This publication contains information to help you select a 1394 Digital, AC, Multi-Axis Motion Control System:

- Comprehensive descriptions of the various 1394 systems
- An explanation of what you need for a complete system
- System, environmental, and power dissipation specifications
- System module and axis module dimensions
- Interconnection information
- A list of related publications
- A simple step-by-step selection process
- Tables that help you determine the catalog numbers of the system module, axis module(s) and external shunt resistor (optional)
- A convenient system configuration worksheet
What is the 1394

The 1394 is a modular, multi-axis, motion control and drive family. Its unique design allows the 1394 to be used as: an integrated motion controller (IMC–S/23x) and drive (GMC); an integrated CNC controller (9/440) and drive; a 9/series CNC digital interface and drive; or a stand-alone servo drive.

All 1394 systems provide direct line connections (transformerless) for 380 to 460V three-phase input power, efficient IGBT power conversion, and slide-and-lock, module-to-module connection systems. Each system module can be configured with up to four axis modules, with each axis module interfacing with a motor. Because of its integrated design, the 1394 decreases the number of electrical connections and provides significant panel space savings.

GMC System

The 1394 GMC System provides all the functionality of the IMC S Class Compact Motion Controller, as well as power conversion, integrated within the 1394 system module. The system is completely programmed and commissioned via GML (Graphical Motion Control Language). Allen-Bradley DH485, RS–232, and RS–422 are standard and Remote I/O and AxisLink are available as communication options.
CNC Interface System

The 1394 9/Series CNC Interface System provides a digital servo system to be used with the 9/260 and 9/290 CNC. This system provides all power electronics and uses a cost-saving digital interface approach. Servo control for this system is handled by the 9/Series CNC. A fiber optic I/O ring is provided to the 1394 and the system is completely interfaced with and programmed using ODS (Offline Development System) and the CNC operator panel. Allen-Bradley Remote I/O, MMS/Ethernet (9/260 and 9/290 only), and Data Highway Plus (9/260 and 9/290 only) communications are available options with the 9/Series CNC interface system.

Figure 2
CNC Interface System (1394–SJTx–E)
9/440 CNC System

The 9/440 CNC System provides all the functionality of the 9/Series CNC as well as power conversion, integrated within the 1394 system module. The system is completely programmed and commissioned using ODS (Offline Development System) and the CNC Operator Panel. RIO, RS–232 and RS–422 communications are standard. For more information, refer to the 9/Series CNC Product Specifications (publication number 8520–2.1.1)

Figure 3
9/440 CNC System (8520–xS–x–x)
Stand-Alone Servo System

The 1394 Stand-Alone Servo System provides a digital servo drive system with a traditional ±10V DC analog interface. It can be used as a velocity or torque control system and is quickly commissioned with the Allen-Bradley universal Bulletin 1201 HIM (Human Interface Module), which provides access to auto tuning and startup prompting. The 1394 also provides a SCANport interface as a standard feature.

Figure 4
Servo System 1394–SJTxx–A

Spare Allen-Bradley Parts
Standard Features of the 1394

The 1394 provides the following standard features:

- UL Listed and CSA Certified
- CE Marked

Control

- Supports GMC, CNC, and Stand-alone Servo configurations with a standard array of hardware
- Digitally-adjusted velocity and current loop compensation, which accommodates a wide range of system inertias
- Two configurable analog test outputs that can be linked to critical system parameters for troubleshooting (GMC and Servo system modules)
- All systems provide digital fault and diagnostic utilities (including a current monitor, thermal overload detection, and a feedback signal monitor)
- Status LEDs for system and axis modules
- Status LEDs for motion board, Axislink, and RIO (GMC system only)
- Highly-integrated surface mount circuitry
- Encoder signal output (A QUAD B) for encoder emulation (2048 ppr, 13 bit for the GMC and Servo system modules) (8192, 15 bit, selectable for the CNC Interface system module)
- DSP assisted processing

