FPC into a different slot.

Figure 84: Removing an M120 FPC
Installing an M120 FPC

To install an FPC (see Figure 85 on page 218 and Figure 86 on page 218):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Place the FPC on an antistatic mat.

3. Take each PIC to be installed in the replacement FPC out of its electrostatic bag and identify the slot on the FPC where it will be connected.

4. Verify that each fiber-optic PIC has a rubber safety cap covering the PIC transceiver. If it does not, cover the transceiver with a safety cap.

5. Install each PIC into the appropriate slot on the FPC. For information on installing a PIC, see “Installing an M120 PIC” on page 225.

6. Locate the slot in the FPC card cage in which you plan to install the FPC.

7. Ensure that the FPC is right-side up, with the text on the faceplate of the FPC facing upward.

8. Lift the FPC into place and carefully align first the bottom, then the top of the FPC with the guides inside the card cage.

   CAUTION: When the FPC is out of the chassis, do not hold it by the ejector handles, bus bars, or edge connectors. They cannot support its weight.

9. Slide the FPC all the way into the card cage until you feel resistance.

10. Grasp both ejector handles and rotate them simultaneously clockwise until the FPC is fully seated.

11. If any of the PICs on the FPC connect to fiber-optic cable, remove the rubber safety cap from each transceiver and cable.
WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

12. Insert the appropriate cable into the cable connector ports on each PIC on the FPC. Secure the cables so that they are not supporting their own weight. Place excess cable out of the way in a neatly coiled loop, using the cable management system. Placing fasteners on a loop helps to maintain its shape.

CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

13. Use one of the following methods to bring the FPC online:

- Press and hold the FPC online/offline button until the green STATUS LED next to the button lights steadily, in about 5 seconds. The LEDs and online/offline button for each FPC are located directly above it on the craft interface.

- Issue the CLI command:

  user@host>request chassis fpc slot slot-number online

  For more information about the command, see the CLI Explorer.

CAUTION: After the OK LED lights steadily, wait at least 30 seconds before removing the FPC again, removing an FPC from a different slot, or inserting an FPC in a different slot.

You can also verify correct FPC and PIC functioning by issuing the show chassis fpc and show chassis fpc pic-status commands described in “Maintaining M120 FPCs and CFPCs” on page 270 and “Maintaining M120 PICs and PIC Cables” on page 275.
Figure 85: Installing an M120 FPC

Figure 86: Connecting Fiber-Optic Cable to an M120 PIC

See Also  •  M120 Flexible PIC Concentrators (FPCs) Description on page 51
Replacing an M120 CFPC

The router holds up to two CFPCs, which are installed vertically in the front of the router. The CFPCs are hot-insertable and hot-removable. When you remove a CFPC, the router continues to function. Each CFPC weighs approximately 2 lbs. (0.9 kg.) To replace a CFPC, perform the following procedures:

- Removing an M120 CFPC on page 219
- Installing an M120 CFPC on page 221

Removing an M120 CFPC

To remove a CFPC (see Figure 87 on page 220):

1. Have ready a replacement CFPC or a blank panel and an antistatic mat for the CFPC.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Use one of the following methods to take the CFPC offline:
   - Press and hold the CFPC online/offline button. The green STATUS LED next to the button begins to blink. Hold the button down until the LED goes out. The LEDs and online/offline button for each FPC are located directly above it on the craft interface.
   - Issue the following CLI command:

     ```
     user@host>request chassis fpc slot slot-number offline
     ```

     For more information about the command, see the CLI Explorer.

4. Remove the cable from the transceiver on the CFPC faceplate.

5. Pull the lower end of the ejector lever away from the CFPC faceplate to unseat the CFPC.

6. Continue to pull the lever toward you and slide the CFPC straight out of the card cage halfway.
7. Place one hand around the front of the CFPC and the other hand under it to support it. Slide the CFPC completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

**CAUTION:** When the CFPC is out of the chassis, do not hold it by the ejector handle, bus bars, or edge connectors. They cannot support its weight.

Place each individual CFPC in an individual electrostatic bag or on its own antistatic mat on a flat, stable surface.

8. If you are not reinstalling a CFPC into the emptied CFPC slot within a short time, install a blank CFPC panel over the slot to maintain proper airflow within the router.

**CAUTION:** After removing a CFPC from the chassis, wait at least 30 seconds before reinserting it, removing a CFPC from a different slot, or inserting a CFPC into a different slot.

*Figure 87: Removing an M120 CFPC*

**See Also**
- M120 Compact FPCs (CFPCs) Description on page 54
- Maintaining M120 FPCs and CFPCs on page 270
- Troubleshooting M120 FPCs and CFPCs on page 287
Installing an M120 CFPC on page 221

Installing an M120 CFPC

To install a CFPC (see Figure 88 on page 222):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Place the CFPC on the antistatic mat.

3. Take the CFPC to be installed out of its electrostatic bag and identify the slot on the CFPC in which it will be installed.

4. Verify that the transceiver has a rubber safety cap covering the PIC transceiver. If it does not, cover the transceiver with a safety cap.

5. Ensure that the CFPC is right-side up, with the text on the faceplate of the CFPC facing upward.

6. Lift the CFPC into place and carefully align first the bottom, then the top of the CFPC with the guides inside the card cage.

7. Slide the CFPC all the way into the card cage until you feel resistance.

8. Pull the end of the ejector lever away from the CFPC faceplate, and hold the lever out while continuing to push on the CFPC faceplate to further install it into the chassis.

9. When the CFPC is about 0.5 in (1 cm) from being fully inserted, release the ejector level and gently push on the CFPC faceplate until you hear a click as the CFPC contacts the midplane. The ejector lever engages and closes automatically.

10. Remove the rubber safety cap from the transceiver on the CFPC faceplate.

11. Insert the appropriate cable into the transceiver on the CFPC faceplate.

12. Use one of the following methods to bring the CFPC online:
   - Press and hold the CFPC online/offline button until the green STATUS LED next to the button lights steadily, in about 5 seconds. The LEDs and online/offline button for each FPC are located directly above it on the craft interface.
   - Issue the following CLI command:

     ```
     user@host>request chassis fpc slot slot-number online
     ```
For more information about the command, see the CLI Explorer.

**CAUTION:** After the OK LED lights steadily, wait at least 30 seconds before removing the CFPC again or removing the CFPC from the other slot.

You can also verify correct CFPC functioning by issuing the `show chassis fpc` command as described in “Maintaining M120 FPCs and CFPCs” on page 270.

*Figure 88: Installing an M120 CFPC*

**See Also**
- M120 Compact FPCs (CFPCs) Description on page 54
- Maintaining M120 FPCs and CFPCs on page 270
- Troubleshooting M120 FPCs and CFPCs on page 287
- Removing an M120 CFPC on page 219

**Related Documentation**
- M120 Compact FPCs (CFPCs) Description on page 54
- Maintaining M120 FPCs and CFPCs on page 270
- Troubleshooting M120 FPCs and CFPCs on page 287
Replacing an M120 PIC

PICs are hot-insertable and hot-removable. When you remove a PIC, the router continues to function, although the PIC interfaces being removed no longer function. To replace a PIC, perform the following procedures:

- Removing an M120 PIC on page 223
- Installing an M120 PIC on page 225

Removing an M120 PIC

The PICs are located in the FPCs installed in the front of the router. A PIC weighs less than 2 lb (0.9 kg).

To remove a PIC (see Figure 89 on page 225):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the PIC. If the PIC connects to fiber-optic cable, have ready a rubber safety cap for each transceiver and cable.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Use one of the following methods to take the PIC offline:
   - Press and hold the PIC offline button until its failure indicator LED lights, which usually takes about 5 seconds. The failure LED is usually red; for more information, see the M120 Multiservice Edge Router Interface Module Reference. For the PICs that install on an Type 1 FPCs, the offline button for each PIC is next to it on the FPC card carrier. For the PICs that install on an Type 2 FPCs, the offline button is on the PIC faceplate.
   - Issue the CLI command:

     `user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot offline`

     For more information about the command, see the CLI Explorer.

4. Label the cables connected to the PIC so that you can later reconnect each cable to the correct PIC.

5. Disconnect the cables from the PIC. If the PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.

**WARNING:** Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.
CAUTION: Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

6. Arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

7. For an FPC3 PIC, loosen the captive screw at the bottom of the PIC faceplate, and then twist the ejector handle at the top of the faceplate counterclockwise to unseat the PIC. For an FPC1 or FPC2 PIC, loosen the captive screws at the top and bottom of the faceplate.

8. Slide the PIC out of the FPC card carrier and place it in the electrostatic bag or on the antistatic mat.

9. If you are not reinstalling a PIC into the emptied PIC slot within a short time, install a blank PIC panel over the slot to maintain proper airflow in the FPC card cage.
Installing an M120 PIC

To install a PIC (see Figure 90 on page 227):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. If the PIC uses fiber-optic cable, verify that there is a rubber safety cap over each transceiver on the faceplate. Install a cap if necessary.

3. Align the notches in the connector at the rear of the PIC with the notches in the PIC slot in the FPC and then slide the PIC in until it lodges firmly in the FPC.

**CAUTION:** Slide the PIC straight into the slot to avoid damaging the components on the bottom of the PIC.
4. For an FPC3 PIC, turn the ejector handle at the top of the PIC faceplate clockwise, and then tighten the captive screw at the bottom of the faceplate to secure the PIC in the FPC. For an FPC 1 or FPC2 PIC, tighten the captive screws at the top and bottom of the faceplate.

5. If the PIC uses fiber-optic cable, remove the rubber safety cap from each transceiver and the end of each cable.

   WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

   CAUTION: Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

6. Insert the appropriate cables into the cable connectors on the PIC.

7. Arrange each cable in the cable management system to prevent the cable from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

   CAUTION: Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

   CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

8. Use one of the following methods to bring the PIC online:
   - Press and hold the PIC offline button until the status LED on the PIC faceplate indicates normal functioning, which usually takes about 5 seconds. The LED is usually green; for more information, see the M120 Multiservice Edge Router Interface Module Reference. For the PICs that install on an FPC1, the offline button for each PIC is next to it on the FPC card carrier. For the PICs that install on an FPC2 or FPC3, the offline button is on the PIC faceplate.
   - Issue the CLI command:
user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot online

For more information about the command, see the CLI Explorer.

The normal functioning status LED confirms that the PIC is online. You can also verify correct PIC functioning by issuing the show chassis fpc pic-status command described in “Maintaining M120 PICs and PIC Cables” on page 275.

Figure 90: Installing an M120 PIC

See Also
- M120 PICs Description on page 57
- Troubleshooting M120 PICs on page 288
- Removing an M120 PIC on page 223

Related Documentation
- M120 PICs Description on page 57
- Maintaining M120 PICs and PIC Cables on page 275
- Troubleshooting M120 PICs on page 288
Replacing an M120 PIC Cable

Removing and installing PIC cables does not affect router function, except that a PIC does not receive or transmit data while its cable is disconnected. To replace a PIC cable, perform the following procedures:

- Removing an M120 PIC Cable on page 228
- Installing an M120 PIC Cable on page 229

Removing an M120 PIC Cable

To remove a PIC cable:

1. If the PIC connects to fiber-optic cable, have ready a rubber safety cap for each cable and transceiver.

2. If removing all cables connected to the PIC, use one of the following methods to take the PIC offline:
   - Press its online/offline button. For a PIC installed in an FPC1, use a tool—such as a flat-blade screwdriver—to press the button slightly beneath the faceplate of the PIC. For a PIC installed in an FPC2 or FPC3, use a narrow-ended tool that fits inside the opening that leads to the button. Press and hold the button until the PIC LED goes out (about 5 seconds).
   - Issue the CLI command:

     ```
     user@host> request chassis pic fpc-slot fpc-slot pic-slot offline
     ```

     For more information about the command, see the CLI Explorer.

3. Unplug the cable from the cable connector port. If the PIC uses fiber-optic cable, immediately cover each transceiver and the end of each cable with a rubber safety cap.

   **WARNING:** Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

   **CAUTION:** Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

4. Remove the cable from the cable management system and detach it from the destination port.
Installing an M120 PIC Cable

To install a PIC cable (see Figure 91 on page 230):

1. Have ready a length of the type of cable used by the PIC. For cable specifications, see the M120 Multiservice Edge Router Interface Module Reference.

2. If the PIC cable connector port is covered by a rubber safety plug, remove the plug.

   **WARNING:** Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

   **CAUTION:** Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

3. Insert the cable connector into the cable connector port on the PIC faceplate.

4. Arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

   **CAUTION:** Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

   **CAUTION:** Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

5. Insert the other end of the cable into the destination port.
6. Repeat the previous steps for any additional cables.

7. If the PIC is offline (its failure indicator LED is lit), use one of the following methods to bring the PIC online:
   - Press the PIC offline/online button until the PIC LED lights green. For a PIC installed in an FPC1, use a tool—such as a flat-blade screwdriver—to press the button slightly beneath the faceplate of the PIC. For a PIC installed in an FPC2 or FPC3, use a narrow-ended tool that fits inside the opening that leads to the button.
   - Issue the following CLI command:

     ```
     user@host> request chassis pic fpc-slot fpc-slot pic-slot pic-slot online
     ```

     For more information about the command, see the CLI Explorer.

     The normal functioning indicator LED confirms that the PIC is online. You can also verify correct PIC functioning by issuing the `show chassis fpc pic-status` command described in “Maintaining M120 PICs and PIC Cables” on page 275.

**Figure 91: Connecting Fiber-Optic Cable to an M120 PIC**

**See Also**
- M120 PICs Description on page 57
- Connecting PIC Cables to the M120 Router on page 164
- Maintaining M120 PICs and PIC Cables on page 275
- Removing an M120 PIC Cable on page 228
Replacing an M120 XENPAK Module

XENPAK modules are optical transceivers that can be removed from a PIC (for more information, see “M120 PICs Description” on page 57).

XENPAK modules are hot-insertable and hot-removable. Removing a XENPAK module does not interrupt PIC functioning, but the removed module no longer receives or transmits data. To replace a XENPAK module, perform the following procedures:

- Removing an M120 XENPAK Module on page 231
- Installing an M120 XENPAK Module on page 232

Removing an M120 XENPAK Module

To remove a XENPAK module (see Figure 92 on page 232):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface to receive the XENPAK module. Have ready a rubber safety cap for the XENPAK transceiver and the cable.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Label the cable connected to the XENPAK module so that you can later reconnect it to the correct module.

4. Disconnect the cable from the XENPAK module. Immediately cover the transceiver and the end of the cable with a rubber safety cap.

   WARNING: Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

   CAUTION: Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

5. Arrange the cable in the cable management system to prevent it from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight.
as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

CAUTION: Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

6. Unscrew the thumbscrews at the top and bottom of the XENPAK module.

7. Slide the module out of the PIC and place it in the electrostatic bag or on the antistatic mat.

**Figure 92: Removing a M120 XENPAK Module**

See Also
- M120 Router Chassis Description on page 7
- Overview of Troubleshooting Resources for the M120 Router on page 283
- Installing an M120 XENPAK Module on page 232

**Installing an M120 XENPAK Module**

To install a replacement XENPAK module (see Figure 93 on page 234):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Verify that a rubber safety cap covers the XENPAK transceiver. Install one if necessary.
3. Orient the XENPAK module so that the optical port faces out, and the transmit (TX) port is above the receive (RX) port (see Figure 93 on page 234).

4. Slide the XENPAK module into the slot.

5. Tighten the thumbscrews at the top and bottom of the XENPAK module. Verify that the module is seated properly.

6. Remove the rubber safety cap from the transceiver and the end of the cable. Insert the cable into the transceiver.

   **WARNING:** Do not look directly into a fiber-optic transceiver or into the ends of fiber-optic cables. Fiber-optic transceivers and fiber-optic cable connected to a transceiver emit laser light that can damage your eyes.

   **CAUTION:** Do not leave a fiber-optic transceiver uncovered except when inserting or removing cable. The safety cap keeps the port clean and prevents accidental exposure to laser light.

7. Arrange the cable in the cable management system to prevent the cable from dislodging or developing stress points. Secure the cable so that it is not supporting its own weight as it hangs to the floor. Place excess cable out of the way in a neatly coiled loop in the cable management system. Placing fasteners on the loop helps to maintain its shape.

   **CAUTION:** Do not let fiber-optic cable hang free from the connector. Do not allow fastened loops of cable to dangle, which stresses the cable at the fastening point.

   **CAUTION:** Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

8. Verify that the status LEDs on the PIC faceplate indicate that the XENPAK module is functioning correctly. For more information about the PIC LEDs, see the MI20 Multiservice Edge Router Interface Module Reference. You can also verify PIC functioning by issuing the `show chassis fpc pic-status` command described in “Maintaining MI20 PICs and PIC Cables” on page 275.
Replacing an SFP or XFP Transceiver

To replace an SFP or XFP transceiver, perform the following procedures:

- Removing an SFP or XFP Transceiver on page 234
- Installing an SFP or XFP Transceiver on page 236

Removing an SFP or XFP Transceiver

Small form-factor pluggables (SFPs) are optical transceivers that can be removed from a PIC (for more information, see “M120 PICs Description” on page 57).

SFPs and XFPs are hot-insertable and hot-removable. Removing an SFP or XFP does not interrupt PIC functioning, but the removed SFP or XFP no longer receives or transmits data.
To remove an SFP or XFP transceiver (see Figure 94 on page 236):

1. Have ready a replacement transceiver, or a transceiver slot plug, an antistatic mat, and a rubber safety cap for the transceiver.

2. Attach an ESD wrist strap to your bare wrist and connect the wrist strap to one of the ESD points on the chassis.

3. Label the cables connected to the transceiver so that you can reconnect them correctly later.

   **WARNING:** Do not look directly into a fiber-optic transceiver or into the end of a fiber-optic cable. Fiber-optic transceivers contain laser light sources that can damage your eyes.

4. Remove the cable connector plugged into the transceiver.

5. Carefully drape the disconnected cable over the bobbins in the cable management system below the FPC card cage to prevent the cable from developing stress points.

   **CAUTION:** Avoid bending fiber-optic cable beyond its minimum bend radius. An arc smaller than a few inches in diameter can damage the cable and cause problems that are difficult to diagnose.

6. Pull the ejector handle out from the transceiver to unlock the transceiver.

   **CAUTION:** Make sure that you open the ejector handle completely (you will hear it click). This prevents damage to the transceiver.

   For the 10-port Gigabit Ethernet PIC, use needlenose pliers to pull the ejector handle out from the SFP.

7. Grasp the transceiver ejector handle and pull the transceiver approximately 0.5 in (1.3 cm) out of the PIC or CFPC.

   For the 10-port Gigabit Ethernet PIC, use needlenose pliers to grasp the SFP ejector and pull the SFP approximately 0.5 in (1.3 cm) out of the PIC.

8. Using your fingers, grasp the body of the transceiver and pull it the rest of the way out of the PIC or CFPC.
9. Place a rubber safety cap over the transceiver.

10. Place the removed transceiver on an antistatic mat or in an electrostatic bag.

---

**CAUTION:** After removing a transceiver from the chassis, wait at least 30 seconds before reinserting it or inserting a transceiver into a different slot.

---

**See Also**

- M120 Router Chassis Description on page 7
- Overview of Troubleshooting Resources for the M120 Router on page 283
- Installing an SFP or XFP Transceiver on page 236

---

**Installing an SFP or XFP Transceiver**

To install an SFP or XFP (see "Removing SFPs or XFPs" on page 236):

1. Attach an ESD wrist strap to your bare wrist and connect the wrist strap to one of the ESD points on the chassis.

2. Take each transceiver to be installed out of its electrostatic bag and identify the slot on the PIC or CFPC where it will be installed.

3. Verify that each transceiver is covered by a rubber safety cap. If it is not, cover the transceiver with a safety cap.

4. Carefully align the transceiver with the slots in the PIC or CFPC. The connectors should face the PIC or CFPC.
5. Slide the transceiver until the connector is seated in the PIC or CFPC slot. If you are unable to fully insert the transceiver, make sure the connector is facing the right way.

6. Remove the rubber safety cap from the transceiver and the end of the cable. Insert the cable into the transceiver.

7. Verify that the status LEDs on the PIC faceplate indicate that the SFP or XFP is functioning correctly. For more information about the PIC LEDs, see the PIC description for the PIC in the M120 Multiservice Edge Router Interface Module Reference. You can also verify PIC functioning by issuing the `show chassis fpc pic-status` command described in “Maintaining M120 PICs and PIC Cables” on page 275.

See Also
- M120 Router Chassis Description on page 7
- Overview of Troubleshooting Resources for the M120 Router on page 283
- Removing an SFP or XFP Transceiver on page 234

Related Documentation
- M120 Router Chassis Description on page 7
- Overview of Troubleshooting Resources for the M120 Router on page 283
Replacing Power System Components

- Replacing an M120 AC Power Supply on page 239
- Replacing an M120 AC Power Supply Cord on page 244
- Replacing an M120 DC Power Supply on page 245
- Replacing an M120 DC Power Supply Cable on page 251

Replacing an M120 AC Power Supply

In the AC power configuration, the router has two AC power supplies (see Figure 21 on page 73), located at the rear of the chassis in slots PEM0 and PEM1 (left to right). Each AC power supply provides power to all components in the router. The AC power supplies are fully redundant and current is shared almost equally in a fully configured system. In a fully configured router, if one power supply fails or is removed, the remaining power supply instantly assumes the entire electrical load.

Each power supply (AC or DC) is hot-insertable and hot-removable.

**NOTE:** To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.

- Removing an M120 AC Power Supply on page 239
- Installing an M120 AC Power Supply on page 242

Removing an M120 AC Power Supply

The power supplies are located at the rear of the chassis to the right of the CB1. Each power supply weighs approximately 8.4 lb (3.8 kg).

**CAUTION:** Do not leave a power supply slot empty for more than 30 minutes while the router is operational. For proper airflow, the power supply must remain in the chassis, or a blank panel must be used in an empty slot.
NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To remove an AC power supply (see Figure 95 on page 241):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Move the power switch on the power supply faceplate to the standby position.

3. Unplug the power cords from the power source receptacles.

4. Remove the cable restraint from the lower edge of the power supply faceplate by removing its retainer screw.

5. Unplug the power cord from the appliance inlet on the power supply faceplate.

6. Loosen the captive screw on each flange at the top and bottom of the power supply faceplate completely.

7. Grasp the handle on the power supply faceplate and pull firmly. Slide it halfway out of the chassis.

8. Place one hand underneath the power supply to support it and slide it completely out of the chassis.

WARNING: Do not touch the power connectors on the rear of the power supply (see Figure 96 on page 241). They can contain dangerous voltages.
See Also

- M120 AC Power Supply Description on page 72
- Maintaining the M120 Power Supplies on page 277
- Electrical Specifications for the M120 AC Power Supply on page 95
- Installing an M120 AC Power Supply on page 242
Installing an M120 AC Power Supply

To install an AC power supply (see Figure 97 on page 243):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Move the power switch on the power supply faceplate to the standby position.

3. Using both hands, slide the power supply into the chassis until you feel resistance.

4. Firmly push the power supply into the chassis until it comes to a stop. The power supply faceplate should be flush with any adjacent power supply faceplates.

5. Tighten the captive screws on the top and bottom flanges of the power supply faceplate to secure the power supply in the chassis.

6. Insert the appliance coupler end of each power cord into the appliance inlet on the power supply faceplate.

7. Remove the cable restraint from the lower edge of the power supply faceplate by removing its retainer screw.

8. Wrap the cable restraint around the power cord, then slide it along the power cord to a position that enables you to reinstall it in the power supply faceplate.

9. Reinstall the cable restraint by tightening its retainer screw part of the way into the power supply faceplate.

10. Carefully pull the AC power cords through the cable restraint until you have the desired amount of slack in the power cord.

11. Tighten the cable restraint retainer screw to hold the power cords in place.

12. Insert the power cord plugs into an AC power source receptacle. Verify that the power cord does not block access to router components or drape where people could trip on it.
NOTE: Each AC power supply has two AC appliance inlets. Each power supply must be connected to a dedicated AC power feed. For 100-120 VAC, both inlets are used. For 200-240 VAC, only the top inlet is used. For information about site power preparations, see “M120 Router Power Requirements” on page 88. For information about connecting the router to power and ground, see “Connecting Power to an AC-Powered M120 Router” on page 167.

13. Switch the power switch on the power supply faceplate to the on position (I). Verify that the status LED on the power supply faceplate blinks, then lights steadily approximately one minute after you switch on the power switch.

See Also
- M120 AC Power Supply Description on page 72
- Maintaining the M120 Power Supplies on page 277
- Electrical Specifications for the M120 AC Power Supply on page 95
- Removing an M120 AC Power Supply on page 239
Replacing an M120 AC Power Supply Cord

To replace the power cord for an AC power supply:

1. Locate a replacement power cord with the type of plug appropriate for your geographical location (see “M120 AC Power, Connection, and Power Cord Specifications” on page 93).

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Move the power switch on the power supply faceplate to the standby position.

4. Unplug the power cords from the power source receptacles.

5. Remove the cable restraint from the lower edge of the power supply faceplate by removing its retainer screw.

6. Remove the cable restraint from the power cord and save it so you can use it on the replacement power cord.

7. Unplug the power cord from the appliance inlet on the power supply faceplate.

8. Insert the appliance coupler end of the replacement power cord into the appliance inlet on the power supply faceplate.

9. Wrap the cable restraint around the power cord, then slide it along the power cord to a position that enables you to reinstall it in the power supply faceplate.

10. Reinstall the cable restraint by tightening its retainer screw part of the way into the power supply faceplate.

11. Carefully pull the AC power cords through the cable restraint until you have the desired amount of slack in the power cord.

12. Tighten the cable restraint retainer screw to hold the power cords in place.
13. Insert the power cord plugs into an AC power source receptacle. Verify that the power cord does not block access to router components or drape where people could trip on it.

**NOTE:** Each AC power supply has two AC appliance inlets. Each power supply must be connected to a dedicated AC power feed. For 100-120 VAC, both inlets are used. For 200-240 VAC, only the top inlet is used. For information about site power preparations, see “M120 Router Power Requirements” on page 88. For information about connecting the router to power and ground, see “Connecting Power to an AC-Powered M120 Router” on page 167.

14. Switch the power switch on the power supply faceplate to the on position (I). Verify that the status LED on the power supply faceplate blinks, then lights steadily approximately one minute after you switch on the power switch.

### Related Documentation
- M120 AC Power Supply Description on page 72
- Maintaining the M120 Power Supplies on page 277
- Electrical Specifications for the M120 AC Power Supply on page 95

### Replacing an M120 DC Power Supply

In the DC power configuration, the router contains two DC power supplies (see Figure 20 on page 72), located in the right rear of the chassis in slots PEM0 and PEM1 (left to right). A single DC power supply provides sufficient power for a fully configured router.

Each power supply (AC or DC) is hot-insertable and hot-removable.

**NOTE:** To maintain proper cooling and prevent thermal shutdown of the operating power supply unit, each power supply slot must contain either a power supply or a blank panel. If you remove a power supply, you must install a replacement power supply or a blank panel shortly after the removal.

- Removing an M120 DC Power Supply on page 245
- Installing an M120 DC Power Supply on page 248

### Removing an M120 DC Power Supply

The power supplies are located at the rear of the chassis to the right of the CB1. Each power supply weighs approximately 8.4 lb (3.8 kg).
CAUTION: Do not leave a power supply slot empty for more than 30 minutes while the router is operational. For proper airflow, the power supply must remain in the chassis, or a blank panel must be used in an empty slot.

NOTE: After powering off a power supply, wait at least 60 seconds before turning it back on.

To remove a DC power supply:

1. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Switch the circuit breaker on the power supply faceplate to the off position (O).

4. Remove the clear plastic cover protecting the terminal studs on the faceplate.

5. Remove the nut and washer from the terminal studs (see Figure 98 on page 246). (Use a 3/8-in. nut driver or pliers.)

   Figure 98: Disconnecting Power Cables from the M120 DC Power Supply

6. Remove the cable lugs from the terminal studs.

7. Loosen the captive screws on the cable restraints on the lower edge of the power supply faceplate.
8. Carefully move the power cables out of the way.

9. Loosen the captive screw on each flange at the top and bottom of the power supply faceplate completely.

10. Grasp the handle on the power supply and pull firmly. Slide it halfway out of the chassis (see Figure 99 on page 248).

   WARNING: Do not touch the power connectors on the rear of the power supply (see “Rear of the Power Supply Showing Midplane Connector” on page 241). They can contain dangerous voltages.

11. Place one hand underneath the power supply to support it and slide it completely out of the chassis.

   CAUTION: Each power supply weighs approximately 8.4 lb (3.8 kg). Be prepared to support the full weight of the power supply as you remove it from the router.
See Also

- M120 DC Power Supply Description on page 72
- Electrical Specifications for the M120 DC Power Supply on page 100
- Maintaining the M120 Power Supplies on page 277
- Installing an M120 DC Power Supply on page 248

Installing an M120 DC Power Supply

To install a DC power supply (see Figure 100 on page 250):
1. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during installation.

   **CAUTION:** You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (–) to indicate their polarity. There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines the color coding for the leads on the power cables that attach to the terminal studs on the power supply faceplate.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Switch the circuit breaker on the power supply faceplate to the off position (O).

4. Using both hands, slide the power supply into the chassis until you feel resistance.

5. Firmly push the power supply into the chassis until it comes to a stop. The power supply faceplate should be flush with any adjacent power supply faceplates.

6. Tighten the captive screws on the top and bottom flanges of the power supply faceplate to secure the power supply in the chassis.

7. Remove the clear plastic cover protecting the terminal studs on the faceplate.

8. Remove the nut and washer from the terminal studs.

9. Attach the lugs on the DC source power cables to the terminal studs, making sure the cables are not touching or in the way of any router components:
   - Attach the positive (+) DC source power cable lug to the RETURN (return) terminal.
   - Attach the negative (–) DC source power cable lug to the –48V (input) terminal.

   **NOTE:** For information about connecting to DC power sources, see “M120 DC Power, Connection, and Cable Specifications” on page 97.

10. Secure the power cable lugs to the terminal studs, first with the flat washer, then with the nut. Apply between 12 lb-in. (1.4 Nm) and 15 lb-in. (1.7 Nm) of torque to each nut (see Figure 101 on page 251).

11. Loosen the captive screw on the cable restraint on the lower edge of the power supply faceplate.
12. Connect each DC power cable to the appropriate external DC power source.

**NOTE:** For information about connecting to external DC power sources, see "M120 DC Power, Connection, and Cable Specifications" on page 97.

13. Switch the power switch on the power supply faceplate to the on position (1). Verify that the status LED on the power supply faceplate blinks, then lights steadily approximately one minute after you switch on the power switch.

*Figure 100: Installing an M120 DC Power Supply*
Replacing an M120 DC Power Supply Cable

To replace a power cable for a DC power supply:

1. Locate a replacement power cable that meets the specifications defined in “M120 DC Power, Connection, and Cable Specifications” on page 97.

   CAUTION: A licensed electrician must attach a cable lug to the power cable that you supply. A cable with an incorrectly attached lug can damage the router (for example, by causing a short circuit).

2. Make sure that the voltage across the DC power source cable leads is 0 V and that there is no chance that the cables might become active during the removal process.
CAUTION: You must ensure that power connections maintain the proper polarity. The power source cables might be labeled (+) and (−) to indicate their polarity. There is no standard color coding for DC power cables. The color coding used by the external DC power source at your site determines the color coding for the leads on the power cables that attach to the terminal studs on the power supply faceplate.

3. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

4. Switch the circuit breaker on the power supply faceplate to the off position (O).

5. Remove the power cable from the DC power source.

6. Remove the clear plastic cover protecting the terminal studs on the faceplate.

7. Remove the nut and washer from the terminal studs (see “Disconnecting Power Cables from the DC Power Supply” on page 246). (Use a 3/8-in. nut driver or pliers.)

8. Remove the cable lug from the terminal studs.

9. Loosen the captive screw on the cable restraint on the lower edge of the power supply faceplate.

10. Carefully move the power cable out of the way.

11. Attach the lug on the replacement power cable to the terminal studs, making sure the cable is not touching or in the way of any router components.

12. Secure the power cable lugs to the terminal studs, first with the flat washer, then with the nut. Apply between 12 lb-in. (1.4 Nm) and 15 lb-in. (1.7 Nm) of torque to each nut, (see “Connecting Power Cables to the DC Power Supply” on page 251

13. Route the power cable through the cable restraint.

14. Tighten the cable restraint captive screw to hold the power cable in place.

15. Replace the clear plastic cover over the terminal studs on the faceplate.

16. Attach the power cable to the DC power source.
17. Verify that the DC source power cabling is correct, that the cables are not touching or blocking access to router components, and that they do not drape where people could trip on them.

18. Switch the power switch on the power supply faceplate to the on position (I). Verify that the status LED on the power supply faceplate blinks, then lights steadily approximately one minute after you switch on the power switch.

Related Documentation

- M120 DC Power Supply Description on page 72
- Electrical Specifications for the M120 DC Power Supply on page 100
- Maintaining the M120 Power Supplies on page 277
CHAPTER 29

Replacing Switch Fabric Components

• Replacing an M120 FEB on page 255

Replacing an M120 FEB

To replace a FEB, perform the following procedures:

• Removing an M120 FEB on page 255
• Installing an M120 FEB on page 256

Removing an M120 FEB

Six FEBs are installed in the router. The FEBs are located in the rear of the chassis in the slots marked FEB0 through FEB5. Each FEB weighs approximately 4.5 lb (2.0 kg).

To remove a FEB (see Figure 102 on page 256):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. Press and hold down the online/offline button on the FEB faceplate until the green OK LED goes out (about 5 seconds).

4. Loosen the captive screws (using a Phillips (+) screwdriver, number 2) on the ejector handles on each side of the FEB faceplate.

5. Flip the ejector handles outward to unseat the FEB.

6. Grasp both ejector handles, pull firmly, and slide the FEB about three-quarters of the way out of the chassis.

7. Place one hand underneath the FEB to support it and slide it completely out of the chassis. Place it on the antistatic mat.
CAUTION: Do not stack hardware components on one another after you remove them. Place each component on an antistatic mat resting on a stable, flat surface.

Figure 102: Removing an M120 FEB

See Also
- M120 Forwarding Engine Boards (FEBs) Description on page 75
- M120 Forwarding Engine Boards (FEBs) LEDs on page 77
- Maintaining the M120 FEBs on page 278
- Troubleshooting M120 FEBs on page 289
- Installing an M120 FEB on page 256

Installing an M120 FEB

To install a FEB (see Figure 103 on page 257):

1. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

2. Place one hand underneath the FEB to support it. With the other hand, hold one of the ejector handles on the FEB faceplate.
3. Carefully align the sides of the FEB with the guides inside the chassis.

4. Carefully slide the FEB into the chassis, ensuring that it is correctly aligned.

5. Grasp both ejector handles and press them inward to seat the FEB.

6. Tighten the captive screws on the ejector handles.

7. Press the offline/online button until the green **OK** LED blinks to bring the FEB online.

8. To verify that the FEB is functioning normally, check the LEDs on its faceplate. The **OK** LED should light steadily a few minutes after the FEB is installed. If the **FAIL** LED is lit steadily, remove and install the FEB again (see “Removing an M120 FEB” on page 255). If the **FAIL** LED still lights steadily, the FEB is not functioning properly. Contact your customer support representative.

To check the status of the FEBs, issue the following CLI command:

```
user@host> show chassis environment feb
```

*Figure 103: Installing an M120 FEB*
See Also

- M120 Forwarding Engine Boards (FEBs) Description on page 75
- M120 Forwarding Engine Boards (FEBs) LEDs on page 77
- Maintaining the M120 FEBs on page 278
- Troubleshooting M120 FEBs on page 289
- Removing an M120 FEB on page 255

Related Documentation

- M120 Forwarding Engine Boards (FEBs) Description on page 75
- M120 Forwarding Engine Boards (FEBs) LEDs on page 77
- Maintaining the M120 FEBs on page 278
- Troubleshooting M120 FEBs on page 289
PART 5

Maintaining the Chassis and Components

- Routine Maintenance Procedures on page 261
- Maintaining Components and Cables on page 263
CHAPTER 30

Routine Maintenance Procedures

- Routine Maintenance Procedures on the M120 Router on page 261

Routine Maintenance Procedures on the M120 Router

**Purpose**
For optimum router performance, perform preventive maintenance procedures regularly.

**Action**
- Inspect the installation site for moisture, loose wires or cables, and excessive dust. Make sure that airflow is unobstructed around the router and into the air intake vents.
- Check the status-reporting devices on the craft interface—System alarms and LEDs.
- Inspect the air filter at the bottom front of the router. Replace it every 6 months for optimum cooling system performance. Do not run the router for more than a few minutes without the air filter in place. For maintenance instructions, see “Maintaining the M120 Air Filter” on page 263.

**Related Documentation**
- M120 Router Chassis Description on page 7
- M120 Clearance Requirements for Airflow and Hardware Maintenance on page 85
CHAPTER 31

Maintaining Components and Cables

- Tools and Parts Required to Maintain M120 Hardware Components on page 263
- Maintaining the M120 Air Filter on page 263
- Maintaining the M120 Fan Trays on page 264
- Maintaining the M120 Host Subsystem on page 266
- Taking the M120 Host Subsystem Offline on page 267
- Maintaining M120 FPCs and CFPCs on page 270
- Storing an M120 FPC on page 271
- Holding an M120 FPC on page 271
- Maintaining M120 PICs and PIC Cables on page 275
- Maintaining the M120 Power Supplies on page 277
- Maintaining the M120 FEBs on page 278

Tools and Parts Required to Maintain M120 Hardware Components

To maintain hardware components, you need the following tools and parts:

- ESD grounding wrist strap
- Flat-blade (−) screwdriver
- Phillips (+) screwdriver, number 1
- Phillips (+) screwdriver, number 2

Related Documentation

- M120 Router Chassis Description on page 7
- M120 Clearance Requirements for Airflow and Hardware Maintenance on page 85

Maintaining the M120 Air Filter

Purpose

For optimum cooling, verify the condition of the air filters.

Action

- A dirty air filter restricts airflow in the unit, producing a negative effect on the ventilation of the chassis. The filter elements degrade over time, so the filter elements in use,
should be replaced every 6 months. For procedures to replace the air filter, see “Replacing an M120 Air Filter” on page 187.

- Spare filter elements should be used within one year of manufacture. Check the date of manufacture printed on the filter. Store spare filter elements in a dark, cool, and dry place. Storing the filter elements at higher temperatures, or where they can be exposed to ultraviolet (UV) radiation, hydrocarbon emissions, or vapors from solvents, can significantly reduce their life.

---

CAUTION: Always keep the air filter in place while the router is operating. Because the fans are very powerful, they could pull small bits of wire or other materials into the router through the unfiltered air intake. This could damage the router components.

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Related Documentation

- M120 Cooling System Description on page 19
- Replacing an M120 Air Filter on page 187
- Troubleshooting the M120 Cooling System on page 286

Maintaining the M120 Fan Trays

Purpose

For optimum cooling, verify the condition of the fans.

Action

- Monitor the status of the fans. Each fan tray contains multiple fans that work in unison to cool the router components. If one fan fails, the host subsystem adjusts the speed of the remaining fans to maintain proper cooling. A red alarm is triggered when a fan fails, and a yellow alarm is triggered when a fan tray is removed.