Power

- IGBT technology for efficient, quiet operation
- Transient (MOV) voltage and ground fault protected input
- An integral 200W shunt resistor
- Current ratings of 3.0, 4.5, 7.5A and 35A continuous, at 50° C (122° F) (inside cabinet), with up to 300% motor ratings for high duty-cycle operation producing continuous torque ranges of 0.7 to 53.0 N-m (6 to 469 lb-in.)
- 324–528V AC, three-phase, 50/60 Hz direct line inputs
- No isolation transformer or inductors are required (380/460V AC Hz direct line operation) for most applications
- Advanced protective features, such as software-based current foldback, which provides overload tolerant operation and soft current limiting
Integration

- Hinged system module front cover for easy access to control and power wiring
- System and axis modules that can be quickly removed and easily interchanged for troubleshooting and diagnostics
- Standard 50 mm (AM03/04/07) and 75 mm (AM75) wide mounting configurations.
- Mass termination plugs and reliable, constant pressure, contact-type, terminal blocks are used for easy installation and service
- Plug interconnects for velocity/torque command (servo), encoder input (GMC), encoder output and motor resolver input (all)
- Slide-and-lock, module-to-module connection, which eliminates bus bars and wiring harnesses
- Advanced communications and I/O capabilities help integrate the 1394 to standard plant floor networks

What is a 1394 System

A base 1394 system consists of the following:

System Modules

System modules are available in four types, (GMC, CNC Interface, 9/440, and Stand-Alone Servo) with ratings of 5.0 and 10.0 kW (at 460V). The system module houses the system control PCB and converts 380 – 460V AC, three-phase, 50/60 Hz input power to a 530 – 680V DC link voltage. It has an internal shunt resistor with a 200W continuous rating and a peak rating of 40,000W. A single system module can power and control up to four axis modules.

Axis Modules

Axis modules, with continuous output currents (RMS) of 3.0, 4.5, 7.5 and 35.0A convert the DC power supplied by the system module to a variable AC voltage. You will require one axis module for every 1326Ax–Bxxx servomotor you plan to run using the 1394. Choose each axis module based on the current requirements of the servomotor.
Optional System Module Cables

The following pre-configured cables are available to make integration easier. These cables have the mating connectors (system module end) already installed and provide flying leads (1394–GE15, 1394–SA15) or mating connectors (1394–GR04) on the other end. Refer to the figures that follow for connection information.

Figure 5
Connecting a 4100–REC and an 845H Encoder to the 1394

Figure 6
Connecting a Customer-Supplied Motion Controller to the 1394
Motors

There are two series of 460V AC, permanent magnet, brushless servomotors that can be used with the Bulletin 1394.

Bulletin 1326AB–Bxxx

This family of high-performance, medium inertia, ferrite, three-phase servomotors feature a specially designed housing that reduces motor length. They are available with continuous torque ratings of 2.3 to 53.0 N-m (20.7 to 469.0 lb-in.). Refer to the 1326AB 460V Torque Plus Series Servomotor Product Data (Publication 1326A–2.9) for more information on features and options.

Bulletin 1326AS–Bxxx

This family of high-performance servomotors feature neodymium-iron-boron permanent magnets rotors that provide low inertias, high accelerations and high peak torques. They are available with continuous torque ratings of 0.7 to 9.0 N-m (6 to 80 lb-in.). Refer to the 1326AS Series Low Inertia, Brushless Servomotor Product Data (Publication 1326A–2.10) for more information on features and options.

Important: 1326AS–Bxxx motors can not be used with the 9/Series and 9/440 Series controllers.

Motor Cables

Two cables (motor power and motor feedback) are required for each motor. Allen-Bradley offers two types of specially designed cables to meet stringent emissions and shielding requirements. Refer to the 1326AB 460V Torque Plus Series Servomotor Product Data (Publication 1326A–2.9) or the 1326AS Series Low Inertia, Brushless Servomotor Product Data (Publication 1326A–2.10) for more information.

Standard Tray-Rated Cables (1326–CCU–xxx, 1326–CPx1–xxx)

Bulletin 1326 cables are specially designed for use with the Bulletin 1394 and the 1326Ax (460V) motors. All cables feature a durable, chemically-resistant jacket; advanced shielding; a molded quick disconnect connection system; and IP67 protection for harsh environments.