- To display the status of the cooling system, issue the `show chassis environment` command. The output is similar to the following:

```
user@host> show chassis environment

Class     Item            Status     Measurement
Temp      PEM 0            OK
          PEM 1            OK
Routing   Engine 0        OK         56 degrees C / 132 degrees F
Routing   Engine 1        Absent
CB 0      Intake          OK         52 degrees C / 125 degrees F
CB 0      Exhaust A       OK         47 degrees C / 116 degrees F
CB 0      Exhaust B       OK         44 degrees C / 111 degrees F
CB 1      Intake          OK         41 degrees C / 105 degrees F
CB 1      Exhaust A       OK         40 degrees C / 104 degrees F
CB 1      Exhaust B       OK         42 degrees C / 107 degrees F
FEB 2     Intake          OK         44 degrees C / 111 degrees F
FEB 2     Exhaust A       OK         44 degrees C / 111 degrees F
FEB 2     Exhaust B       OK         48 degrees C / 118 degrees F
FEB 3     Intake          OK         46 degrees C / 114 degrees F
FEB 3     Exhaust A       OK         46 degrees C / 114 degrees F
FEB 3     Exhaust B       OK         52 degrees C / 125 degrees F
```
<table>
<thead>
<tr>
<th>Date</th>
<th>Component</th>
<th>Status</th>
<th>Temperature (°C/°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEB 4</td>
<td>Intake</td>
<td>OK</td>
<td>45 / 113</td>
</tr>
<tr>
<td>FEB 4</td>
<td>Exhaust A</td>
<td>OK</td>
<td>46 / 114</td>
</tr>
<tr>
<td>FEB 4</td>
<td>Exhaust B</td>
<td>OK</td>
<td>49 / 120</td>
</tr>
<tr>
<td>FEB 5</td>
<td>Intake</td>
<td>OK</td>
<td>42 / 107</td>
</tr>
<tr>
<td>FEB 5</td>
<td>Exhaust A</td>
<td>OK</td>
<td>41 / 105</td>
</tr>
<tr>
<td>FEB 5</td>
<td>Exhaust B</td>
<td>OK</td>
<td>49 / 120</td>
</tr>
<tr>
<td>FPC 2</td>
<td>Exhaust A</td>
<td>OK</td>
<td>39 / 102</td>
</tr>
<tr>
<td>FPC 2</td>
<td>Exhaust B</td>
<td>OK</td>
<td>40 / 104</td>
</tr>
<tr>
<td>FPC 3</td>
<td>Exhaust A</td>
<td>OK</td>
<td>41 / 105</td>
</tr>
<tr>
<td>FPC 3</td>
<td>Exhaust B</td>
<td>OK</td>
<td>42 / 107</td>
</tr>
<tr>
<td>FPC 4</td>
<td>Exhaust A</td>
<td>OK</td>
<td>43 / 109</td>
</tr>
<tr>
<td>FPC 4</td>
<td>Exhaust B</td>
<td>OK</td>
<td>41 / 105</td>
</tr>
<tr>
<td>FPC 5</td>
<td>Exhaust A</td>
<td>OK</td>
<td>39 / 102</td>
</tr>
<tr>
<td>FPC 5</td>
<td>Exhaust B</td>
<td>OK</td>
<td>39 / 102</td>
</tr>
</tbody>
</table>

FPC 2 Exhaust A          | OK     | 39 / 102             |
FPC 2 Exhaust B          | OK     | 40 / 104             |
FPC 3 Exhaust A          | OK     | 41 / 105             |
FPC 3 Exhaust B          | OK     | 42 / 107             |
FPC 4 Exhaust A          | OK     | 43 / 109             |
FPC 4 Exhaust B          | OK     | 41 / 105             |
FPC 5 Exhaust A          | OK     | 39 / 102             |
FPC 5 Exhaust B          | OK     | 39 / 102             |

Fans
Front Top Tray Fan 1   | OK     | Spinning at high speed |
Front Top Tray Fan 2   | OK     | Spinning at high speed |
Front Top Tray Fan 3   | OK     | Spinning at high speed |
Front Top Tray Fan 4   | OK     | Spinning at high speed |
Front Top Tray Fan 5   | OK     | Spinning at high speed |
Front Top Tray Fan 6   | OK     | Spinning at high speed |
Front Top Tray Fan 7   | OK     | Spinning at high speed |
Front Top Tray Fan 8   | OK     | Spinning at high speed |
Front Bottom Tray Fan 1| OK     | Spinning at high speed |
Front Bottom Tray Fan 2| OK     | Spinning at high speed |
Front Bottom Tray Fan 3| OK     | Spinning at high speed |
Front Bottom Tray Fan 4| OK     | Spinning at high speed |
Front Bottom Tray Fan 5| OK     | Spinning at high speed |
Front Bottom Tray Fan 6| OK     | Spinning at high speed |
Front Bottom Tray Fan 7| OK     | Spinning at high speed |
Front Bottom Tray Fan 8| OK     | Spinning at high speed |
Rear Top Tray Fan 1    | OK     | Spinning at high speed |
Rear Top Tray Fan 2    | OK     | Spinning at high speed |
Rear Top Tray Fan 3    | OK     | Spinning at high speed |
Rear Top Tray Fan 4    | OK     | Spinning at high speed |
Rear Top Tray Fan 5    | OK     | Spinning at high speed |
Rear Top Tray Fan 6    | OK     | Spinning at high speed |
Rear Top Tray Fan 7    | OK     | Spinning at high speed |
Rear Top Tray Fan 8    | OK     | Spinning at high speed |
Rear Bottom Tray Fan 1 | OK     | Spinning at high speed |
Rear Bottom Tray Fan 2 | OK     | Spinning at high speed |
Rear Bottom Tray Fan 3 | OK     | Spinning at high speed |
Rear Bottom Tray Fan 4 | OK     | Spinning at high speed |
Rear Bottom Tray Fan 5 | OK     | Spinning at high speed |
Rear Bottom Tray Fan 6 | OK     | Spinning at high speed |
Rear Bottom Tray Fan 7 | OK     | Spinning at high speed |
Rear Bottom Tray Fan 8 | OK     | Spinning at high speed |

**NOTE:** The fan numbers are stamped into the fan tray sheet metal next to each fan.

**Related Documentation**
- M120 Cooling System Description on page 19
- Replacing an M120 Fan Tray on page 190
- Troubleshooting the M120 Cooling System on page 286
Maintaining the M120 Host Subsystem

Purpose  For optimum router performance, verify the condition of the host subsystem. The host subsystem comprises a Routing Engine installed directly into a CB.

Action  On a regular basis:

- Check the LEDs on the craft interface to view information about the status of the Routing Engines. For more information about the LEDs and the display, see “M120 Craft Interface Description” on page 11.
- Check the LEDs on the CB faceplate to see information about them.
- Check the LEDs on the Routing Engine faceplate to see information about them.
- To check the status of the Routing Engines, issue the `show chassis routing-engine` command. The output is similar to the following:

```
user@host> show chassis routing-engine routing engine status
Routing Engine status:

Slot 0:
  Current state                  Master
  Election priority              Master (default)
  Temperature                 56 degrees C / 132 degrees F
  CPU temperature             63 degrees C / 145 degrees F
  DRAM                      3584 MB
  Memory utilization          12 percent
  CPU utilization:
    User                       0 percent
    Background                 0 percent
    Kernel                     6 percent
    Interrupt                  0 percent
    Idle                     93 percent
  Model                          RE-A-2000
  Serial ID                      1000642871
  Start time                     2006-08-29 10:06:11 PDT
  Uptime                         57 minutes, 49 seconds
  Load averages:                 1 minute   5 minute  15 minute
                                 0.00       0.03       0.00
Routing Engine status:
  Slot 1:
  Current state                  Backup
  Election priority              Backup (default)
  Temperature                 45 degrees C / 113 degrees F
  CPU temperature             52 degrees C / 125 degrees F
  DRAM                      3584 MB
  Memory utilization          10 percent
  CPU utilization:
    User                       0 percent
    Background                 0 percent
    Kernel                     0 percent
    Interrupt                  0 percent
    Idle                     100 percent
  Model                          RE-A-2000
  Serial ID                      1000636825
```
To check the status of the CBs, issue the `show chassis environment cb` command. The output is similar to the following:

```
user@host> show chassis environment cb
CB 0 status:
  State                      Online Master
  Temperature                67 degrees C / 152 degrees F
  Power
    1.2 V                     1218 mV
    1.5 V                     1498 mV
    2.5 V                     2520 mV
    3.3 V                     3332 mV
    5.0 V                     5066 mV
    3.3 V bias                3296 mV
  Bus Revision               15
  FPGA Revision              20

CB 1 status:
  State                      Online Standby
  Temperature                66 degrees C / 150 degrees F
  Power
    1.2 V                     1214 mV
    1.5 V                     1501 mV
    2.5 V                     2510 mV
    3.3 V                     3306 mV
    5.0 V                     5111 mV
    3.3 V bias                3296 mV
  Bus Revision               15
  FPGA Revision              20
```

For more information about using the CLI, see the Junos OS documentation.

**Related Documentation**
- M120 Router Chassis Description on page 7
- M120 Host Subsystem Description on page 21
- Taking the M120 Host Subsystem Offline on page 267
- Replacing an M120 CB on page 202
- Replacing an M120 Routing Engine on page 195

**Taking the M120 Host Subsystem Offline**

The host subsystem is taken offline and brought online as a unit. Before you replace a CB or a Routing Engine, you must take the host subsystem offline.

Normally, if two host subsystems are installed in the router, RE0 functions as the master and RE1 functions as the backup. You can remove the backup host subsystem (or either of its components) without interrupting the functioning of the router. If you take the master host subsystem offline, the backup host subsystem becomes the master (the router might reboot, depending on your configuration). If the router has only one host subsystem, taking the host subsystem offline causes the router to shut down.
Table 69 on page 268 explains the effect of taking the host subsystem offline.

### Table 69: Effect of Taking the M120 Host Subsystem Offline

<table>
<thead>
<tr>
<th>Type of Host Subsystem</th>
<th>Effect of taking the Host Subsystem Offline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonredundant host subsystem</td>
<td>The router shuts down.</td>
</tr>
<tr>
<td>Backup host subsystem</td>
<td>The functioning of the router is not interrupted. The backup host subsystem is hot-removable and hot-insertable.</td>
</tr>
<tr>
<td>Master host subsystem</td>
<td>The backup host subsystem becomes the master. The backup Routing Engine assumes Routing Engine functions. The master host subsystem is hot-pluggable. Removal or failure of the master Routing Engine affects forwarding and routing based on the high availability configuration:</td>
</tr>
</tbody>
</table>

  - Dual Routing Engines without any high availability features enabled—Traffic is interrupted while the Packet Forwarding Engine is reinitialized. All kernel and forwarding processes are restarted. When the switchover to the new master Routing Engine is complete, routing convergence takes place and traffic is resumed.
  - Graceful Routing Engine switchover (GRES) is enabled—Graceful Routing Engine switchover preserves interface and kernel information. Traffic is not interrupted. However, graceful Routing Engine switchover does not preserve the control plane. Neighboring routers detect that the router has restarted and react to the event in a manner prescribed by individual routing protocol specifications. To preserve routing without interruption during a switchover, graceful Routing Engine switchover must be combined with nonstop active routing.
  - Nonstop active routing is enabled (graceful Routing Engine switchover must be configured for nonstop active routing to be enabled)—Nonstop active routing supports Routing Engine switchover without alerting peer nodes that a change has occurred. Nonstop active routing uses the same infrastructure as graceful Routing Engine switchover to preserve interface and kernel information. However, nonstop active routing also preserves routing information and protocol sessions by running the routing protocol process (rpd) on both Routing Engines. In addition, nonstop active routing preserves TCP connections maintained in the kernel.
  - Graceful restart is configured—Graceful restart provides extensions to routing protocols so that neighboring helper routers restore routing information to a restarting router. These extensions signal neighboring routers about the graceful restart and prevent the neighbors from reacting to the router restart and from propagating the change in state to the network during the graceful restart period. Neighbors provide the routing information that enables the restarting router to stop and restart routing protocols without causing network reconvergence. Neighbors are required to support graceful restart. The routing protocol process (rpd) restarts. A graceful restart interval is required. For certain protocols, a significant change in the network can cause graceful restart to stop.

**NOTE:** Router performance might change if the backup Routing Engine's configuration differs from the former master's configuration. For the most predictable performance, configure the two Routing Engines identically, except for parameters unique to each Routing Engine.

**NOTE:** For information about configuring graceful Routing Engine switchover, graceful restart, and nonstop active routing, see the Junos OS High Availability Library for Routing Devices.
NOTE: The first supported release for graceful Routing Engine switchover and nonstop active routing on the M120 router is Junos OS Release 8.2 and Junos OS Release 9.0, respectively. Graceful restart software requirements are dependent on the routing protocols configured on the router. For the minimum software requirements for graceful restart, see the Junos OS High Availability Library for Routing Devices.

To take a host subsystem offline:

1. Determine whether the host subsystem is functioning as the master or as the backup, using one of the two following methods:
   - Check the Routing Engine LEDs on the craft interface. If the green REMASTER LED is lit, the corresponding host subsystem is functioning as the master.
   - The master Routing Engine is designated Master in the Current state field when you issue the command:

   ```
   user@host> show chassis routing-engine
   Routing Engine status: Slot 0: Current state Master
   ...
   ```

2. If the host subsystem is functioning as the master, switch it to backup using the CLI command:

   ```
   user@host> request chassis routing-engine master switch
   ```

3. On the console or other management device connected to the Routing Engine that is paired with the CB you are removing, enter CLI operational mode and issue the following command. The command shuts down the Routing Engine cleanly, so its state information is preserved:

   ```
   user@host> request system halt
   ```
   Wait until a message appears on the console confirming that the operating system has halted.
   For more information about the command, see the CLI Explorer.

   NOTE: The FEB might continue forwarding traffic for approximately 5 minutes after the request system halt command has been issued.

4. On the console or other management device connected to the other Routing Engine, enter CLI operational mode and issue the following command.

   ```
   user@host> request chassis cb offline slot n
   ```
$n$ is 0 or 1 for the slot number of the host subsystem being taken offline.

5. Verify that the control board is offline:

```
user@host> show chassis environment cb
```

**Related Documentation**

- M120 Host Subsystem Description on page 21
- Maintaining the M120 Host Subsystem on page 266

## Maintaining M120 FPCs and CFPCs

### Purpose

For optimum router performance, verify the condition of the Flexible PIC Concentrators (FPCs) and compact FPCs (CFPCs). The router can have up to six FPCs, four of Type 1, 2, or 3, and two compact CFPCs, mounted vertically in the FPC card cage at the front of the chassis, as shown in Figure 1 on page 8.

### Action

On a regular basis:

- Check the LEDs on the craft interface directly above each FPC slot. The green LED labeled OK lights steadily when an FPC is functioning normally. For more information, see "FPC LEDs on the M120 Craft Interface" on page 15.

- Issue the CLI `show chassis fpc` command to check the status of installed FPCs. As shown in the sample output, the value Online in the column labeled State indicates that the FPC is functioning normally:

```
Slot State           Temp (C) CPU Utilization (%) Memory Utilization (%)
0    Empty
1    Empty
2    Online         39    1    0    128    1    59
3    Online         41    0    0    128    1    59
4    Online         43    0    0    128    1    58
5    Online         39    0    0    128    3    59
```

For more detailed output, add the `detail` option. The following example also specifies a slot number (2), which is optional:

```
user@host> show chassis fpc detail 2
State                     Temperature     Total CPU DRAM     Start time     Uptime
Online                    39 degrees C / 102 degrees F    128 MB     2006-05-02 08:53:29 PDT     1 hour, 51 minutes, 57 seconds
```

For further description of the output from the commands, see the CLI Explorer.
Storing an M120 FPC

Many components on the FPC are fragile. Follow these guidelines to avoid damaging the FPCs.

CAUTION: Failure to handle FPCs as specified can cause irreparable damage.

You must store an FPC as follows:

- In the router
- In the container in which a spare FPC is shipped
- Horizontally and component-side up on a flat, stable surface

When you store an FPC on a horizontal surface or in the shipping container, always place it inside an antistatic bag. Because the FPC is heavy, and because antistatic bags are fragile, inserting the FPC into the bag is easier with two people. To do this, one person holds the FPC in the horizontal position with the faceplate facing the body, and the other person slides the opening of the bag over the FPC connector edge.

If you must insert the FPC into a bag by yourself, first lay the FPC horizontally on a flat, stable surface, component-side up. Orient the FPC with the faceplate facing you. Carefully insert the FPC connector edge into the opening of the bag, and pull the bag toward you to cover the FPC.

Never stack an FPC under or on top of any other component. Never lay an FPC component-side down.

Holding an M120 FPC

Many components on the FPC are fragile. Follow these procedures and guidelines to avoid damaging the FPCs.
CAUTION: Failure to handle FPCs as specified can cause irreparable damage.

When carrying an FPC, you can hold it either vertically or horizontally.

NOTE: An FPC configured with four PICs weighs 12.3 lb (5.6 kg). Be prepared to accept the full weight of the FPC as you lift it.

You hold an FPC vertically when installing it into the chassis or an equipment rack. If the FPC is vertical before you grasp it (for example, if it is installed in a router), you can place either hand around the faceplate and your other hand under the bottom edge.

To hold an FPC vertically (see Figure 104 on page 272):

1. Orient the FPC so that the faceplate faces you. To verify orientation, confirm that the text on the FPC is right-side up and that the EMI strips are facing up.

2. Place one hand around the FPC faceplate about a quarter of the way down from the top edge. To avoid deforming the electromagnetic interference (EMI) shielding strip, do not press hard on it.

3. Place your other hand at the bottom edge of the FPC.

Figure 104: Holding an M120 FPC Vertically
If the FPC is horizontal before you grasp it, place your left hand around the faceplate and your right hand along the bottom edge.

To hold an FPC horizontally (see Figure 105 on page 273):

1. Orient the FPC so that the faceplate faces you. To verify orientation, confirm that the text on the FPC is right-side up and that the EMI strips are on the right-hand side.

2. Grasp the top edge with your left hand and the bottom edge with your right hand. If the FPC has heat sinks about midway between the faceplate and connector edge, place your right hand against the heat sinks.

You can rest the faceplate of the FPC against your body as you carry it.

Figure 105: Holding an M120 FPC Horizontally

As you carry the FPC, do not bump it against anything. FPC components are fragile.

Never hold or grasp the FPC anywhere except places as indicated in the documentation. In particular, never grasp the connector edge, especially at the power connector in the corner where the connector and bottom edges meet (see Figure 106 on page 273).

Figure 106: Do Not Grasp the Connector Edge
Never carry the FPC by the faceplate with only one hand (see Figure 107 on page 274).

*Figure 107: Do Not Carry an FPC with Only One Hand*
Do not rest any edge of an FPC directly against a hard surface (see Figure 108 on page 275).

Figure 108: Do Not Rest the FPC on an Edge

If you must rest the FPC temporarily on an edge while changing its orientation between vertical and horizontal, use your hand as a cushion between the edge and the surface.

Related Documentation
- M120 Flexible PIC Concentrators (FPCs) Description on page 51
- Replacing an M120 FPC on page 213
- Storing an M120 FPC on page 271

Maintaining M120 PICs and PIC Cables

Purpose  For optimum router performance, verify the condition of the PICs and PIC cables.

Action  On a regular basis:

- Check the LEDs on PIC faceplates. Most PIC faceplates have an LED labeled STATUS. Some PICs have additional LEDs, often one per port. The meaning of the LED states differs for various PICs. For more information, see the M120 Multiservice Edge Router Interface Module Reference. If the FPC that houses the PIC detects a PIC failure, the FPC generates an alarm message to be sent to the Routing Engine.
• Issue the CLI `show chassis fpc pic-status` command. The PIC slots in an FPC are numbered from 0 through 3, top to bottom:

```
user@host> show chassis fpc pic-status
Slot 2   Online       M120 FPC Type 1
  PIC 2  Present      1x G/E, 1000 BASE-SX- Not Supported
  PIC 3  Online       1x Tunnel
Slot 3   Online       M120 FPC Type 2
  PIC 0  Online       4x OC-3 SONET, SMIR
  PIC 1  Present      2x G/E, 1000 BASE-SX- Not Supported
  PIC 2  Online       4x G/E SFP, 1000 BASE
  PIC 3  Present      1x OC-48 SONET, SMSR- Not Supported
Slot 4   Online       M120 FPC Type 3
Slot 5   Online       M120 FPC Type 1
  PIC 0  Online       1x G/E SFP, 1000 BASE
  PIC 2  Online       4x CHD53 IQ
```

For further description of the output from the command, see the CLI Explorer.