High Flex-Rated Cables (1326–CCUT–xxx, 1326CPx1T–xxx)

Power track cabling is required for applications where dynamic linear flexing occurs. Allen-Bradley high, flex-rated cables have excellent minimum bend radius specifications and a long flex cycle life in linear flex applications.
External Shunt Resistor Kits

You can add an optional 1000W external shunt resistor (catalog number 1394–SR10A) to handle regenerative loads that exceed the capacity of the shunt resistor included with every system module. The external shunt resistor kit contains a resistor bank, mounting hardware, fuse holder, fuse, and 1.5 m leadwire. If you mount the external shunt resistor away from the 1394, it may require guarding or other protection, depending on your local codes. You may need the external shunt resistor kit if your system has/does either of the following:

- Overhauling loads of significant duration, speed, and torque where multiple axes are regenerating and exceed the motoring axes loads
- Stopping many axes where all axes speeds and loads are high and machine friction is low

The external shunt resistor kit is available for systems with regenerative loads that exceed the capacity of the internal 200W shunt resistor provided. Many systems will not require an external shunt resistor kit.

**ATTENTION:** The external shunt resistor is of open construction and may reach temperatures in excess of 400°C (752°F). Resistor must be guarded to avoid hazard of shock or serious burns and ignition of flammable material.

User-Supplied Components

- Contactor
- Input fusing
- 24V AC or DC logic power for system module and contactor enable/DRIVEOK power

Input Power Conditioning

You can directly connect the 1394 to a three-phase, AC power line. However, certain power line conditions can cause intermittent faults or fuse trips. If either of the following is true, you can use a line reactor or isolation-type transformer to reduce the possibility of intermittent faults and fuse trips.

- The AC line supplying the drive has power factor correction capacitors
- The AC line frequently experiences transient power interruptions or significant voltage spikes
The general specifications of the 1394 are provided below. These specifications are for reference only and are subject to change without notice.

### System Modules

The table below shows the specifications for the ratings available for system modules:

<table>
<thead>
<tr>
<th>The:</th>
<th>For the 1394–SJT05 is:</th>
<th>For the 1394–SJT10 is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated AC input voltage</td>
<td>324–528V AC 50/60 Hz</td>
<td>324–528V AC 50/60 Hz</td>
</tr>
<tr>
<td>AC input current</td>
<td>6.5A</td>
<td>13.0A</td>
</tr>
<tr>
<td>Peak inrush current¹</td>
<td>975A</td>
<td>1300A</td>
</tr>
<tr>
<td>Line loss ride through</td>
<td>20 ms</td>
<td>20 ms</td>
</tr>
<tr>
<td>Nominal bus output voltage</td>
<td>530/680V DC</td>
<td>530/680V DC</td>
</tr>
<tr>
<td>Continuous power output</td>
<td>4/5 kW</td>
<td>8/10 kW</td>
</tr>
<tr>
<td>Peak power output</td>
<td>28 kW</td>
<td>28 kW</td>
</tr>
<tr>
<td>Efficiency</td>
<td>99%</td>
<td>99%</td>
</tr>
<tr>
<td>Weight</td>
<td>11 kg (24.25 lb)</td>
<td>11 kg (24.25 lb)</td>
</tr>
<tr>
<td>Continuous current output</td>
<td>7.36A</td>
<td>14.73A</td>
</tr>
<tr>
<td>Peak current output</td>
<td>15.0A</td>
<td>29.46A</td>
</tr>
<tr>
<td>Capacitance</td>
<td>220 µF</td>
<td>330 µF</td>
</tr>
<tr>
<td>Inductance</td>
<td>1000 µH</td>
<td>750 µH</td>
</tr>
<tr>
<td>Internal shunt resistor</td>
<td>200W continuous, 40,000W peak (two second maximum on time)</td>
<td></td>
</tr>
</tbody>
</table>

¹ Peak inrush current = Line voltage × 1.1 × \(\sqrt{\frac{L_{\text{system}}}{C_{\text{system}}}}\) \(\sqrt{\frac{L_{\text{axes}}}{C_{\text{axes}}}}\)