• Use the cable management system (shown in Figure 5 on page 11) to support cables and prevent cables from dislodging or developing stress points.

• Place excess cable out of the way in the cable management system. Do not allow fastened loops of cable to dangle from the connector or cable management system, because this stresses the cable at the fastening point. Putting fasteners on the loops helps to maintain their shape.

• Keep the cable connections clean and free of dust and other particles, which can cause drops in the received power level. Always inspect cables and clean them if necessary before connecting an interface.

• Label both ends of PIC cables to identify them.

The following guidelines apply specifically to fiber-optic cable:

• When you unplug a fiber-optic cable from a PIC, always place a rubber safety plug over the transceiver on the PIC faceplate and on the end of the cable.

• Anchor fiber-optic cable to avoid stress on the connectors. When attaching fiber to a PIC, be sure to secure the fiber so it is not supporting its own weight as it hangs to the floor. Never let fiber-optic cable hang free from the connector.

• Avoid bending fiber-optic cable beyond its bend radius. An arc smaller than a few inches can damage the cable and cause problems that are difficult to diagnose.

• Frequent plugging and unplugging of fiber-optic cable into and out of optical instruments, such as ATM or SONET/SDH analyzers, can cause damage to the instruments that is expensive to repair. Instead, attach a short fiber extension to the optical equipment. Any wear and tear due to frequent plugging and unplugging is then absorbed by the short fiber extension, which is easy and inexpensive to replace.

• Keep fiber-optic cable connections clean. Small micro-deposits of oil and dust in the canal of the transceiver or cable connector could cause loss of light, reducing signal power and possibly causing intermittent problems with the optical connection.
To clean the transceivers, use an appropriate fiber-cleaning device, such as RIFOCS Fiber Optic Adaptor Cleaning Wands (part number 946). Follow the directions for the cleaning kit you use.

After you have cleaned the transceiver on the fiber-optic PIC, make sure that the connector tip of the fiber-optic cable is clean. Use only an approved alcohol-free fiber-optic cable cleaning kit, such as the Opptex Cletop-S® Fiber Cleaner. Follow the directions for the cleaning kit you use.

Related Documentation

- M120 PICs Description on page 57
- Replacing an M120 PIC on page 223
- Replacing an M120 PIC Cable on page 228
- Troubleshooting M120 PICs on page 288

Maintaining the M120 Power Supplies

Purpose

For optimum router performance, verify the condition of the power supplies.

Action

- Check the status of the power supplies by issuing the `show chassis environment pem` command. The output is similar to the following:

```
user@host> show chassis environment pem
PEM 0 status:
  State                Online
  Temperature          OK
  DC output             OK
PEM 1 status:
  State                Online
  Temperature          OK
  DC output             OK
```

- Make sure that the power and grounding cables are arranged so that they do not obstruct access to other router components.

- Routinely check the OK and the STATUS OK LEDs on the power supply faceplates and the craft interface. If these output status LEDs are lit, the power supplies are functioning normally. For more information about the power supply LEDs, see “M120 Power Supply LEDs” on page 73.

- Check the red and yellow alarm LEDs on the craft interface. Power supply failure or removal triggers an alarm that causes one or both of the LEDs to light. You can display the associated error messages by issuing the following CLI command:

```
user@host> show chassis alarms
```

For a list of possible alarm messages, see “Troubleshooting Using the Chassis and Interface Alarm Messages” on page 284.

- Periodically inspect the site to ensure that the grounding and power cables connected to the router are securely in place and that there is no moisture accumulating near the...
router. To review grounding and site wiring requirements for the router, see “DC Power Electrical Safety Guidelines for the M120 Router” on page 347 and “Site Electrical Wiring Guidelines for Juniper Networks Devices” on page 349.

Related Documentation

- M120 Power Supplies Description on page 71
- Replacing an M120 AC Power Supply on page 239
- Replacing an M120 DC Power Supply on page 245
- Troubleshooting the M120 Power System on page 288

Maintaining the M120 FEBs

**Purpose**  For optimum cooling, verify the condition of the FEBs.

**Action**  On a regular basis:

- Check the LEDs on the FEB faceplate. For more information on the FEB LEDs, see Table 45 on page 77.
- Check the FEB LEDs on the craft interface to view information; see “FEB LEDs on the M120 Craft Interface” on page 15.
- Issue the CLI `show chassis feb` command to check the status of each of the installed FEBs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the FEB is functioning normally.

```
user@host> show chassis feb

<table>
<thead>
<tr>
<th>Slot</th>
<th>State Buffer</th>
<th>Temp (C)</th>
<th>CPU Utilization (%)</th>
<th>Memory DRAM (MB)</th>
<th>Utilization (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Empty</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Empty</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Online</td>
<td>44</td>
<td>4</td>
<td>0</td>
<td>512</td>
</tr>
<tr>
<td>3</td>
<td>Online</td>
<td>46</td>
<td>4</td>
<td>0</td>
<td>512</td>
</tr>
<tr>
<td>4</td>
<td>Online</td>
<td>45</td>
<td>3</td>
<td>0</td>
<td>512</td>
</tr>
<tr>
<td>5</td>
<td>Online</td>
<td>42</td>
<td>4</td>
<td>0</td>
<td>512</td>
</tr>
</tbody>
</table>
```

For more detailed output, add the **detail** option. The following example also specifies a slot number (0), which is optional:

```
user@host> show chassis feb detail 0

Slot 0 information:

<table>
<thead>
<tr>
<th>State</th>
<th>Intake temperature</th>
<th>Exhaust A temperature</th>
<th>Exhaust B temperature</th>
<th>Total DDR DRAM</th>
<th>Total RLDRAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online</td>
<td>66 degrees C / 150 degrees F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust A</td>
<td>67 degrees C / 152 degrees F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exhaust B</td>
<td>73 degrees C / 163 degrees F</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total DDR DRAM</td>
<td>512 MB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total RLDRAM</td>
<td>64 MB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```
You can also issue the `show chassis environment feb` command to check the status of a specific FEB. In the example below, the FEB is slot 0 is used. The output is similar to the following:

```
user@host> show chassis environment feb 0
FEB 0 status:
State                      Online
Temperature Intake         66 degrees C / 150 degrees F
Temperature Exhaust A      67 degrees C / 152 degrees F
Temperature Exhaust B      73 degrees C / 163 degrees F
Power
   1.2 V                     1153 mV
   1.5 V                     1417 mV
   1.8 V                     1704 mV
   2.5 V                     2375 mV
   3.3 V                     3138 mV
   5.0 V                     4763 mV
   1.2 V Rocket IO           1160 mV
   1.5 V Rocket IO           1408 mV
   1.8 V RLDRAM              1717 mV
I2C Slave Revision         15
```

- To take a FEB offline or online or restart it, click Offline, Online, enter the `request chassis feb (online | offline | restart) slot slot-number` command.

**NOTE:** If you bring a FEB offline (or remove it), interfaces on FPCs connected to the FEB are deleted. When you bring the FEB back online, the interfaces are restored.

- Plan FEB redundancy groups according to your network requirements.

A FEB redundancy group is a named collection of two or more Forwarding Engine Boards (FEBs) that can improve interface availability. You can design your redundant FEB configuration to provide backup on a one-to-one basis, or you can provide one backup for multiple FEBs. Each FEB redundancy group can contain only one primary FEB.

To create or edit FEB redundancy groups, use the `edit chassis redundancy feb-redundancy group-group-name` command.

- Change the default assignments of FPCs to FEBs according to your network requirements. By default, each FPC is assigned to the FEB of the same identifying number; for example, FPC 1 is assigned to FEB 1.

  - To assign an FPC to a FEB, use the `fpc-feb-connectivity` statement at the `[edit chassis]` hierarchy level. You can also map an FPC to none to specify that the FPC is not mapped to any FEB. (When an FPC is configured not to connect to any FEB, interfaces on that FPC are not created; however, no alarm is triggered.)

  - To view which FPCs are mapped to which FEBs and the status of each link, enter the `show chassis fpc-feb-connectivity` command.
For more information about FEB redundancy groups and FPC-to-FEB connectivity, see the Junos OS Administration Library.

Related Documentation

- M120 Forwarding Engine Boards (FEBs) Description on page 75
- Replacing an M120 FEB on page 255
- Troubleshooting M120 FEBs on page 289
Troubleshooting Hardware

- Troubleshooting Components on page 283
Troubleshooting Components

- Overview of Troubleshooting Resources for the M120 Router on page 283
- M120 LED Overview on page 284
- Troubleshooting the M120 Cooling System on page 286
- Troubleshooting M120 FPCs and CFPCs on page 287
- Troubleshooting M120 PICs on page 288
- Troubleshooting the M120 Power System on page 288
- Troubleshooting M120 FEBs on page 289
- Troubleshooting an M120 FEB When a Chassis Alarm Is Lit Upon Initial Startup or Removal on page 291

Overview of Troubleshooting Resources for the M120 Router

- Troubleshooting Using the Command-Line Interface on page 283
- Troubleshooting Using the Chassis and Interface Alarm Messages on page 284
- Troubleshooting Using the Juniper Networks Technical Assistance Center on page 284

Troubleshooting Using the Command-Line Interface

The Junos OS command-line interface (CLI) is the primary tool for controlling and troubleshooting router hardware, the Junos OS, routing protocols, and network connectivity. CLI commands display information from routing tables, information specific to routing protocols, and information about network connectivity derived from the ping and traceroute utilities.

You enter CLI commands on one or more external management devices connected to the Routing Engine through ports on the Craft Interface. The port labeled AUX attaches the Routing Engine to a laptop, modem, or other auxiliary device, the port labeled CONSOLE attaches to a system console, and the port labeled ETHERNET attaches to a management LAN. For more information, see “M120 Routing Engine Description” on page 22.

For information about using the CLI to display details about alarms generated by interfaces and hardware components, see “Troubleshooting Using the Chassis and Interface Alarm Messages” on page 284.
For information about using the CLI to troubleshoot the Junos OS, see the appropriate Junos OS configuration guide.

Troubleshooting Using the Chassis and Interface Alarm Messages

When the Routing Engine detects an alarm condition, it lights the red or yellow alarm LED on the craft interface as appropriate. To view a more detailed description of the alarm cause, issue the `show chassis alarms` CLI command:

```
user@host> show chassis alarms
```

There are two classes of alarm messages:

- Chassis alarms—Indicate a problem with a chassis component such as the cooling system or power supplies.
- Interface alarms—Indicate a problem with a specific network interface.

Troubleshooting Using the Juniper Networks Technical Assistance Center

If you need assistance during troubleshooting, you can contact the Juniper Networks Technical Assistance Center (JTAC) by using the Web or by telephone. See “Contacting Customer Support” on page 295.

Related Documentation

- M120 Router Description on page 3
- M120 Router Physical Specifications on page 82
- M120 Router Power Requirements on page 88

M120 LED Overview

- Craft Interface LEDs on page 284
- Component LEDs on page 285

Craft Interface LEDs

The craft interface is the panel on the front of the router that displays system status and allows you to troubleshoot the router. The craft interface is located at the top of the chassis above the FPC card cage.

For more information about using the craft interface, see “M120 Craft Interface Description” on page 11.

LEDs on the craft interface include the following:
Host subsystem LEDs—Three LEDs, **RE MASTER**, **RE STATUS**, and **CB STATUS**, indicate the status of the host subsystem. On the **RE MASTER**, a green LED indicates **MASTER**. On the **RE STATUS** and **CB STATUS** LEDs, green indicates **OK** and red indicates **FAIL**. The host subsystem LEDs are located in the middle of the craft interface, and are labeled 0 and 1.

See “Host Subsystem LEDs on the MI20 Craft Interface” on page 14.

FEB LEDs—Two LEDs (one **ACTIVE** and one **STATUS**) indicate the status of each FEB. Green indicates **OK** and red indicates **FAIL**. The FEB LEDs are located on the lower right of the craft interface, and are labeled 0 through 5.

See “FEB LEDs on the MI20 Craft Interface” on page 15.

Power supply LED—One LED (**STATUS**) indicates the status of each power supply. Green indicates the power supply is functioning properly. Red indicates the power supply is not functioning properly. The power supply LEDs are located on the lower left of the craft interface, and are labeled 0 and 1.

See “Power Supply LEDs on the MI20 Craft Interface” on page 15.

FPC LEDs—One LED, **STATUS**, indicates the status of each FPC. Green indicates **OK** and red indicates a failure. The FPC LEDs are located along the bottom of the craft interface, and are labeled **FPC0** through **FPC5**.

See “FPC LEDs on the MI20 Craft Interface” on page 15.

Alarm LEDs—One large red circular LED and one large yellow triangular LED, located on the upper upper left of the craft interface, indicate two levels of alarm conditions.

See “MI20 Alarm LEDs and Alarm Cutoff/Lamp Test Button” on page 13.

Component LEDs

The following LEDs are located on various router components and display the status of those components:

- FEB LEDs—Six LEDs, labeled 0 through 5, on each FEB faceplate indicate which FPC the FEB is connected to. Three additional LEDs on the FEB faceplate display the status of the FEB, **OK**, **FAIL**, and **ACTIVE**.

  See “MI20 Forwarding Engine Boards (FEBs) LEDs” on page 77.

- CB LEDs—Three LEDs, labeled **OK**, **FAIL**, and **MSTR**, on each CB faceplate indicate the status of the CB. If no LEDs are lit, the master RE may still be booting or the CB is not receiving power.

  See “MI20 Control Board (CB) LEDs” on page 48.

- PIC LEDs—Each port on each PIC has an LED that indicates the status of the port.

  See the **M120 Multiservice Edge Router Interface Module Reference**.

- Power supply LEDs—One LED on each power supply faceplate indicates the status of that power supply.

  See “MI20 Power Supply LEDs” on page 73.
Troubleshooting the M120 Cooling System

Problem Description: The fans in a fan tray are not functioning normally. During normal operation, the fans in each fan tray function at less than full speed. The CB constantly monitors the temperatures detected by sensors and router components, adjusting the speed of the fans as necessary. If the router temperature exceeds the acceptable maximum, the CB turns off the power supplies. The following conditions automatically cause the fans to run at full speed and also trigger the indicated alarm:

- A fan fails (red alarm).
- One of the fan trays is removed (yellow alarm).
- The router temperature exceeds the “temperature warm” threshold (yellow alarm).
- The temperature of the router exceeds the maximum (“temperature hot”) threshold (red alarm and automatic shutdown of the power supplies).

Solution: To troubleshoot the fans:

- If the red alarm LED on the craft interface lights, use the CLI to get information about the source of an alarm condition: `user@host> show chassis alarms`. For information about alarms, see “M120 Alarm LEDs and Alarm Cutoff/Lamp Test Button” on page 13.

  Use the CLI to check the status of the fans: `user@host> show chassis environment`. If the CLI output lists only one fan failure, and the other fans are functioning normally, the fan is most likely faulty and you need to replace the fan tray, as described in “Replacing an M120 Fan Tray” on page 190.

- Use the CLI to check the status of the fans. For example, you can issue the following command to get information about the source of an alarm condition:

  `user@host> show chassis alarms`

  For information about the alarms, see “M120 Alarm LEDs and Alarm Cutoff/Lamp Test Button” on page 13.

  - Place your hand near the exhaust vents at the rear of the chassis to determine whether the fans are pushing air out of the chassis.
  - If all power supplies have failed, the system temperature might have exceeded the threshold, causing the system to shut down.

Related Documentation:

- M120 Cooling System Description on page 19
- Maintaining the M120 Air Filter on page 263
- Maintaining the M120 Fan Trays on page 264
- Replacing an M120 Air Filter on page 187
Troubleshooting M120 FPCs and CFPCs

Problem  Description: The FPCs or CFPCs are not functioning normally.

Solution  As soon as an FPC (or CFPC) is seated in an operating router, the Routing Engine downloads the FPC software to it under two conditions: the FPC is present when the Routing Engine boots the Junos OS, and the FPC is installed and requested online through the CLI or push button on the front panel. The FPC then runs diagnostics and enables the PICs housed on it. During this time, the green LED labeled STATUS above the FPC on the craft interface blinks. When the FPC is online and functioning normally, the STATUS LED lights steadily.

To troubleshoot the FPCs:

- Make sure the FPC is properly seated in the midplane. Check that each ejector handle has been turned clockwise and is tight.

- Issue the show chassis fpc command to check the status of installed FPCs. As shown in the sample output, the value Online in the column labeled State indicates that the FPC is functioning normally:

  user@host> show chassis fpc

<table>
<thead>
<tr>
<th>Slot</th>
<th>State</th>
<th>Temp (C)</th>
<th>CPU Utilization (%)</th>
<th>Memory Utilization (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Empty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Empty</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Online</td>
<td>39</td>
<td>1</td>
<td>128</td>
</tr>
<tr>
<td>3</td>
<td>Online</td>
<td>41</td>
<td>0</td>
<td>128</td>
</tr>
<tr>
<td>4</td>
<td>Online</td>
<td>43</td>
<td>0</td>
<td>128</td>
</tr>
<tr>
<td>5</td>
<td>Online</td>
<td>39</td>
<td>0</td>
<td>128</td>
</tr>
</tbody>
</table>

For more detailed output, add the detail option. The following example also specifies a slot number (2), which is optional:

  user@host> show chassis fpc detail 2

<table>
<thead>
<tr>
<th>State</th>
<th>Temperature</th>
<th>Total CPU</th>
<th>DRAM (MB)</th>
<th>Start time</th>
<th>Uptime</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online</td>
<td>39 degrees C / 102 degrees F</td>
<td>128 MB</td>
<td>2006-05-02 08:53:29 PDT</td>
<td>1 hour, 51 minutes, 57 seconds</td>
<td></td>
</tr>
</tbody>
</table>

For further description of the output from the commands, see the CLI Explorer.

Related Documentation

- M120 Flexible PIC Concentrators (FPCs) Description on page 51
- M120 Compact FPCs (CFPCs) Description on page 54
- Maintaining M120 FPCs and CFPCs on page 270
- Replacing an M120 FPC on page 213
- Replacing an M120 CFPC on page 219
Troubleshooting M120 PICs

**Problem**  Description: The PICs are not functioning normally.

**Solution**  To troubleshoot the PICs:

- Check the status of each port on a PIC by looking at the LED located on the PIC faceplate. For information about the meaning of LED states on different PICs, see the *M120 Multiservice Edge Router Interface Module Reference*.

- To check the status of a PIC, issue the following CLI command. The PIC slots in the FPC are numbered from 0 through 3, top to bottom:

```
user@host> show chassis fpc pic-status
```

```
Slot 2  Online   M120 FPC Type 1
   PIC 2 Present  1x G/E, 1000 BASE-SX- Not Supported
   PIC 3  Online   1x Tunnel
Slot 3  Online   M120 FPC Type 2
   PIC 0  Online   4x OC-3 SONET, SMIR
   PIC 1  Present  2x G/E, 1000 BASE-SX- Not Supported
   PIC 2  Online   4x G/E SFP, 1000 BASE
   PIC 3  Present  1x OC-48 SONET, SMSR- Not Supported
Slot 4  Online   M120 FPC Type 3
Slot 5  Online   M120 FPC Type 1
   PIC 0  Online   1x G/E SFP, 1000 BASE
   PIC 2  Online   4x CHDS3 IQ
```

*NOTE:* If a PIC does not come online as expected, check the assigned FEB, as described in “Troubleshooting M120 FEBs” on page 289.

For further description of the output from the command, see the CLI Explorer.

**Related Documentation**
- M120 PICs Description on page 57
- Maintaining M120 PICs and PIC Cables on page 275
- Replacing an M120 PIC on page 223

Troubleshooting the M120 Power System

**Problem**  Description: The power supply is not functioning properly.
Solution

- If a red alarm condition occurs, issue the `show chassis alarms` command to determine the source of the problem.

NOTE: If the system temperature exceeds the threshold, the Junos OS shuts down all power supplies so that no status is displayed.

The Junos OS also can shut down one of the power supplies for other reasons. In this case, the remaining power supply assumes the load, and you can still view the system status through the CLI or display.

- If the power supply LED is off and no red alarm condition exists, check that the circuit breaker on a DC power supply or power switch on an AC power supply is switched to the on position (I).
- Verify that the source circuit breaker has the proper current rating. Each power supply must be connected to a separate source circuit breaker.
- If the LED is blinking, verify that the input voltage to the power supply is within the supply’s operating range.
- Verify that the power cord (AC) or power cables (DC) from the power source to the router are not damaged. If the insulation is cracked or broken, immediately replace the cord or cable.
- Connect the power supply to a different power source with a new power cord or power cables. If the power supply LED still does not light, the power supply is the source of the problem. Replace the power supply with a spare, as described in “Maintaining the M120 Power Supplies” on page 277.
- If the LED on the installed spare lights, the replaced power supply is faulty, and you should return it for replacement, as described in “Returning a Hardware Component to Juniper Networks, Inc.” on page 305.
- If you cannot determine the cause of the problem or need additional assistance, see “Troubleshooting Using the Juniper Networks Technical Assistance Center” on page 284.

Related Documentation

- M120 AC Power Supply Description on page 72
- M120 DC Power Supply Description on page 72
- Replacing an M120 AC Power Supply on page 239
- Replacing an M120 DC Power Supply on page 245
- Definition of Safety Warning Levels on page 311

Troubleshooting M120 FEBs

Problem Description: The FEBs are not functioning normally:
Solution  To troubleshoot the FEBs, follow these guidelines:

To troubleshoot the FEBs:

- Check the FEB LEDs on the craft interface.
- Make sure the FEB is properly seated in the midplane. Check that each ejector handle is fully engaged and flush with the FEB bulkhead.
- Issue the CLI `show chassis feb` command to check the status of each of the installed FEBs. As shown in the sample output, the value **Online** in the column labeled **State** indicates that the FEB is functioning normally.

```
user@host> show chassis feb
Temp  CPU Utilization (%) Memory Utilization (%)
Slot  State            (C)  Total  Interrupt  DRAM (MB)  Heap
Buffer
0  Online            66      4          0       512         7
59
1  Online            66      4          0       512         7
59
2  Online            64      4          0       512         7
59
3  Online            67      4          0       512         7
59
4  Empty
5  Offline
```

For more detailed output, add the `detail` option. The following example also specifies a slot number (0), which is optional:

```
user@host> show chassis feb detail 0
Slot 0 information:
State                                 Online
Intake temperature                 66 degrees C / 150 degrees F
Exhaust A temperature              67 degrees C / 152 degrees F
Exhaust B temperature              73 degrees C / 163 degrees F
Total DDR DRAM                     512 MB
Total RLDRAM                       64 MB
Start time:                           2006-09-08 16:29:59 PDT
Uptime:                               1 hour, 3 minutes, 4 seconds
```

You can also issue the `show chassis environment feb` command to check the status of a specific FEB. In the example below, the FEB is slot 0 is used. The output is similar to the following:

```
user@host> show chassis environment feb 0
FEB 0 status:
State                                 Online
Temperature Intake                    66 degrees C / 150 degrees F
Temperature Exhaust A                 67 degrees C / 152 degrees F
Temperature Exhaust B                 73 degrees C / 163 degrees F
Power
  1.2 V                                 1153 mV
  1.5 V                                 1417 mV
  1.8 V                                 1704 mV
  2.5 V                                 2375 mV
```
### Troubleshooting an M120 FEB When a Chassis Alarm Is Lit Upon Initial Startup or Removal

**Problem**

**Description:** An FPC is mapped to an empty FEB slot, the red alarm LED on the chassis is lit:
The FPC mapped to an empty FEB slot (or to a FEB that is offline) comes online, but its Physical Interface Cards (PICs) do not, and the physical interfaces on those PICs are not created.

**Solution**

- On startup, the red alarm LED is lit if an FPC slot is filled, but the corresponding FEB slot is empty.

- The red alarm LED is lit if a FEB is removed before its connected FPCs are remapped to either another FEB or to none.

To eliminate the red alarm LED:

1. Check the status of FEBs and determine whether each FPC is connected to an active FEB by entering the `show chassis fpc-feb-connectivity` command. By default, each FPC is associated with the FEB of the same identifying number; for example, FPC1 to FEB1.

2. If necessary, change the default FPC-FEB connection by using the `fpc-feb-connectivity` statement at the `[edit chassis]` hierarchy level. You can also map an FPC to `none` to specify that the FPC is not mapped to any FEB. (When an FPC is configured not to connect to any FEB, interfaces on that FPC are not created; however, no alarm is triggered.)

3. Verify that the associated physical interfaces are created by entering the `show interfaces terse` command.

For more information about configuring FPC-FEB connectivity, see the Junos OS Administration Library.
Related Documentation

- M120 Forwarding Engine Boards (FEBs) Description on page 75
- Maintaining the M120 FEBs on page 278
- Replacing an M120 FEB on page 255
PART 7

Contacting Customer Support and Returning the Chassis or Components

- Contacting Customer Support on page 295
- Locating Component Serial Numbers on page 297
- Packing and Returning Components on page 305
Contacting Customer Support

You can contact Juniper Networks Technical Assistance Center (JTAC) 24 hours a day, 7 days a week in one of the following ways:

- On the Web, using the Case Manager link at: https://www.juniper.net/support/

- By telephone:
  - From the US and Canada: 1-888-314-JTAC
  - From all other locations: 1-408-745-9500
  - If contacting JTAC by phone, enter your 12-digit case number followed by the # key if this is an existing case, or press the * key to be routed to the next available support engineer.

When requesting support from JTAC by telephone, be prepared to provide the following information:

- Your existing case number, if you have one
- Details of the failure or problem
- Type of activity being performed on the platform when the problem occurred
- Configuration data using one or more of the show commands
## Locating Component Serial Numbers

- Displaying M120 Router Components and Serial Numbers on page 297
- M120 Chassis Serial Number Label on page 298
- M120 Craft Interface Serial Number Label on page 299
- M120 Routing Engine Serial Number Label on page 299
- M120 CB Serial Number Label on page 300
- M120 FPC Serial Number Label on page 301
- M120 CFPC Serial Number Label on page 301
- M120 PIC Serial Number Label on page 302
- M120 Power Supply Serial Number Labels on page 302
- M120 FEB Serial Number Label on page 303

### Displaying M120 Router Components and Serial Numbers

Before contacting Juniper Networks, Inc. to request a Return Materials Authorization (RMA), you must find the serial number on the router or component. To list all of the router components and their serial numbers, enter the following command-line interface (CLI) command:

```
user@host> show chassis hardware
```

<table>
<thead>
<tr>
<th>Item</th>
<th>Version</th>
<th>Part number</th>
<th>Serial number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis</td>
<td>N0000023AC</td>
<td>M120</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Midplane</td>
<td>REV 01</td>
<td>710-013667</td>
<td>RB4724</td>
<td>M120 Midplane</td>
</tr>
<tr>
<td>FPM Board</td>
<td>REV 03</td>
<td>710-011407</td>
<td>C39521</td>
<td>M120 FPM Board</td>
</tr>
<tr>
<td>FPM Display</td>
<td>REV 02</td>
<td>710-011405</td>
<td>CP6650</td>
<td>M120 FPM</td>
</tr>
<tr>
<td>FPM CIP</td>
<td>REV 03</td>
<td>710-011410</td>
<td>CP6592</td>
<td>M120 FPM CIP</td>
</tr>
<tr>
<td>PEM 0</td>
<td>Rev 04</td>
<td>740-011935</td>
<td>RL27523</td>
<td>DC Power Entry</td>
</tr>
<tr>
<td>Routing Engine 0</td>
<td>REV 02</td>
<td>740-014080</td>
<td>1000621161</td>
<td>RE-A-1000</td>
</tr>
<tr>
<td>CB 0</td>
<td>REV 04</td>
<td>710-011403</td>
<td>C39336</td>
<td>M120 Control</td>
</tr>
<tr>
<td>FPC 0 (proto)</td>
<td>REV 02</td>
<td>710-012879</td>
<td>CP6753</td>
<td>M120 CFPC OC192</td>
</tr>
<tr>
<td>PIC 0</td>
<td></td>
<td>BUILTIN</td>
<td>BUILTIN</td>
<td></td>
</tr>
<tr>
<td>OC-192 SONET XFP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SFP 0</td>
<td>00</td>
<td>FTRX-1411M3</td>
<td>K8E01L4</td>
<td>XFP-OC192-5R</td>
</tr>
<tr>
<td>FPC 2</td>
<td>REV 03</td>
<td>710-011393</td>
<td>C39226</td>
<td>M120 FPC Type 2</td>
</tr>
<tr>
<td>(proto) PIC 0</td>
<td>REV 20</td>
<td>750-001901</td>
<td>HZ0268</td>
<td>4x OC-12</td>
</tr>
</tbody>
</table>
Most components also have a small rectangular serial number ID label (see Figure 109 on page 298) attached to the component body.

*Figure 109: Serial Number ID Label*

![Serial Number ID Label](image)

**Related Documentation**
- M120 PIC Serial Number Label on page 302
- M120 Routing Engine Serial Number Label on page 299
- Contacting Customer Support on page 295

**M120 Chassis Serial Number Label**

The chassis serial number is located on the side of the chassis (see Figure 110 on page 299).
Figure 110: M120 Chassis Serial Number Label

The serial number is located on the right side of the craft interface faceplate (see Figure 111 on page 299).

Figure 111: M120 Craft Interface Serial Number Label

M120 Craft Interface Serial Number Label

- M120 Craft Interface Description on page 11
- M120 Component LEDs on the Craft Interface on page 14

M120 Routing Engine Serial Number Label

The serial number label is located on the right side of the top of the Routing Engine (see Figure 112 on page 300).
M120 CB Serial Number Label

The serial number is located on the right side of the top of the CB (see Figure 113 on page 300).

Figure 113: M120 CB Serial Number Label

Related Documentation
- M120 Control Board (CB) Description on page 47
- M120 Control Board (CB) LEDs on page 48
M120 FPC Serial Number Label

The serial number label is located on the center of the right side of the FPC3 (see Figure 114 on page 301). On an FPC2, the serial number label is located near the top PIC slot.

Figure 114: M120 FPC Serial Number Label

Related Documentation
- M120 Flexible PIC Concentrators (FPCs) Description on page 51
- Troubleshooting M120 FPCs and CFPCs on page 287

M120 CFPC Serial Number Label

The serial number label is located on the top center of the CFPC (see Figure 115 on page 301).

Figure 115: M120 Routing Engine Serial Number Label

Related Documentation
- M120 Compact FPCs (CFPCs) Description on page 54
M120 PIC Serial Number Label

The serial number label is located on the right side of the PIC (see Figure 116 on page 302), when the PIC is vertically oriented (as it would be installed in the router). The exact location may be slightly different on different PICs, depending on the placement of components on the PIC board.

Figure 116: M120 PIC Serial Number Label

M120 Power Supply Serial Number Labels

The serial number label is located on the AC power supply faceplate under the power switch (see Figure 117 on page 303).

The serial number label is located on the DC power supply faceplate under the circuit breaker switch (see Figure 118 on page 303).
Figure 117: M120 AC Power Supply Serial Number Label

Figure 118: M120 DC Power Supply Serial Number Label

Related Documentation

- M120 Power Supplies Description on page 71
- Troubleshooting the M120 Power System on page 288

M120 FEB Serial Number Label

The serial number is located in the center of the right side (see Figure 119 on page 304).
Figure 119: M120 FEB Serial Number Label

Related Documentation
- M120 Forwarding Engine Boards (FEBs) Description on page 75
- Troubleshooting M120 FEBs on page 289
CHAPTER 35

Packing and Returning Components

- Returning a Hardware Component to Juniper Networks, Inc. on page 305
- Tools and Parts Required to Remove Components from an M120 Router on page 306
- Packing the M120 Router for Shipment on page 306
- Guidelines for Packing M120 Components for Shipment on page 308

Returning a Hardware Component to Juniper Networks, Inc.

In the event of a hardware failure, please contact Juniper Networks, Inc. to obtain a Return Material Authorization (RMA) number. This number is used to track the returned material at the factory and to return repaired or new components to the customer as needed.

**NOTE:** Do not return any component to Juniper Networks, Inc. unless you have first obtained an RMA number. Juniper Networks, Inc. reserves the right to refuse shipments that do not have an RMA. Refused shipments are returned to the customer by collect freight.

For more information about return and repair policies, see the customer support Web page at [https://www.juniper.net/support/guidelines.html](https://www.juniper.net/support/guidelines.html).

For product problems or technical support issues, contact the Juniper Networks Technical Assistance Center (JTAC) by using the Case Manager link at [https://www.juniper.net/support/] or at 1-888-314-JTAC (within the United States) or 1-408-745-9500 (from outside the United States).

To return a defective hardware component:

1. Determine the part number and serial number of the defective component.

2. Obtain an RMA number from the Juniper Networks Technical Assistance Center (JTAC). You can send e-mail or telephone as described above.

3. Provide the following information in your e-mail message or during the telephone call:
   - Part number and serial number of component
   - Your name, organization name, telephone number, and fax number
4. The support representative validates your request and issues an RMA number for return of the component.

5. Pack the component for shipment.

**Tools and Parts Required to Remove Components from an M120 Router**

To remove components from the router or the router from a rack, you need the following tools and parts:

- 2.5-mm flat-blade (−) screwdriver, for detaching alarm relay terminal block
- 3/8–in. nut driver
- Blank panels to cover empty slots
- Electrostatic bag or antistatic mat, for each component
- Electrostatic discharge (ESD) grounding wrist strap
- Flat-blade (−) screwdriver
- Mechanical lift, if available
- Phillips (+) screwdrivers, numbers 1 and 2
- Rubber safety cap for fiber-optic interfaces or cables
- Wire cutters

**Related Documentation**

- Packing the M120 Router for Shipment on page 306
- Displaying M120 Router Components and Serial Numbers on page 297
- Contacting Customer Support on page 295
- Guidelines for Packing M120 Components for Shipment on page 308

**Packing the M120 Router for Shipment**

To pack the router for shipment:

1. Retrieve the shipping crate and packing materials in which the router was originally shipped. If you do not have these materials, contact your Juniper Networks representative about approved packaging materials.

2. Attach an ESD grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.

3. On the console or other management device connected to the master Routing Engine, enter CLI operational mode and issue the following command to shut down the router.
software. (If two Routing Engines are installed, also issue the command on the backup Routing Engine.)