Where: 
- \(L\) = Inductance
- \(C\) = Capacitance

Spare Allen-Bradley Parts
Axis Modules

The table below shows the specifications for the axis modules:

<table>
<thead>
<tr>
<th></th>
<th>For the 1394–AM03 is:</th>
<th>For the 1394–AM04 is:</th>
<th>For the 1394–AM07 is:</th>
<th>For the 1394–AM75 is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed Regulation*</td>
<td>0 to 0.05% of base speed with 100% torque disturbance</td>
<td>0 to 0.05% of base speed with 100% torque disturbance</td>
<td>0 to 0.05% of base speed with 100% torque disturbance</td>
<td>0 to 0.05% of base speed with 100% torque disturbance</td>
</tr>
<tr>
<td>Static Gain (rms A/mV)*</td>
<td>1.28</td>
<td>2.6</td>
<td>4.9</td>
<td>22.8</td>
</tr>
<tr>
<td>Peak Current Limit Adjust</td>
<td>200%</td>
<td>200%</td>
<td>200%</td>
<td>143%</td>
</tr>
<tr>
<td>Modulation Frequency</td>
<td>5 kHz ± 10%</td>
<td>5 kHz ± 10%</td>
<td>5 kHz ± 10%</td>
<td>5 kHz ± 10%</td>
</tr>
<tr>
<td>Drift</td>
<td>0.03 rpm/degree C</td>
<td>0.03 rpm/degree C</td>
<td>0.03 rpm/degree C</td>
<td>0.03 rpm/degree C</td>
</tr>
<tr>
<td>Nominal Input Voltage</td>
<td>530/680V DC</td>
<td>530/680V DC</td>
<td>530/680V DC</td>
<td>530/680V DC</td>
</tr>
<tr>
<td>Continuous Current (rms)</td>
<td>3.0A</td>
<td>4.5A</td>
<td>7.5A</td>
<td>35.0A</td>
</tr>
<tr>
<td>Peak Current (rms – 1 second)</td>
<td>6.0A</td>
<td>9.0A</td>
<td>15.0A</td>
<td>50.0A</td>
</tr>
<tr>
<td>Continuous Power Out 380/480V nominal</td>
<td>1.6/2 kW</td>
<td>2.4/3 kW</td>
<td>4/5 kW</td>
<td>17.8/23.8 kW</td>
</tr>
<tr>
<td>Efficiency</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
<td>98%</td>
</tr>
<tr>
<td>Weight</td>
<td>5 kg (11.02 lb)</td>
<td>5 kg (11.02 lb)</td>
<td>5 kg (11.02 lb)</td>
<td>7 kg (15.44 lb)</td>
</tr>
<tr>
<td>Capacitance</td>
<td>110 μF</td>
<td>110 μF</td>
<td>220 μF</td>
<td>660 μF</td>
</tr>
</tbody>
</table>

* When used with the controller in the 1394–SJT.xx system module.

Contact Ratings

The table below shows the contact ratings of the drive relay outputs:

<table>
<thead>
<tr>
<th>The contact rating for the:</th>
<th>Is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive OK (DROK)</td>
<td>115V AC/24V DC, 1A inductive</td>
</tr>
<tr>
<td>Contactor Enable Relay</td>
<td>115V AC/24V DC, 1A inductive</td>
</tr>
</tbody>
</table>

User-Supplied Contactor (M1)

The table below shows the requirements for the contactor that you must supply:

<table>
<thead>
<tr>
<th>The contactor:</th>
<th>Is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>600V AC, 30A</td>
</tr>
<tr>
<td>Recommended types:</td>
<td></td>
</tr>
<tr>
<td>AC Coil Operation</td>
<td>Allen–Bradley 100–A30Nx3 (where x indicates the coil voltage)</td>
</tr>
<tr>
<td>Note</td>
<td>A surge suppressor is required</td>
</tr>
<tr>
<td>DC Coil Operation</td>
<td>Allen–Bradley 100–A30NZx3 (where x indicates the coil voltage)</td>
</tr>
</tbody>
</table>
User-Supplied Line Input Fusing or Circuit Breaker