```
user@host> request system halt
```

Wait until a message appears on the console confirming that the operating system has halted.

For more information about the command, see the CLI Explorer.

**NOTE:** The CFEB might continue forwarding traffic for approximately 5 minutes after the `request system halt` command has been issued.

4. Shut down power to the router by pressing the power switch for all power supplies to the off (O) position. On both AC and DC power supplies, the switch is located on the power supply faceplate.

5. Disconnect power from the router. For instructions, see “Replacing an M120 AC Power Supply Cord” on page 244 or “Replacing an M120 DC Power Supply Cable” on page 251.

6. Remove the cables that connect to all external devices. For instructions, see “Replacing Connections to M120 Routing Engine Interface Ports” on page 206 and “Removing an M120 PIC Cable” on page 228.

7. Remove all Field Replaceable Units (FRUs) from the router.

8. Remove the router from the rack:
   - If you are using a mechanical lift, place the lift platform under the router, unscrew and remove the mounting screws from the rack, and move the router to the shipping crate.
   - If you are not using a mechanical lift and the router weight is fully supported by a shelf or another router, unscrew and remove the mounting screws from the rack. Three people can then lift the router and move it to the shipping crate.
   - If you are not using a mechanical lift and the router weight is not fully supported by a shelf or another router, three people should grasp the router while a fourth person unscrews and removes the mounting screws from the rack. The three lifters can then move the router to the shipping container.

9. Place the router in the shipping crate or onto the pallet. If on a pallet, bolt the router to the pallet.

10. Cover the router with an ESD bag and place the packing foam on top of and around the router.

11. Replace the accessory box on top of the packing foam.
12. Securely tape the box closed or place the crate cover over the router.

13. Write the RMA number on the exterior of the box to ensure proper tracking.

---

Guidelines for Packing M120 Components for Shipment

To pack and ship individual components:

- When you return components, make sure they are adequately protected with packing materials and packed so that the pieces are prevented from moving around inside the carton.
- Use the original shipping materials if they are available.
- Place individual components in antistatic bags.
- Write the RMA number on the exterior of the box to ensure proper tracking.

---

CAUTION: Do not stack any of the hardware components.

---

Related Documentation

- Tools and Parts Required to Remove Components from an M120 Router on page 306
- Displaying M120 Router Components and Serial Numbers on page 297
- Contacting Customer Support on page 295
- Guidelines for Packing M120 Components for Shipment on page 308
Safety and Compliance Information

- General Safety Guidelines and Warnings on page 311
- Fire Safety Requirements on page 319
- Installation Safety Guidelines and Warnings on page 321
- Laser and LED Safety Guidelines and Warnings on page 329
- Maintenance and Operational Safety Guidelines and Warnings on page 333
- Electrical Safety Guidelines and Warnings on page 339
- Agency Approvals and Compliance Statements on page 351
CHAPTER 36

General Safety Guidelines and Warnings

- Definition of Safety Warning Levels on page 311
- General Safety Guidelines for Juniper Networks Devices on page 313
- General Safety Warnings for Juniper Networks Devices on page 314
- Preventing Electrostatic Discharge Damage to an M120 Router on page 316

Definition of Safety Warning Levels

The documentation uses the following levels of safety warnings:

NOTE: You might find this information helpful in a particular situation, or might otherwise overlook it.

CAUTION: You must observe the specified guidelines to avoid minor injury or discomfort to you, or severe damage to the hardware device.

WARNING: This symbol alerts you to the risk of personal injury from a laser.

WARNING: This symbol means danger. You are in a situation that could cause bodily injury. Before you work on any equipment, be aware of the hazards involved with electrical circuitry and be familiar with standard practices for preventing accidents.

Waarschuwing Dit waarschuwingssymbool betekent gevaar. U verkeert in een situatie die lichamelijk letsel kan veroorzaken. Voordat u aan enige apparatuur gaat werken, dient u zich bewust te zijn van de bij elektrische schakelingen betrokken risico’s en dient u op de hoogte te zijn van standaard maatregelen om ongelukken te voorkomen.

Varoitus Tämä varoitusmerkki merkitsee vaaraa. Olet tilanteessa, joka voi johtaa ruumiinvammaan. Ennen kuin työskentelet minkään laitteiston parissa,
ota selvää sähkökytkentöihin liittyvää vaaroista ja tavanomaisista
onnettomuksien ehkäisykeinoista.

Attention Ce symbole d'avertissement indique un danger. Vous vous trouvez
dans une situation pouvant causer des blessures ou des dommages corporels.
Avant de travailler sur un équipement, soyez conscient des dangers posés
par les circuits électriques et familiarisez-vous avec les procédures
couramment utilisées pour éviter les accidents.

Warnung Dieses Warnsymbol bedeutet Gefahr. Sie befinden sich in einer
Situation, die zu einer Körperverletzung führen könnte. Bevor Sie mit der
Arbeit an irgendeinem Gerät beginnen, seien Sie sich der mit elektrischen
Stromkreisen verbundenen Gefahren und der Standardpraktiken zur
Vermeidung von Unfällen bewusst.

Avvertenza Questo simbolo di avvertenza indica un pericolo. La situazione
potrebbe causare infortuni alle persone. Prima di lavorare su qualsiasi
apparecchiatura, occorre conoscere i pericoli relativi ai circuiti elettrici ed
essere al corrente delle pratiche standard per la prevenzione di incidenti.

Advarsel Dette varselsymbolet betyr fare. Du befinner deg i en situasjon som
kan føre til personskade. før du utfører arbeid på utstyr, må du vare
oppmerksom på de faremomentene som elektriske kretser innebærer, samt
gjøre deg kjent med vanlig praksis når det gjelder å unngå ulykker.

Aviso Este símbolo de aviso indica perigo. Encontra-se numa situação que
lhe poderá causar danos físicos. Antes de começar a trabalhar com qualquer
equipamento, familiarize-se com os perigos relacionados com circuitos
eléctricos, e com quaisquer práticas comuns que possam prevenir possíveis
acidentes.

¡Atención! Este símbolo de aviso significa peligro. Existe riesgo para su
integridad física. Antes de manipular cualquier equipo, considerar los riesgos
que entrañan la corriente eléctrica y familiarizarse con los procedimientos
estándar de prevención de accidentes.

Warning! Denna varningssymbol signalerar fara. Du befinner dig i en situation
som kan leda till personskada. Innan du utför arbete på någon utrustning
måste du vara medveten om farorna med elkretsar och känna till vanligt
förfarande för att förebygga skador.

Related Documentation
- General Safety Warnings for Juniper Networks Devices on page 314
- Installation Safety Warnings for Juniper Networks Devices on page 322
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 333
- General Electrical Safety Warnings for Juniper Networks Devices on page 339
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 344
General Safety Guidelines for Juniper Networks Devices

The following guidelines help ensure your safety and protect the hardware equipment from damage. The list of guidelines might not address all potentially hazardous situations in your working environment, so be alert and exercise good judgment at all times.

- Perform only the procedures explicitly described in this documentation. Make sure that only authorized service personnel perform other system services.
- Keep the area around the chassis clear and free from dust before, during, and after installation.
- Keep tools away from areas where people could trip over them while walking.
- Do not wear loose clothing or jewelry, such as rings, bracelets, or chains, that could become caught in the chassis.
- Wear safety glasses if you are working under any conditions that could be hazardous to your eyes.
- Do not perform any actions that create a potential hazard to people or make the equipment unsafe.
- Never attempt to lift an object that is too heavy for one person to handle.
- Never install or manipulate wiring during electrical storms.
- Operate the hardware equipment only when the chassis is properly grounded.
- Do not open or remove chassis covers or sheet metal parts unless instructions are provided in this documentation. Such an action could cause severe electrical shock.
- Do not push or force any objects through any opening in the chassis frame. Such an action could result in electrical shock or fire.
- Avoid spilling liquid onto the chassis or onto any hardware component. Such an action could cause electrical shock or damage the hardware equipment.
- Avoid touching uninsulated electrical wires or terminals that have not been disconnected from their power source. Such an action could cause electrical shock.
- Some parts of the router might become hot. The following label provides the warning of the hot surfaces on the router:

![Hot Surface Warning]

Related Documentation
- General Safety Warnings for Juniper Networks Devices on page 314
General Safety Warnings for Juniper Networks Devices

- Qualified Personnel Warning on page 314
- Restricted-Access Area Warning on page 314

Qualified Personnel Warning

**WARNING:** Only trained and qualified personnel should install or replace the hardware equipment.

Waarschuwing Installatie en reparaties mogen uitsluitend door getraind en bevoegd personeel uitgevoerd worden.

Varoitus Ainoastaan koulutettu ja pätevä henkilökunta saa asentaa tai vaihtaa tämän laitteen.

Attention Tout installation ou remplacement de l'appareil doit être réalisé par du personnel qualifié et compétent.

Warnung Gerät nur von geschultem, qualifiziertem Personal installieren oder auswechseln lassen.

Avvertenza Solo personale addestrato e qualificato deve essere autorizzato ad installare o sostituire questo apparecchio.

Advarsel Kun kvalifisert personell med riktig opplæring bør montere eller bytte ut dette utstyret.

Aviso Este equipamento deverá ser instalado ou substituído apenas por pessoal devidamente treinado e qualificado.

¡Atención! Estos equipos deben ser instalados y reemplazados exclusivamente por personal técnico adecuadamente preparado y capacitado.

Warning! Denna utrustning ska endast installeras och bytas ut av utbildad och kvalificerad personal.

Restricted-Access Area Warning

**WARNING:** The hardware equipment is intended for installation in restricted-access areas. A restricted-access area is an area to which access can be gained only by service personnel through the use of a special tool, lock and key, or other means of security, and which is controlled by the authority responsible for the location.

Waarschuwing Dit toestel is bedoeld voor installatie op plaatsen met beperkte toegang. Een plaats met beperkte toegang is een plaats waar toegang slechts door servicepersoneel verkregen kan worden door middel van een speciaal
instrument, een slot en sleutel, of een ander veiligheidsmiddel, en welke
beheerd wordt door de overheidsinstantie die verantwoordelijk is voor de
locatie.

Varoitus Tämä laite on tarkoitetut asennettavaksi paikkaan, johon pääsy on
rajoitettua. Paikka, johon pääsy on rajoitettua, tarkoittaa paikkaa, johon vain
huoltohenkilöstö pääsee jonkin erikoistyökalun, lukkoon sopivan avaimen
tai jonkin muun turvalaitteen avulla ja joka on paikasta vastuussa olevien
toimivaltaisten henkilöiden valvoma.

Attention Cet appareil est à installer dans des zones d’accès réservé. Ces
dernières sont des zones aux quelles seul le personnel de service peut accéder
en utilisant un outil spécial, un mécanisme de verrouillage et une clé, ou tout
autre moyen de sécurité. L’accès aux zones de sécurité est sous le contrôle
de l’autorité responsable de l’emplacement.

Warnung Diese Einheit ist zur Installation in Bereichen mit beschränktem
Zutritt vorgesehen. Ein Bereich mit beschränktem Zutritt ist ein Bereich, zu
dem nur Wartungspersonal mit einem Spezialwerkzeugs, Schloß
und Schlüssel oder anderer Sicherheitsvorkehrungen Zugang hat, und der von
dem für die Anlage zuständigen Gremium kontrolliert wird.

Avvertenza Questa unità deve essere installata in un’area ad accesso limitato.
Un'area ad accesso limitato è un’area accessibile solo a personale di
assistenza tramite un'attrezzo speciale, lucchetto, o altri dispositivi di
sicurezza, ed è controllata dall’autorità responsabile della zona.

Advarsel Denne enheten er laget for installasjon i områder med begrenset
adgang. Et område med begrenset adgang gir kun adgang til servicepersonale
som bruker et spesielt verktøy, lås og nøkkel, eller en annen
sikkerhetsanordning, og det kontrolleres av den autoriteten som er ansvarlig
for området.

Aviso Esta unidade foi concebida para instalação em áreas de acesso restrito.
Uma área de acesso restrito é uma área à qual apenas tem acesso o pessoal
de serviço autorizado, que possua uma ferramenta, chave e fechadura
especial, ou qualquer outra forma de segurança. Esta área é controlada pela
autoridade responsável pelo local.

¡Atención! Esta unidad ha sido diseñada para instalarse en áreas de acceso
restringido. Área de acceso restringido significa un área a la que solamente
tiene acceso el personal de servicio mediante la utilización de una herramienta
especial, cerradura con llave, o algún otro medio de seguridad, y que está
bajo el control de la autoridad responsable del local.

Warning! Denna enhet är avsedd för installation i områden med begränsat
tillträde. Ett område med begränsat tillträde får endast tillträdes av
servicepersonal med ett speciellt verktyg, lås och nyckel, eller annan
säkerhetsanordning, och kontrolleras av den auktoritet som ansvarar för
området.
Preventing Electrostatic Discharge Damage to an M120 Router

Many router hardware components are sensitive to damage from static electricity. Some components can be impaired by voltages as low as 30 V. You can easily generate potentially damaging static voltages whenever you handle plastic or foam packing material or if you move components across plastic or carpets. Observe the following guidelines to minimize the potential for electrostatic discharge (ESD) damage, which can cause intermittent or complete component failures:

- Always use an ESD wrist strap or ankle strap, and make sure that it is in direct contact with your skin.

  **CAUTION:** For safety, periodically check the resistance value of the ESD strap. The measurement should be in the range of 1 through 10 Mohms.

- When handling any component that is removed from the chassis, make sure the equipment end of your ESD strap is attached to one of the ESD points on the chassis.

- Avoid contact between the component and your clothing. ESD voltages emitted from clothing can still damage components.

- When removing or installing a component, always place it component-side up on an antistatic surface, in an antistatic card rack, or in an electrostatic bag (see Figure 120 on page 316). If you are returning a component, place it in an electrostatic bag before packing it.

*Figure 120: Placing a Component into an Electrostatic Bag*
Related Documentation

- Definition of Safety Warning Levels on page 311
- General Safety Warnings for Juniper Networks Devices on page 314
- AC Power Electrical Safety Guidelines for the M120 Router on page 343
- DC Power Electrical Safety Guidelines for the M120 Router on page 347
CHAPTER 37

Fire Safety Requirements

- Fire Safety Requirements for Juniper Networks Devices on page 319

Fire Safety Requirements for Juniper Networks Devices

- General Fire Safety Requirements on page 319
- Fire Suppression on page 319
- Fire Suppression Equipment on page 319

General Fire Safety Requirements

In the event of a fire emergency involving network devices, the safety of people is the primary concern. Establish procedures for protecting people in a fire emergency, provide safety training, and properly provision fire-control equipment and fire extinguishers.

In addition, establish procedures to protect your equipment in a fire emergency. Juniper Networks products must be installed in an environment suitable for electronic equipment. We recommend that fire suppression equipment be available in the event of a fire in the vicinity of the equipment, and that you observe all local fire, safety, and electrical codes and ordinances when installing and operating your equipment.

Fire Suppression

In the event of an electrical hazard or an electrical fire, first turn off power to the equipment at the source. Then use a Type C fire extinguisher, which uses noncorrosive fire retardants, to extinguish the fire.

Fire Suppression Equipment

Type C fire extinguishers, which use noncorrosive fire retardants such as carbon dioxide ($\text{CO}_2$) and Halotron, are most effective for suppressing electrical fires. Type C fire extinguishers displace the oxygen from the point of combustion to eliminate the fire. For extinguishing fire on or around equipment that draws air from the environment for cooling, use this type of inert oxygen displacement extinguisher instead of an extinguisher that leave residues on equipment.

Do not use multipurpose Type ABC chemical fire extinguishers (dry chemical fire extinguishers) near Juniper Networks devices. The primary ingredient in these fire extinguishers is monoammonium phosphate, which is very sticky and difficult to clean.
In addition, in minute amounts of moisture, monoammonium phosphate can become highly corrosive and corrodes most metals.

Any equipment in a room in which a chemical fire extinguisher has been discharged is subject to premature failure and unreliable operation. The equipment is considered to be irreparably damaged.

**NOTE:** To keep warranties effective, do not use a dry chemical fire extinguisher to control a fire at or near a Juniper Networks device. If a dry chemical fire extinguisher is used, the unit is no longer eligible for coverage under a service agreement.

We recommend that you dispose of any irreparably damaged equipment in an environmentally responsible manner.

**Related Documentation**
- General Safety Guidelines for Juniper Networks Devices on page 313
- General Safety Warnings for Juniper Networks Devices on page 314
- General Electrical Safety Warnings for Juniper Networks Devices on page 339
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 344
CHAPTER 38

Installation Safety Guidelines and Warnings

- M120 Chassis Lifting Guidelines on page 321
- Installation Safety Warnings for Juniper Networks Devices on page 322

M120 Chassis Lifting Guidelines

The weight of a fully configured chassis is about 225 lb (102.1 kg). Observe these guidelines for lifting and moving the router:

- Before moving the router, read the guidelines in "M120 Site Preparation Checklist" on page 81 to verify that the intended site meets the specified power, environmental, and clearance requirements.
- Do not attempt to lift a fully configured router by yourself. Using a mechanical lift to maneuver the router into a rack is recommended. If a lift cannot be used, a minimum of two people must lift the router, and you must remove components from the chassis before lifting.
- Before lifting or moving the router, disconnect all external cables.
- As when lifting any heavy object, lift most of the weight with your legs rather than your back. Keep your knees bent and your back relatively straight and avoid twisting your body as you lift. Balance the load evenly and be sure that your footing is solid.

Related Documentation
- Installing the M120 Router Using a Mechanical Lift on page 125
- Installing the M120 Router Without Using a Mechanical Lift on page 139
- Removing Components from the Chassis Before Installing the M120 Router Without a Mechanical Lift on page 129
- Installation Safety Warnings for Juniper Networks Devices on page 322
Installation Safety Warnings for Juniper Networks Devices

Observe the following warnings before and during hardware equipment installation:

- Intrabuilding Ports Warning on page 322
- Installation Instructions Warning on page 322
- Rack-Mounting Requirements and Warnings on page 323
- Ramp Warning on page 326

Intrabuilding Ports Warning

WARNING: The intrabuilding ports of the equipment or subassembly are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the Outside Plant (OSP) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.

Installation Instructions Warning

WARNING: Read the installation instructions before you connect the hardware equipment to a power source.

Waarschuwing Raadpleeg de installatie-aanwijzingen voordat u het systeem met de voeding verbindt.

Varoitus Lue asennusohjeet ennen järjestelmän yhdistämistä virtalähteeseen.

Attention Avant de brancher le système sur la source d'alimentation, consulter les directives d'installation.

Warnung Lesen Sie die Installationsanweisungen, bevor Sie das System an die Stromquelle anschließen.

Avvertenza Consultare le istruzioni di installazione prima di collegare il sistema all'alimentatore.

Advarsel Les installasjonsinstruksjonene før systemet kobles til strømkilden.

Aviso Leia as instruções de instalação antes de ligar o sistema à sua fonte de energia.

¡Atención! Ver las instrucciones de instalación antes de conectar el sistema a la red de alimentación.
Warning! Läs installationsanvisningarna innan du kopplar systemet till dess strömförsörjningsenhet.

Rack-Mounting Requirements and Warnings

Ensure that the equipment rack into which the chassis is installed is evenly and securely supported, to avoid the hazardous condition that could result from uneven mechanical loading.

**WARNING:** To prevent bodily injury when mounting or servicing the chassis in a rack, take the following precautions to ensure that the system remains stable. The following directives help maintain your safety:

- The chassis must be installed into a rack that is secured to the building structure.
- The chassis should be mounted at the bottom of the rack if it is the only unit in the rack.
- When mounting the chassis in a partially-filled rack, load the rack from the bottom to the top, with the heaviest component at the bottom of the rack.
- If the rack is provided with stabilizing devices, install the stabilizers before mounting the chassis in the rack or servicing the hardware equipment.

**Waarschuwing** Om lichamelijk letsel te voorkomen wanneer u dit toestel in een rek monteert of het daar een servicebeurt geeft, moet u speciale voorzorgsmaatregelen nemen om ervoor te zorgen dat het toestel stabiel blijft. De onderstaande richtlijnen worden verstrekt om uw veiligheid te verzekeren:

- De router moet in een stellage worden geïnstalleerd die aan een bouwsel is verankerd.
- Dit toestel dient onderaan in het rek gemonteerd te worden als het toestel het enige in het rek is.
- Wanneer u dit toestel in een gedeeltelijk gevuld rek monteert, dient u het rek van onderen naar boven te laden met het zwaarste onderdeel onderaan in het rek.
- Als het rek voorzien is van stabiliseringshulpmiddelen, dient u de stabilisatoren te monteren voordat u het toestel in het rek monteert of het daar een servicebeurt geeft.

**Varoitus** Kun laite asetetaan telineeseen tai huolletaan sen ollessa telineessä, on noudatettava erityisiä varotoimia järjestelmän vakavuuden säilyttämiseksi, jotta väältäään loukkaantumiselta. Noudata seuraavia turvallisuusohjeita:
• Router on asennettava telineeseen, joka on kiinnitetty rakennukseen.
• Jos telineessä ei ole muita laitteita, aseta laite telineen alaosaan.
• Jos laite asetetaan osaksi täytettyyn telineeseen, aloita kuormittaminen sen alaosasta kaikkein raskaimmalla esineellä ja siirry sitten sen yläosaan.
• Jos telineetä varten on vakaime, asenna ne ennen laitteen asettamista telineeseen tai sen huoltamista siinä.

Attention Pour éviter toute blessure corporelle pendant les opérations de montage ou de réparation de cette unité en casier, il convient de prendre des précautions spéciales afin de maintenir la stabilité du système. Les directives ci-dessous sont destinées à assurer la protection du personnel:
• Le rack sur lequel est monté le router doit être fixé à la structure du bâtiment.
• Si cette unité constitue la seule unité montée en casier, elle doit être placée dans le bas.
• Si cette unité est montée dans un casier partiellement rempli, charger le casier de bas en haut en plaçant l’élément le plus lourd dans le bas.
• Si le casier est équipé de dispositifs stabilisateurs, installer les stabilisateurs avant de monter ou de réparer l’unité en casier.

Warnung Zur Vermeidung von Körperverschmutzung beim Anbringen oder Warten dieser Einheit in einem Gestell müssen Sie besondere Vorkehrungen treffen, um sicherzustellen, daß das System stabil bleibt. Die folgenden Richtlinien sollen zur Gewährleistung Ihrer Sicherheit dienen:
• Der router muß in einem Gestell installiert werden, das in der Gebäudestruktur verankert ist.
• Wenn diese Einheit die einzige im Gestell ist, sollte sie unten im Gestell angebracht werden.
• Bei Anbringung dieser Einheit in einem zum Teil gefüllten Gestell ist das Gestell von unten nach oben zu laden, wobei das schwerste Bauteil unten im Gestell anzubringen ist.
• Wird das Gestell mit Stabilisierungszubehör geliefert, sind zuerst die Stabilisatoren zu installieren, bevor Sie die Einheit im Gestell anbringen oder sie warten.

Avvertenza Per evitare infortuni fisici durante il montaggio o la manutenzione di questa unità in un supporto, occorre osservare speciali precauzioni per garantire che il sistema rimanga stabile. Le seguenti direttive vengono fornite per garantire la sicurezza personale:
• Il router deve essere installato in un telaio, il quale deve essere fissato alla struttura dell’edificio.
• Questa unità deve venire montata sul fondo del supporto, se si tratta dell’unica unità da montare nel supporto.
• Quando questa unità viene montata in un supporto parzialmente pieno, caricare il supporto dal basso all’alto, con il componente più pesante sistemato sul fondo del supporto.
• Se il supporto è dotato di dispositivi stabilizzanti, installare tali dispositivi prima di montare o di procedere alla manutenzione dell’unità nel supporto.

Advarsel Unngå fysiske skader under montering eller reparasjonsarbeid på denne enheten når den befinner seg i et kabinett. Vær nøye med at systemet er stabilt. Følgende retningslinjer er gitt for å verne om sikkerheten:
• Router må installeres i et stativ som er forankret til bygningsstrukturen.
• Denne enheten bør monteres nederst i kabinettet hvis dette er den eneste enheten i kabinettet.
• Ved montering av denne enheten i et kabinett som er delvis fylt, skal kabinettet lastes fra bunnen og opp med den tyngste komponenten nederst i kabinettet.
• Hvis kabinettet er utstyrt med stabiliseringsutstyr, skal stabilisatorene installeres før montering eller utføring av reparasjonsarbeid på enheten i kabinettet.

Aviso Para se prevenir contra danos corporais ao montar ou reparar esta unidade numa estante, deverá tomar precauções especiais para se certificar de que o sistema possui um suporte estável. As seguintes directrizes ajudá-lo-ão a efectuar o seu trabalho com segurança:
• O router deverá ser instalado numa prateleira fixa à estrutura do edifício.
• Esta unidade deverá ser montada na parte inferior da estante, caso seja esta a única unidade a ser montada.
• Ao montar esta unidade numa estante parcialmente ocupada, coloque os itens mais pesados na parte inferior da estante, arrumando-os de baixo para cima.
• Se a estante possuir um dispositivo de estabilização, instale-o antes de montar ou reparar a unidade.

¡Atención! Para evitar lesiones durante el montaje de este equipo sobre un bastidor, o posteriormente durante su mantenimiento, se debe poner mucho cuidado en que el sistema quede bien estable. Para garantizar su seguridad, proceda según las siguientes instrucciones:
• El router debe instalarse en un bastidor fijado a la estructura del edificio.
• Colocar el equipo en la parte inferior del bastidor, cuando sea la única unidad en el mismo.
• Cuando este equipo se vaya a instalar en un bastidor parcialmente ocupado, comenzar la instalación desde la parte inferior hacia la superior colocando el equipo más pesado en la parte inferior.
• Si el bastidor dispone de dispositivos estabilizadores, instalar éstos antes de montar o proceder al mantenimiento del equipo instalado en el bastidor.

Warning! För att undvika kroppsskadan när du installerar eller utför underhållsarbete på denna enhet på en ställning måste du vidta särskilda försiktighetsåtgärder för att försäkra dig om att systemet står stadigt. Följande riktlinjer ges för att trygga din säkerhet:

• Router måste installeras i en ställning som är förankrad i byggnadens struktur.
• Om denna enhet är den enda enheten på ställningen skall den installeras längst ned på ställningen.
• Om denna enhet installeras på en delvis fylld ställning skall ställningen fyllas nedifrån och upp, med de tyngsta enheterna längst ned på ställningen.
• Om ställningen är försedd med stabiliseringsdon skall dessa monteras fast innan enheten installeras eller underhålls på ställningen.

Ramp Warning

WARNING: When installing the hardware equipment, do not use a ramp inclined at more than 10 degrees.

Waarschuwing Gebruik een oprijplaat niet onder een hoek van meer dan 10 graden.

Varoitus Älä käytä sellaista kaltevaa pintaa, jonka kaltevuus ylittää 10 astetta.

Attention Ne pas utiliser une rampe dont l’inclinaison est supérieure à 10 degrés.

Warnung Keine Rampen mit einer Neigung von mehr als 10 Grad verwenden.

Avvertenza Non usare una rampa con pendenza superiore a 10 gradi.

Advarsel Bruk aldri en rampe som heller mer enn 10 grader.

Aviso Não utilize uma rampa com uma inclinação superior a 10 graus.

¡Atención! No usar una rampa inclinada más de 10 grados
Warning! Använd inte ramp med en lutning på mer än 10 grader.

Related Documentation

- General Safety Guidelines for Juniper Networks Devices on page 313
- General Safety Warnings for Juniper Networks Devices on page 314
- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 333
CHAPTER 39

Laser and LED Safety Guidelines and Warnings

- General Laser Safety Guidelines for the M120 Router on page 329
- M120 Laser and LED Safety Warnings on page 329

General Laser Safety Guidelines for the M120 Router

Physical Interface Cards (PICs) with single-mode optical interfaces are equipped with laser transmitters, which are considered a Class 1 Laser Product by the U.S. Food and Drug Administration, and are evaluated as a Class 1 Laser Product per EN 60825–1 +A11 +A2 requirements.

When working around PICs, observe the following safety guidelines to prevent eye injury:

- Do not look into unterminated ports or at fibers that connect to unknown sources.
- Do not examine unterminated optical ports with optical instruments.
- Avoid direct exposure to the beam.

**WARNING:** Unterminated optical connectors can emit invisible laser radiation. The lens in the human eye focuses all the laser power on the retina, so focusing the eye directly on a laser source—even a low-power laser—could permanently damage the eye.

Related Documentation
- M120 Laser and LED Safety Warnings on page 329

M120 Laser and LED Safety Warnings

- Class 1 Laser Product Warning on page 330
- Class 1 LED Product Warning on page 330
- Laser Beam Warning on page 330
- Radiation from Open Port Apertures Warning on page 331
Class 1 Laser Product Warning

**WARNING:** Class 1 laser product.
Waarschuwing Klasse-1 laser produkt.
Varoitus Luokan 1 lasertuote.
Attention Produit laser de classe I.
Warnung Laserprodukt der Klasse 1.
Avvertenza Prodotto laser di Classe 1.
Advarsel Laserprodukt av klasse 1.
Aviso Produto laser de classe 1.
¡Atención! Producto láser Clase I.
Varning! Laserprodukt av klass 1.

Class 1 LED Product Warning

**WARNING:** Class 1 LED product.
Waarschuwing Klasse 1 LED-product.
Varoitus Luokan 1 valodiodituote.
Attention Alarme de produit LED Class 1.
Warnung Class 1 LED-Produktwarnung.
Avvertenza Avvertenza prodotto LED di Classe 1.
Advarsel LED-produkt i klasse 1.
Aviso Produto de classe 1 com LED.
¡Atención! Aviso sobre producto LED de Clase 1.
Varning! Lysdiodprodukt av klass 1.

Laser Beam Warning

**WARNING:** Do not stare into the laser beam or view it directly with optical instruments.
Waarschuwing  Niet in de straal staren of hem rechtstreeks bekijken met optische instrumenten.

Varoitus  Älä katso näeeseen äläkä tarkastele sitä suoraan optisen laitteen avulla.

Attention  Ne pas fixer le faisceau des yeux, ni l’observer directement à l’aide d’instruments optiques.

Warnung  Nicht direkt in den Strahl blicken und ihn nicht direkt mit optischen Geräten prüfen.

Avvertenza  Non fissare il raggio con gli occhi né usare strumenti ottici per osservarlo direttamente.

Advarsel  Stirreller se ikke direkte p strlen med optiske instrumenter.

Aviso  Não olhe fixamente para o raio, nem olhe para ele directamente com instrumentos ópticos.

¡Atención!  No mirar fijamente el haz ni observarlo directamente con instrumentos ópticos.

Warning!  Rikta inte blicken in mot strålen och titta inte direkt på den genom optiska instrument.

Radiation from Open Port Apertures Warning

**WARNING:**  Because invisible radiation may be emitted from the aperture of the port when no fiber cable is connected, avoid exposure to radiation and do not stare into open apertures.

Waarschuwing  Aangezien onzichtbare straling vanuit de opening van de poort kan komen als er geen fiberkabel aangesloten is, dient blootstelling aan straling en het kijken in open openingen vermeden te worden.

Varoitus  Koska portin aukosta voi emittoitua näkymätöntä säteilyä, kun kuitukaapelia ei ole kytkettynä, vältä säteilylle altistumista äläkä katso avoimiin aukoihin.

Attention  Des radiations invisibles à l’il nu pouvant traverser l’ouverture du port lorsqu’aucun câble en fibre optique n’y est connecté, il est recommandé de ne pas regarder fixement l’intérieur de ces ouvertures.

Warnung  Aus der Port-Öffnung können unsichtbare Strahlen emittieren, wenn kein Glasfaserkabel angeschlossen ist. Vermeiden Sie es, sich den Strahlungen auszusetzen, und starren Sie nicht in die Öffnungen!
Avvertenza Quando i cavi in fibra non sono inseriti, radiazioni invisibili possono essere emesse attraverso l'apertura della porta. Evitate di esporvi alle radiazioni e non guardate direttamente nelle aperture.

Advarsel Unngå utsettelse for stråling, og stir ikke inn i åpninger som er åpne, fordi.usynlig stråling kan emitteres fra portens åpning når det ikke er tilkoblet en fiberkabel.

Aviso Dada a possibilidade de emissão de radiação invisível através do orifício da via de acesso, quando esta não tiver nenhum cabo de fibra conectado, deverá evitar a exposição à radiação e não deverá olhar fixamente para orifícios que se encontrarem a descoberto.

¡Atención! Debido a que la apertura del puerto puede emitir radiación invisible cuando no existe un cable de fibra conectado, evite mirar directamente a las aperturas para no exponerse a la radiación.

Warning! Osynlig strålning kan avges från en portöppning utan ansluten fiberkabel och du bör därför undvika att bli utsatt för strålning genom att inte stirra in i oskyddade öppningar.

Related Documentation  
• General Laser Safety Guidelines for the M120 Router on page 329
CHAPTER 40

Maintenance and Operational Safety Guidelines and Warnings

- Maintenance and Operational Safety Warnings for Juniper Networks Devices on page 333

Maintenance and Operational Safety Warnings for Juniper Networks Devices

As you maintain the hardware equipment, observe the following warnings:

- Battery Handling Warning on page 333
- Jewelry Removal Warning on page 334
- Lightning Activity Warning on page 335
- Operating Temperature Warning on page 336
- Product Disposal Warning on page 337

Battery Handling Warning

**WARNING:** Replacing the battery incorrectly might result in an explosion. Replace the battery only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Waarschuwing Er is ontploffingsgevaar als de batterij verkeerd vervangen wordt. Vervang de batterij slechts met hetzelfde of een equivalent type dat door de fabrikant aanbevolen is. Gebruikte batterijen dienen overeenkomstig fabrieksvoorschriften weggeworpen te worden.


Attention Danger d'explosion si la pile n'est pas remplacée correctement. Ne la remplacer que par une pile de type semblable ou équivalent, recommandée par le fabricant. Jeter les piles usagées conformément aux instructions du fabricant.
**Jewelry Removal Warning**

**WARNING:** Before working on equipment that is connected to power lines, remove jewelry, including rings, necklaces, and watches. Metal objects heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.

**Waarschuwing** Alvorens aan apparatuur te werken die met elektrische leidingen is verbonden, sieraden (inclusief ringen, kettingen en horloges) verwijderen. Metalen voorwerpen worden warm wanneer ze met stroom en aarde zijn verbonden, en kunnen ernstige brandwonden veroorzaken of het metalen voorwerp aan de aansluitklemmen lassen.

**Varoitus** Ennen kuin työskentelet voimavirtajohtoihin kytettyjen laitteiden parissa, ota pois kaikki korut (sormukset, kaulakorut ja kellot mukaan lukien). Metalliesineet kuumenevat, kun ne ovat yhteydessä sähkövirran ja maan kanssa, ja ne voivat aiheuttaa vakavia palovammoja tai hitsata metalliesineet kiinni liitäntänäpöihin.

**Attention** Avant d'accéder à cet équipement connecté aux lignes électriques, ôter tout bijou (anneaux, colliers et montres compris). Lorsqu'ils sont branchés
à l'alimentation et reliés à la terre, les objets métalliques chauffent, ce qui peut provoquer des blessures graves ou souder l'objet métallique aux bornes.

Warnung Vor der Arbeit an Geräten, die an das Netz angeschlossen sind, jeglichen Schmuck (einschließlich Ringe, Ketten und Uhren) abnehmen. Metallgegenstände erhitzten sich, wenn sie an das Netz und die Erde angeschlossen werden, und können schwere Verbrennungen verursachen oder an die Anschlußklemmen angeschweißt werden.

Avvertenza Prima di intervenire su apparecchiature collegate alle linee di alimentazione, togliersi qualsiasi monile (inclusi anelli, collane, braccialetti ed orologi). Gli oggetti metallici si riscaldano quando sono collegati tra punti di alimentazione e massa: possono causare ustioni gravi oppure il metallo può saldarsi ai terminali.

Advarsel Fjern alle smykker (inkludert ringe, halskjeder og klokker) før du skal arbeide på utstyr som er koblet til kraftledninger. Metallgenstander som er koblet til kraftledninger og jord blir svært varme og kan forårsake alvorlige brannskader eller smelter fast til polene.

Aviso Antes de trabalhar em equipamento que esteja ligado a linhas de corrente, retire todas as jóias que estiver a usar (incluindo anéis, fios e relógios). Os objectos metálicos aquecerão em contacto com a corrente e em contacto com a ligação à terra, podendo causar queimaduras graves ou ficarem soldados aos terminais.

¡Atención! Antes de operar sobre equipos conectados a líneas de alimentación, quitarse las joyas (inclusos anillos, collares y relojes). Los objetos de metal se calientan cuando se conectan a la alimentación y a tierra, lo que puede ocasionar quemaduras graves o que los objetos metálicos queden soldados a los bornes.

Warning! Tag av alla smycken (inklusive ringar, halsband och armbandsur) innan du arbetar på utrustning som är kopplad till kraftledningar. Metallobjekt hettas upp när de kopplas ihop med ström och jord och kan förorsaka allvarliga brännskador; metallobjekt kan också sammansvetsas med kontaktarna.

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**Lightning Activity Warning**

**WARNING:** Do not work on the system or connect or disconnect cables during periods of lightning activity.

Waarschuwing Tijdens onweer dat gepaard gaat met bliksem, dient u niet aan het systeem te werken of kabels aan te sluiten of te ontkoppelen.

Varoitus Älä työskentele järjestelmän parissa äläkä yhdistä tai irrota kaapeleita ukkosimalla.
Operating Temperature Warning

**WARNING:** To prevent the hardware equipment from overheating, do not operate it in an area that exceeds the maximum recommended ambient temperature of 104°F (40°C). To prevent airflow restriction, allow at least 6 inches (15.2 cm) of clearance around the ventilation openings.

**Waarschuwing** Om te voorkomen dat welke router van de router dan ook oververhit raakt, dient u deze niet te bedienen op een plaats waar de maximale aanbevolen omgevingstemperatuur van 40°C wordt overschreden. Om te voorkomen dat de luchtstroom wordt beperkt, dient er minstens 15,2 cm speling rond de ventilatie-openingen te zijn.

**Varoitus** Ettei router-sarjan reititin ylikuumentuisi, sitä ei saa käyttää tilassa, jonka lämpötila ylittää korkeimman suositellun ympäristölämpötilan 40°C. Eteetä ilmanvaihdo estyisi, tuuletusaukkojen ympärille on jätettävä ainakin 15,2 cm tilaa.

**Attention** Pour éviter toute surchauffe des routeurs de la gamme router, ne l'utilisez pas dans une zone où la température ambiante est supérieure à 40°C. Pour permettre un flot d'air constant, dégagez un espace d'au moins 15,2 cm autour des ouvertures de ventilations.

**Warnung** Um einen router der router vor Überhitzung zu schützen, darf dieser nicht in einer Gegend betrieben werden, in der die Umgebungstemperatur das empfohlene Maximum von 40°C überschreitet. Um Lüftungsverschluß zu verhindern, achten Sie darauf, daß mindestens 15,2 cm lichter Raum um die Lüftungsoffnungen herum frei bleibt.
Avvertenza Per evitare il surriscaldamento dei router, non adoperateli in un locale che ecceda la temperatura ambientale massima di 40°C. Per evitare che la circolazione dell’aria sia impedita, lasciate uno spazio di almeno 15,2 cm di fronte alle aperture delle ventole.

Advarsel Unngå overoppheting av eventuelle rutere i router Disse skal ikke brukes på steder der den anbefalte maksimale omgivelsestemperaturen overstiger 40° C (104°F). Sør for at klaringen rundt luftåpningene er minst 15,2 cm (6 tomm) for å forhindre nedsatt luftsirkulasjon.

Aviso Para evitar o sobreaquecimento do encaminhador router, não utilize este equipamento numa área que exceda a temperatura máxima recomendada de 40° C. Para evitar a restrição à circulação de ar, deixe pelo menos um espaço de 15,2 cm à volta das aberturas de ventilação.

¡Atención! Para impedir que un encaminador de la serie router se recaliente, no lo haga funcionar en un área en la que se supere la temperatura ambiente máxima recomendada de 40° C. Para impedir la restricción de la entrada de aire, deje un espacio mínimo de 15,2 cm alrededor de las aperturas para ventilación.

Warning! Förhindra att en router överhettas genom att inte använda den i ett område där den maximalt rekommenderade omgivningstemperaturen på 40° C överskrids. Förhindra att luftcirkulationen inskränks genom att se till att det finns fritt utrymme på minst 15,2 cm omkring ventilationsöppningarna.

Product Disposal Warning

WARNING: Disposal of this product must be handled according to all national laws and regulations.

Waarschuwing Dit produkt dient volgens alle landelijke wetten en voorschriften te worden afgedankt.

Varoitus Tämän tuotteen lopullisesta hävittämisestä tulee huolehtia kaikkia valtakunnallisia lakeja ja säännöksiä noudattaen.

Attention La mise au rebut définitive de ce produit doit être effectuée conformément à toutes les lois et réglementations en vigueur.

Warnung Dieses Produkt muß den geltenden Gesetzen und Vorschriften entsprechend entsorgt werden.

Avvertenza L’eliminazione finale di questo prodotto deve essere eseguita osservando le normative italiane vigenti in materia

Advarsel Endelig disponering av dette produktet må skje i henhold til nasjonale lover og forskrifter.
Aviso A descartagem final deste produto deverá ser efectuada de acordo com os regulamentos e a legislação nacional.

¡Atención! El desecho final de este producto debe realizarse según todas las leyes y regulaciones nacionales.

Warning! Slutlig kassering av denna produkt bör skötas i enlighet med landets alla lagar och föreskrifter.

Related Documentation
- General Safety Guidelines for Juniper Networks Devices on page 313
- General Safety Warnings for Juniper Networks Devices on page 314
CHAPTER 41

Electrical Safety Guidelines and Warnings

- In Case of an Electrical Accident on page 339
- General Electrical Safety Warnings for Juniper Networks Devices on page 339
- AC Power Electrical Safety Guidelines for the M120 Router on page 343
- Japanese AC Power Cord Warning for M Series and MX Series Routers on page 344
- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 344
- DC Power Electrical Safety Guidelines for the M120 Router on page 347
- Site Electrical Wiring Guidelines for Juniper Networks Devices on page 349

In Case of an Electrical Accident

If an electrical accident results in an injury, take the following actions in this order:

1. Use caution. Be aware of potentially hazardous conditions that could cause further injury.

2. Disconnect power from the router.

3. If possible, send another person to get medical aid. Otherwise, assess the condition of the victim, then call for help.

Related Documentation
- General Safety Guidelines for Juniper Networks Devices on page 313
- General Safety Warnings for Juniper Networks Devices on page 314

General Electrical Safety Warnings for Juniper Networks Devices

- Grounded Equipment Warning on page 340
- Grounding Requirements and Warning on page 340
- Midplane Energy Hazard Warning on page 341
- Multiple Power Supplies Disconnection Warning on page 341
- Power Disconnection Warning on page 342
Grounded Equipment Warning

**WARNING:** The network device is intended to be grounded. Ensure that the network device is connected to earth ground during normal use.

Waarschuwing Deze apparatuur hoort geaard te worden Zorg dat de host-computer tijdens normaal gebruik met aarde is verbonden.

Varoitus Tämä laitteisto on tarkoitettu maadoitettavaksi. Varmista, että isäntälaitte on yhdistetty maahan normaalin käytön aikana.

Attention Cet équipement doit être relié à la terre. S’assurer que l’appareil hôte est relié à la terre lors de l’utilisation normale.

Warnung Dieses Gerät muß geerdet werden. Stellen Sie sicher, daß das Host-Gerät während des normalen Betriebs an Erde gelegt ist.

Avvertenza Questa apparecchiatura deve essere collegata a massa. Accertarsi che il dispositivo host sia collegato alla massa di terra durante il normale utilizzo.

Advarsel Dette utstyret skal jordes. Forviss deg om vertsterminalen er jordet ved normalt bruk.

Aviso Este equipamento deverá estar ligado à terra. Certifique-se que o host se encontra ligado à terra durante a sua utilização normal.

¡Atención! Este equipo debe conectarse a tierra. Asegurarse de que el equipo principal esté conectado a tierra durante el uso normal.