The table below shows the requirements for the input fusing that you must supply:

<table>
<thead>
<tr>
<th>The:</th>
<th>For input fusing is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>600V AC, 20A</td>
</tr>
<tr>
<td>Recommended Type</td>
<td>Bussmann FRS–R–20A or equivalent (three are required)</td>
</tr>
</tbody>
</table>

The table below shows the requirements for the circuit breaker that you must supply:

<table>
<thead>
<tr>
<th>The:</th>
<th>For input circuit breaker:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>480V AC, 40A</td>
</tr>
<tr>
<td>Recommended type</td>
<td>Allen-Bradley 1492–CB3H400, 100,000A interrupt current rating</td>
</tr>
</tbody>
</table>

**ATTENTION:** If you use a circuit breaker to protect the 1394 system, the main control cabinet breaker or fuse must have at least a 100,000A interrupt current rating. A fire hazard can exist if you do not adhere to this breaker interrupt current rating requirement.

User-Supplied 24V Logic Input Power

The table below shows the requirements for the 24V logic input power that you must supply:

<table>
<thead>
<tr>
<th>The:</th>
<th>For 24V logic input power must be:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating</td>
<td>19 – 28V AC rms, single phase, 50/60 Hz or 18.75 – 31.25V DC</td>
</tr>
<tr>
<td>Current</td>
<td>If you have: Current draw for user-supplied power:</td>
</tr>
<tr>
<td>Current:</td>
<td>Supply:</td>
</tr>
<tr>
<td>1 axis</td>
<td>3.5A</td>
</tr>
<tr>
<td>2 axes</td>
<td>4.4A</td>
</tr>
<tr>
<td>3 axes</td>
<td>5.2A</td>
</tr>
<tr>
<td>4 axes</td>
<td>6A</td>
</tr>
<tr>
<td>Fusing (Recommended Type)</td>
<td>Bussman MDA–15 or equivalent</td>
</tr>
</tbody>
</table>
External Shunt Resistor Kit

The table below shows the ratings for the external (optional) shunt resistors:

<table>
<thead>
<tr>
<th>The:</th>
<th>Is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating of the external shunt resistor kit (optional)</td>
<td>1000W continuous, 40,000W peak (two second maximum on time)</td>
</tr>
<tr>
<td>Resistance of the external shunt resistor</td>
<td>16 ohms</td>
</tr>
<tr>
<td>Shipping weight of the external shunt resistor kit</td>
<td>4.99 kg (11 lb)</td>
</tr>
</tbody>
</table>

Environmental Specifications

Mount the 1394 in an enclosure that is clean and dry (IP55 protection rating minimum (IEC publication 529)). For enclosures ventilated with ambient air, be sure to have appropriate filtering to protect against contamination. Keep the ambient air temperature between 0° and 50° C (32° and 122° F) and the humidity between 5% and 95%, non-condensing.

The 1394 can operate at elevations to 1000 meters (3300 ft) without derating. However, the continuous current rating must be derated by 3% for each additional 300 m (1000 ft) up to 3000 m (10,000 ft). Consult with your local Allen-Bradley Sales Representative prior to operating at over 3000 m (10,000 ft).

Power Dissipation

The power dissipation characteristics of the 1394 System and Axis Modules are provided on the following page (use for both 460V and 380V input).

**Important:** Use the power dissipation figures on the following page to calculate cumulative system heat dissipation to ensure that the ambient temperature inside the enclosure does not exceed 50° C (122° F). To calculate total power dissipation, add the dissipation of the system module to the dissipation of the axis module(s).
System Modules

The power dissipation (in watts) of the system module types is shown below:

<table>
<thead>
<tr>
<th>At a rated power output of:</th>
<th>The power dissipation for the 1394–SJT05–x is:</th>
<th>The power dissipation for the 1394–SJT10–x is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>66</td>
<td>70</td>
</tr>
<tr>
<td>40%</td>
<td>70</td>
<td>77</td>
</tr>
<tr>
<td>60%</td>
<td>73</td>
<td>84</td>
</tr>
<tr>
<td>80%</td>
<td>77</td>
<td>81</td>
</tr>
<tr>
<td>100%</td>
<td>80</td>
<td>98</td>
</tr>
</tbody>
</table>

Shunt Resistor

When the system module’s internal shunt resistor is active, some additional power will be dissipated at the system module. The shunt resistor’s maximum dissipation is 200W. Many applications will use less than 10% of this capacity.