Warning! Denna utrustning är avsedd att jordas. Se till att vårdhetens är jordad vid normal användning.

Grounding Requirements and Warning

An insulated grounding conductor that is identical in size to the grounded and ungrounded branch circuit supply conductors, but is identifiable by green and yellow stripes, is installed as part of the branch circuit that supplies the unit. The grounding conductor is a separately derived system at the supply transformer or motor generator set.

**WARNING:** When installing the network device, you must always make the ground connection first and disconnect it last.

Waarschuwing Bij de installatie van het toestel moet de aardverbinding altijd het eerste worden gemaakt en het laatste worden losgemaakt.

Varoitus Laitetta asennettaessa on maahan yhdistäminen aina tehtävä ensiksi ja maadoituksen irti kytkeminen viimeiseksi.
**Midplane Energy Hazard Warning**

**WARNING:** High levels of electrical energy are distributed across the midplane. Be careful not to contact the midplane connectors, or any component connected to the midplane, with any metallic object while servicing components.

**Multiple Power Supplies Disconnection Warning**

**WARNING:** The network device has more than one power supply connection. All connections must be removed completely to remove power from the unit completely.

**Waarschuwing** Deze eenheid heeft meer dan één stroomtoevoer verbinding; alle verbindingen moeten volledig worden verwijderd om de stroom van deze eenheid volledig te verwijderen.

**Varoitus** Tässä laitteessa on useampia virtalähdekytkenä. Kaikki kytkenät on irrotettava kokonaan, jotta virta poistettaisiin täysin laitteesta.

**Attention** Cette unité est équipée de plusieurs raccordements d'alimentation. Pour supprimer tout courant électrique de l'unité, tous les cordons d'alimentation doivent être débranchés.
**Power Disconnection Warning**

**WARNING:** Before working on the chassis or near power supplies, switch off the power at the DC circuit breaker.

**Waarschuwing** Voordat u aan een frame of in de nabijheid van voedingen werkt, dient u bij wisselstroom toestellen de stekker van het netsnoer uit het stopcontact te halen; voor gelijkstroom toestellen dient u de stroom uit te schakelen bij de stroomverbreker.

**Varoitus** Kytke irti vaihtovirtalaitteiden virtajohto ja katkaise tasavirtalaitteiden virta suojakytkimellä, ennen kuin teet mitään asennuspohjalle tai työskentelet virtualähteiden läheisyydessä.

**Attention** Avant de travailler sur un châssis ou à proximité d’une alimentation électrique, débranchez le cordon d’alimentation des unités en courant alternatif; couper l’alimentation des unités en courant continu au niveau du disjoncteur.

**Warnung** Bevor Sie an einem Chassis oder in der Nähe von Netzgeräten arbeiten, ziehen Sie bei Wechselstromeinheiten das Netzkabel ab bzw. schalten Sie bei Gleichstromeinheiten den Strom am Unterbrecher ab.

**Avvertenza** Prima di lavorare su un telaio o intorno ad alimentatori, scollegare il cavo di alimentazione sulle unità CA; scollegare l’alimentazione all’interruttore automatico sulle unità CC.
Advarsel Før det utføres arbeid på kabinettet eller det arbeides i nærheten av strømforsyningsenheter, skal strømledningen trekkes ut på vekselstrømsenheter og strømmen kobles fra ved strømbrøyten på likestrømsenheter.

Aviso Antes de trabajar num chassis, ou antes de trabalhar perto de unidades de fornecimento de energia, desligue o cabo de alimentação nas unidades de corrente alternada; desligue a corrente no disjuntor nas unidades de corrente contínua.

¡Atención! Antes de manipular el chasis de un equipo o trabajar cerca de una fuente de alimentación, desenchufar el cable de alimentación en los equipos de corriente alterna (CA); cortar la alimentación desde el interruptor automático en los equipos de corriente continua (CC).

Warning! Innan du arbetar med ett chassi eller nära strömförsörjningsenheter skall du för växelströmsenheter dra ur nätsladden och för likströmsenheter bryta strömmen vid överspänningsskyddet.

Related Documentation

- DC Power Electrical Safety Warnings for Juniper Networks Devices on page 344

**AC Power Electrical Safety Guidelines for the M120 Router**

The following electrical safety guidelines apply to AC-powered routers:

- AC-powered routers are shipped with a three-wire electrical cord with a grounding-type plug that fits only a grounding-type power outlet. Do not circumvent this safety feature. Equipment grounding should comply with local and national electrical codes.

- Each AC power supply has two AC appliance inlets. Each requires a dedicated AC power feed. For 100-120 VAC, both inlets are used. For 200-240 VAC, only the top inlet is used. For information about site power requirements, see "M120 Router Power Requirements" on page 88. For information about connecting the router to power and ground, see "Connecting Power to an AC-Powered M120 Router" on page 167 and "Connecting the Grounding Cable to the M120 Router" on page 151.

- The power cord serves as the main disconnecting device. The socket outlet must be near the router and be easily accessible.

- The cores in the mains lead are colored in accordance with the following code:
  - Green and yellow—Earth
  - Blue—Neutral
  - Brown—Live

Related Documentation

- In Case of an Electrical Accident on page 339
- General Electrical Safety Warnings for Juniper Networks Devices on page 339
• DC Power Electrical Safety Guidelines for the M120 Router on page 347

Japanese AC Power Cord Warning for M Series and MX Series Routers

WARNING:

附属の電源コードセットはこの製品専用です。
他の電気機器には使用しないでください。

Translation from Japanese: The attached power cable is only for this product. Do not use the cable for another product.

Related Documentation

DC Power Electrical Safety Warnings for Juniper Networks Devices

When working with DC-powered equipment, observe the following warnings:

• DC Power Copper Conductors Warning on page 344
• DC Power Disconnection Warning on page 345
• DC Power Wiring Terminations Warning on page 346

DC Power Copper Conductors Warning

WARNING: Use copper conductors only.

Waarschuwing Gebruik alleen koperen geleiders.

Varoitus Käytä vain kuparijohtimia.

Attention Utilisez uniquement des conducteurs en cuivre.

Warnung Verwenden Sie ausschließlich Kupferleiter.

Avvertenza Usateunicamente dei conduttoridirame.

Advarsel Brukbare kobberledninger.

Aviso Utilizeapenasfioscondutoresdecobre.

¡Atención! Empleesóloconductoresdecobre.
DC Power Disconnection Warning

**WARNING:** Before performing any procedures on power supplies, ensure that power is removed from the DC circuit. To ensure that all power is off, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the off position, and tape the switch handle of the circuit breaker in the off position.

**Waarschuwing** Voordat u een van de onderstaande procedures uitvoert, dient u te controleren of de stroom naar het gelijkstroom circuit uitgeschakeld is. Om u ervan te verzekeren dat alle stroom UIT is geschakeld, kiest u op het schakelbord de stroomverbreker die het gelijkstroom circuit bedient, draait de stroomverbreker naar de UIT positie en plakt de schakelaarhendel van de stroomverbreker met plakband in de UIT positie vast.

**Varoitus** Varmista, että tasavirtapiiriissä ei ole virtaa ennen seuraavien toimenpiteiden suorittamista. Varmistaaksesi, että virta on KATKAISTU täysin, paljanna tasavirrasta huolehtivassa kojetaulussa sijaitseva suoajytkin, käännä suoajytkin KATKAISTU-asentoon ja teippaa suoajytkimen varsi niin, että se pysyy KATKAISTU-asennossa.

**Attention** Avant de pratiquer l’une quelconque des procédures ci-dessous, vérifier que le circuit en courant continu n’est plus sous tension. Pour en être sûr, localiser le disjoncteur situé sur le panneau de service du circuit en courant continu, placer le disjoncteur en position fermée (OFF) et, à l’aide d’un ruban adhésif, bloquer la poignée du disjoncteur en position OFF.

**Warnung** Vor Ausführung der folgenden Vorgänge ist sicherzustellen, daß die Gleichstromschaltung keinen Strom erhält. Um sicherzustellen, daß sämtlicher Strom abgestellt ist, machen Sie auf der Schalttafel den Unterbrecher für die Gleichstromschaltung ausfindig, stellen Sie den Unterbrecher auf AUS, und kleben Sie den Schaltergriff des Unterbrechers mit Klebeband in der AUS-Stellung fest.

**Avvertenza** Prima di svolgere una qualsiasi delle procedure seguenti, verificare che il circuito CC non sia alimentato. Per verificare che tutta l'alimentazione sia scollegata (OFF), individuare l'interruttore automatico sul quadro strumenti che alimenta il circuito CC, mettere l'interruttore in posizione OFF e fissarlo con nastro adesivo in tale posizione.

**Advarsel** Før noen av disse prosedyrene utføres, kontroller at strømmen er frakoblet likestrømkretsen. Sørg for at all strøm er slått AV. Dette gjøres ved å lokalisere strømbryteren på brytertavlen som betjener likestrømkretsen, slå strømbryteren AV og teipe bryterhåndtaket på strømbryteren i AV-stilling.
Aviso Antes de executar um dos seguintes procedimentos, certifique-se de desligar a fonte de alimentação de energia do circuito de corrente contínua. Para se assegurar que toda a corrente foi DESLIGADA, localize o disjuntor no painel que serve o circuito de corrente contínua e coloque-o na posição OFF (Desligado), segurando nessa posição a manivela do interruptor do disjuntor com fita isoladora.

¡Atención! Antes de proceder con los siguientes pasos, comprobar que la alimentación del circuito de corriente continua (CC) esté cortada (OFF). Para asegurarse de que toda la alimentación esté cortada (OFF), localizar el interruptor automático en el panel que alimenta al circuito de corriente continua, cambiar el interruptor automático a la posición de Apagado (OFF), y sujetar con cinta la palanca del interruptor automático en posición de Apagado (OFF).

Warning! Innan du utför någon av följande procedurer måste du kontrollera att strömförsörjningen till likströmskretsen är bruten. Kontrollera att all strömförsörjning är BRUTEN genom att slå AV det överspänningsskydd som skyddar likströmskretsen och tejp fast överspänningsskyddets omkopplare i FRÅN-läget.

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**DC Power Wiring Terminations Warning**

**WARNING:** When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations must be the appropriate size for the wires and must clamp both the insulation and conductor.

Waarschuwing Wanneer geslagen bedrading vereist is, dient u bedrading te gebruiken die voorzien is van goedgekeurde aansluitingstoppen, zoals het gesloten-lus type of het grijperschop type waarbij de aansluitpunten omhoog wijzen. Deze aansluitpunten dienen de juiste maat voor de draden te hebben en dienen zowel de isolatie als de geleider vast te klemmen.

Varoitus Jos säikeellinen johdin on tarpeen, käytä hyväksyttyä johdinliitäntää, esimerkiksi suljettua silmukkaa tai kourumaista liitäntää, jossa on ylöspäin käännetyt kiinnityskorvat. Tällaisten liitäntöjen tulee olla kootaan johtimiin sopivia ja niiden tulee puristaa yhteen sekä eristeen että johdinosan.

Attention Quand des fils torsadés sont nécessaires, utiliser des douilles terminales homologuées telles que celles à circuit fermé ou du type à plage ouverte avec cosses rebroussées. Ces douilles terminales doivent être de la taille qui convient aux fils et doivent être refermées sur la gaine isolante et sur le conducteur.

Warnung Wenn Litzenverdrahtung erforderlich ist, sind zugelassene Verdrahtungsabschlüsse, z.B. Ringoesen oder gabelförmige Kabelschuhe mit nach oben gerichteten Enden zu verwenden. Diese Abschlüsse sollten
die angemessene Größe für die Drähte haben und sowohl die Isolierung als auch den Leiter festklemmen.

Avvertenza Quando occorre usare treccce, usare connettori omologati, come quelli a occhiello o a forcella con linguette rivolte verso l'alto. I connettori devono avere la misura adatta per il cablaggio e devono serrare sia l'isolante che il conduttore.

Advarsel Hvis det er nødvendig med flertrådede ledninger, brukes godkjente ledningsavslutninger, som for eksempel lukket sløyfe eller spadetype med oppoverbøyde kabelsko. Disse avslutningene skal ha riktig størrelse i forhold til ledningene, og skal klemme sammen både isolasjonen og lederen.

Aviso Quando forem requeridas montagens de instalação eléctrica de cabo torcido, use terminações de cabo aprovadas, tais como, terminações de cabo em circuito fechado e planas com terminais de orelha voltados para cima. Estas terminações de cabo deverão ser do tamanho apropriado para os respectivos cabos, e deverão prender simultaneamente o isolamento e o fio condutor.

¡Atención! Cuando se necesite hilo trenzado, utilizar terminales para cables homologados, tales como las de tipo "bucle cerrado" o "espada", con las lengüetas de conexión vueltas hacia arriba. Estos terminales deberán ser del tamaño apropiado para los cables que se utilicen, y tendrán que sujetar tanto el aislan te como el conductor.

Warning! När flertrådiga ledningar krävs måste godkända ledningskontakter användas, t.ex. kabelsko av sluten eller öppen typ med uppåtvänd tapp. Storleken på dessa kontakter måste vara avpassad till ledningarna och måste kunna hålla både isoleringen och ledaren fastklämda.

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**Related Documentation**

- General Safety Warnings for Juniper Networks Devices on page 314
- General Electrical Safety Warnings for Juniper Networks Devices on page 339

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**DC Power Electrical Safety Guidelines for the M120 Router**

The following electrical safety guidelines apply to a DC-powered router:
• A DC-powered router is equipped with a DC terminal block that is rated for the power requirements of a maximally configured router. To supply sufficient power, terminate the DC input wiring on a facility DC source capable of supplying at least 60 A @ –48 VDC for the system. We recommend that the 48 VDC facility DC source be equipped with a circuit breaker rated at 125% of the power provisioned for the input minimum, or as required by local code. Incorporate an easily accessible disconnect device into the facility wiring. In the United States and Canada, the –48 VDC facility should be equipped with a circuit breaker rated a minimum of 125% of the power provisioned for the input in accordance with the National Electrical Code in the US and the Canadian Electrical Code in Canada. Be sure to connect the ground wire or conduit to a solid office (earth) ground. A closed loop ring is recommended for terminating the ground conductor at the ground stud.

• Run two wires from the circuit breaker box to a source of 48 VDC. Use appropriate gauge wire to handle up to 60 A.

• A DC-powered router that is equipped with a DC terminal block is intended only for installation in a restricted access location. In the United States, a restricted access area is one in accordance with Articles 110-16, 110-17, and 110-18 of the National Electrical Code ANSI/NFPA 70.

NOTE: Primary overcurrent protection is provided by the building circuit breaker. This breaker should protect against excess currents, short circuits, and earth faults in accordance with NEC ANSI/NFPA70.

• Ensure that the polarity of the DC input wiring is correct. Under certain conditions, connections with reversed polarity might trip the primary circuit breaker or damage the equipment.

• For personal safety, connect the green and yellow wire to safety (earth) ground at both the router and the supply side of the DC wiring.

• The marked input voltage of –48 VDC for a DC-powered router is the nominal voltage associated with the battery circuit, and any higher voltages are only to be associated with float voltages for the charging function.

• Because the router is a positive ground system, you must connect the positive lead to the terminal labeled RETURN, the negative lead to the terminal labeled –48V, and the earth ground to the chassis grounding points.

Related Documentation

• M120 DC Power Supply Description on page 72
• Installing an M120 DC Power Supply on page 248
• Replacing an M120 DC Power Supply on page 245
• Replacing an M120 DC Power Supply Cable on page 251
Site Electrical Wiring Guidelines for Juniper Networks Devices

- Distance Limitations for Signaling on page 349
- Radio Frequency Interference on page 349
- Electromagnetic Compatibility on page 349

Distance Limitations for Signaling

Improperly installed wires can emit radio interference. In addition, the potential for damage from lightning strikes increases if wires exceed recommended distances or if wires pass between buildings. The electromagnetic pulse (EMP) caused by lightning can damage unshielded conductors and destroy electronic devices. If your site has previously experienced such problems, you might want to consult experts in electrical surge suppression and shielding.

Radio Frequency Interference

You can reduce or eliminate the emission of radio frequency interference (RFI) from your site wiring by using twisted-pair cable with a good distribution of grounding conductors. If you must exceed the recommended distances, use a high-quality twisted-pair cable with one ground conductor for each data signal when applicable.

Electromagnetic Compatibility

If your site is susceptible to problems with electromagnetic compatibility (EMC), particularly from lightning or radio transmitters, you might want to seek expert advice. Strong sources of electromagnetic interference (EMI) can destroy the signal drivers and receivers in the network device and conduct power surges over the lines into the equipment, resulting in an electrical hazard. It is particularly important to provide a properly grounded and shielded environment and to use electrical surge-suppression devices.

CAUTION: To comply with intrabuilding lightning and surge requirements, intrabuilding wiring must be shielded, and the shield for the wiring must be grounded at both ends.

WARNING: The intrabuilding ports of the equipment or subassembly are suitable for connection to intrabuilding or unexposed wiring or cabling only. The intrabuilding ports of the equipment or subassembly MUST NOT be metallically connected to interfaces that connect to the Outside Plant (OSP) or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of primary protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring.
Related Documentation

• General Electrical Safety Guidelines and Electrical Codes for Juniper Networks Devices
CHAPTER 42

Agency Approvals and Compliance Statements

- Agency Approvals for M120 Routers on page 351
- Compliance Statements for EMC Requirements for the M120 Router (European Community) on page 353
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada) on page 353
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Israel) on page 353
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan) on page 354
- Compliance Statements for EMC Requirements for Juniper Networks Devices (United States) on page 354
- Compliance Statements for Environmental Requirements on page 354
- Compliance Statements for NEBS for the M120 Router on page 354
- Compliance Statements for Acoustic Noise for the M120 Router on page 355

Agency Approvals for M120 Routers

The router complies with the following standards:

- Safety
  - CAN/CSA-22.2 No. 60950-1-03/UL 60950-1, Safety of Information Technology Equipment
  - EN 60950-1 Safety of Information Technology Equipment

- EMC
  - AS/NZS 3548 Class A (Australia/New Zealand)
  - EN55022 Class A (Europe)
The router is designed to comply with the following standards:

- **NEBS**
  - GR-1089-Core: EMC and Electrical Safety for Network Telecommunications Equipment
  - SR-3580 NEBS Criteria Levels (Level 3 Compliance)
  - GR-63-Core: NEBS, Physical Protection
    - The equipment is suitable for installation as part of the Common Bonding Network (CBN).
    - The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
    - The battery return connection is to be treated as a Common DC return (i.e. DC-C), as defined in GR-1089-CORE.

- **ETS1**
  - ETSI EN-300386-2 Telecommunication Network Equipment. Electromagnetic Compatibility Requirements

**Related Documentation**

- Compliance Statements for EMC Requirements for Juniper Networks Devices (United States) on page 354
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan) on page 354
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada) on page 353
Compliance Statements for EMC Requirements for the M120 Router (European Community)

This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Related Documentation
- Agency Approvals for M120 Routers on page 351

Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada)

This Class A digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Related Documentation
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Israel) on page 353
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan) on page 354
- Compliance Statements for EMC Requirements for Juniper Networks Devices (United States) on page 354

Compliance Statements for EMC Requirements for Juniper Networks Devices (Israel)

Translation from Hebrew—Warning: This product is Class A. In residential environments, the product may cause radio interference, and in such a situation, the user may be required to take adequate measures.

Related Documentation
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada) on page 353
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan) on page 354
- Compliance Statements for EMC Requirements for Juniper Networks Devices (United States) on page 354
Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan)

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

VCCI-A

Translation from Japanese—This is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures. VCCI-A

Related Documentation

Compliance Statements for EMC Requirements for Juniper Networks Devices (United States)

The hardware equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Related Documentation

Compliance Statements for Environmental Requirements

Batteries in this product are not based on mercury, lead, or cadmium substances. The batteries used in this product are in compliance with EU Directives 91/157/EEC, 93/86/EEC, and 98/101/EEC. The product documentation includes instructional information about the proper method of reclamation and recycling.

Compliance Statements for NEBS for the M120 Router

- The equipment is suitable for installation as part of the Common Bonding Network (CBN).
- The equipment is suitable for installation in locations where the National Electrical Code (NEC) applies.
- The battery return connection is to be treated as an isolated DC return (that is, DC-I), as defined in GR-1089-CORE.
- You must provision a readily accessible device outside of the equipment to disconnect power. The device must also be rated based on local electrical code practice.
Compliance Statements for Acoustic Noise for the M120 Router

The router complies with NEBS Level 3 requirements:

- GR-63-CORE: NEBS, Physical Protection
- GR-1089-CORE: EMC and Electrical Safety for Network Telecommunications Equipment

Related Documentation

- Agency Approvals for M120 Routers on page 351
- Compliance Statements for NEBS for the M120 Router on page 354
- Compliance Statements for EMC Requirements for Juniper Networks Devices (United States) on page 354
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Japan) on page 354
- Compliance Statements for EMC Requirements for Juniper Networks Devices (Canada) on page 353