Axis Modules

The power dissipation (in watts) of the axis modules is shown below:

<table>
<thead>
<tr>
<th>At a rated power output of:</th>
<th>The power dissipation for the 1394–AM03 is:</th>
<th>The power dissipation for the 1394–AM04 is:</th>
<th>The power dissipation for the 1394–AM07 is:</th>
<th>The power dissipation for the 1394–AM75(^1) is:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total:</td>
<td>In cabinet:</td>
<td>Outside Cabinet:</td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>24</td>
<td>27</td>
<td>33</td>
<td>85</td>
</tr>
<tr>
<td>40%</td>
<td>30</td>
<td>36</td>
<td>48</td>
<td>145</td>
</tr>
<tr>
<td>60%</td>
<td>36</td>
<td>45</td>
<td>63</td>
<td>212</td>
</tr>
<tr>
<td>80%</td>
<td>42</td>
<td>54</td>
<td>78</td>
<td>279</td>
</tr>
<tr>
<td>100%</td>
<td>48</td>
<td>63</td>
<td>93</td>
<td>346</td>
</tr>
</tbody>
</table>

\(^1\) The AM75 is designed to be mounted with the rear heat sink extended outside the customer-supplied enclosure.
Dimensions for the 1394

The drawings on the following pages show the dimensions of the 1394.

**Figure 7**
System Module Dimensions

Dimensions are in millimeters and (inches)
Depth = 279.4 (11.0)

**Mounting Hole Detail**

All Slots Accept M6, 1/4-20 Mtg. Screws

*Note* Dimension shown is for mounting hardware location and does not reflect the location of the lower slot radius.

Note 1: 25 mm (1.0 in.) side clearance at front cover advised for door operation.

Note 2: 50 mm (2.0 in.) side clearance at front of 1394 advised for terminator and slider release.
Figure 8
1394–AM03, AM04 and AM07 Axis Module Front Dimensions

Dimensions are in millimeters and (inches)

343.0 (13.50)
25.4 (1.00)
28.5 (1.12)
343.0 (13.50)
50.0 (1.97)
50.0 (1.97)
50.0 (1.97)

Mounting Hole Detail

8.0 (0.31)
10.1 (0.40)
15.9 (0.63)

8.0 (0.31)
12.0 (0.47)

All slots accept M6, 1/4-20 mtg. screws

*Note: Dimension shown is for mounting hardware location and does not reflect the location of the lower slot radius.

Figure 9
1394–AM03, AM04 and AM07 Axis Module Side Dimensions

280 (11.02)
350 (13.78)
Figure 10
1394–AM75 Axis Module Front Dimensions

Dimensions are in millimeters and (inches)

Figure 11
1394–AM75 Axis Module Side Dimensions

*Note: Dimension shown is for mounting hardware location and does not reflect the location of the lower slot radius.

*Note: Heat sink width only.
This section provides interconnection diagrams for the GMC, CNC Interface, and Servo version, showing the inputs, outputs and wiring between 1394 components. Because there are many possible electrical circuit designs, these diagrams are provided for reference only. Refer to the 9/440 Information Manual (8520–IMM) for 9/440 information. The following notes apply to the interconnect diagrams on the following pages.

<table>
<thead>
<tr>
<th>Note</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power wiring is 3.3 mm² (12 AWG), 75 degrees C minimum, copper wire.</td>
</tr>
<tr>
<td>2</td>
<td>Input fuse to be Bussmann FRS-R-20A, Class RK-5.</td>
</tr>
<tr>
<td>3</td>
<td>Control Wiring: 0.83 mm² (18 AWG) minimum, 15A maximum.</td>
</tr>
<tr>
<td>4</td>
<td>Allen-Bradley motor (1326-CPB1-xxx or 1326-CPC1-xxx) and resolver (1326-CCU-xxx) cables.</td>
</tr>
<tr>
<td>5</td>
<td>Terminate shield on one end only.</td>
</tr>
<tr>
<td>6</td>
<td>Contactor coil (M1) needs an integrated surge suppressors for AC coil operation.</td>
</tr>
<tr>
<td>7</td>
<td>TB1 pins 24, 25, 26 (16, 17, 18 on Servo) are used for speed and current output commands. ±1.2V DC/1000 rpm (velocity) and ±3V DC = 100% (current), ±6V DC = 200%, ±9V DC = 300% (current command). Use the parameter link function to read the outputs for Axis 0, 1, 2 or 3 (servo only).</td>
</tr>
<tr>
<td>8</td>
<td>The RIO/AxisLink option (-RL) must be ordered with the system module and is installed at the factory. You cannot order these individually.</td>
</tr>
<tr>
<td>9</td>
<td>AxisLink and RIO board connections use Allen–Bradley 1770–CD (Belden 9463 or equivalent).</td>
</tr>
<tr>
<td>10</td>
<td>Use 4100-CCFI or –CCF3 flex I/O cables. Cable length must not exceed 914.4 mm (36 in.).</td>
</tr>
<tr>
<td>11</td>
<td>User-supplied 5V DC power source is required for encoder board regardless if encoder supply voltage is 5V or not.</td>
</tr>
<tr>
<td>12</td>
<td>Resolver inputs for Axis 0 (J5/FB0) are shown. Axis 1, 2 and 3 are identical – use J6/FB1 for Axis 1, J7/FB2 for Axis 2 and J10/FB3 for Axis 3.</td>
</tr>
<tr>
<td>13</td>
<td>Jumper is factory set to J26 &amp; J27 indicating grounded system at user site. Ungrounded sites must jumper the bleeder resistor (J27 &amp; GND3) to prevent high electrostatic buildup.</td>
</tr>
<tr>
<td>14</td>
<td>For multiple axis systems requiring all axes to fault when one motor therm sensor trips – interconnect TB2, pin 3 of each axis to TB2 pin 4 of the adjacent axis. For single-axis control, wire each axis separately.</td>
</tr>
<tr>
<td>15</td>
<td>Either TB1–1, 2 or TB2–1, 2 system enable needs to be energized to enable (hardware) up to four axes. You do not need both TB1–1, 2 and TB2–1, 2.</td>
</tr>
<tr>
<td>16</td>
<td>System enable can be: 1) always tied to 24V DC, use GML to software enable each axis, 2) inserted in the ESTOP string to pull in/out with the M1 contactor, or 3) used in a secondary stop string (for example, photoeye work area).</td>
</tr>
<tr>
<td>17</td>
<td>You must jumper P1 for the optional external shunt resistor.</td>
</tr>
<tr>
<td>18</td>
<td>You must supply source power for Flex I/O (for example, 1794–IB16–24V DC and 1794–IA8–115V AC).</td>
</tr>
<tr>
<td>19</td>
<td>This input is monitored by the CPU and is not intended to be a safety circuit.</td>
</tr>
<tr>
<td>20</td>
<td>The motor thermal switches should be wired in series to the customer stop circuit to prevent damage to the motor.</td>
</tr>
<tr>
<td>21</td>
<td>The thermal switch circuit is a source of conducted noise. Isolation from customer control devices may be required. A separate 24V DC supply or relay can be used.</td>
</tr>
<tr>
<td>22</td>
<td>Brake control can be accomplished using the Flex I/O outputs and adding the appropriate logic to the GML application program. In this case, connect the leads from the axis module TB2 to the appropriate Flex I/O output.</td>
</tr>
<tr>
<td>23</td>
<td>Brake control must be provided by the user–supplied controller.</td>
</tr>
<tr>
<td>24</td>
<td>The brake circuit must be routed to the CNC output module. The brake control logic must be configured in PAL.</td>
</tr>
</tbody>
</table>
Figure 12
GMC System Interconnect Diagram

System Module

Motion Input Wiring Board

Motion Drive Board

Motion CPU Board

User Supplied 24V AC RMS or 24V DC (Non-Polarized)

Three-Phase Input 380-460V AC RMS

Notes 1, 2

Drive O.K. Relay
Rated at 115VAC, 24VDC, 1A Inductive

DS1
Solid Green = Bus Up, Axis Enabled
Flashing Green = Bus Up, Axis Not Enabled
Flashing Red/Green = Ready, Bus Not Up
Flashing Red = Fault
Solid Red = Hardware Failure

P1

DC Minus Bus

DC Bus Pos.

DC Bus Neg.

Motion Input Wiring Board

Motion Drive Board

Motion CPU Board

Flexible I/O Modules

Flexible I/O

Option

User Supplied 24V AC RMS or 24V DC. (Non-Polarized)

Optional External Shunt

Drive OK

DS1

Solid Green = Bus Up, Axis Enabled
Flashing Green = Bus Up, Axis Not Enabled
Flashing Red/Green = Ready, Bus Not Up
Flashing Red = Fault
Solid Red = Hardware Failure

P1

DC Minus Bus

DC Bus Pos.

DC Bus Neg.

Flexible I/O Modules

Flexible I/O

Option

User Supplied 24V AC RMS or 24V DC. (Non-Polarized)

Optional External Shunt

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DC Bus Pos.

DC Bus Neg.

Flexible I/O Modules

Flexible I/O

Option

User Supplied 24V AC RMS or 24V DC. (Non-Polarized)

Optional External Shunt

Drive OK

DS1

Solid Green = Bus Up, Axis Enabled
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Flashing Red/Green = Ready, Bus Not Up
Flashing Red = Fault
Solid Red = Hardware Failure

P1

DC Minus Bus

DC Bus Pos.

DC Bus Neg.

Flexible I/O Modules

Flexible I/O

Option

User Supplied 24V AC RMS or 24V DC. (Non-Polarized)

Optional External Shunt

Drive OK

DS1

Solid Green = Bus Up, Axis Enabled
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Flashing Red/Green = Ready, Bus Not Up
Flashing Red = Fault
Solid Red = Hardware Failure

P1

DC Minus Bus

DC Bus Pos.

DC Bus Neg.

Flexible I/O Modules

Flexible I/O

Option

User Supplied 24V AC RMS or 24V DC. (Non-Polarized)

Optional External Shunt

Drive OK

DS1

Solid Green = Bus Up, Axis Enabled
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Flashing Red/Green = Ready, Bus Not Up
Flashing Red = Fault
Solid Red = Hardware Failure

P1

DC Minus Bus

DC Bus Pos.

DC Bus Neg.

Flexible I/O Modules

Flexible I/O

Option

User Supplied 24V AC RMS or 24V DC. (Non-Polarized)

Optional External Shunt

Drive OK

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Solid Green = Bus Up, Axis Enabled
Flashing Green = Bus Up, Axis Not Enabled
Flashing Red/Green = Ready, Bus Not Up
Flashing Red = Fault
Solid Red = Hardware Failure

P1

DC Minus Bus

DC Bus Pos.

DC Bus Neg.

Flexible I/O Modules

Flexible I/O

Option

User Supplied 24V AC RMS or 24V DC. (Non-Polarized)

Optional External Shunt

Drive OK

DS1

Solid Green = Bus Up, Axis Enabled
Flashing Green = Bus Up, Axis Not Enabled
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Flashing Red = Fault
Solid Red = Hardware Failure

P1

DC Minus Bus

DC Bus Pos.

DC Bus Neg.

Flexible I/O Modules

Flexible I/O

Option

User Supplied 24V AC RMS or 24V DC. (Non-Polarized)

Optional External Shunt

Drive OK

DS1

Solid Green = Bus Up, Axis Enabled
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Flashing Red = Fault
Solid Red = Hardware Failure

P1

DC Minus Bus

DC Bus Pos.

DC Bus Neg.

Flexible I/O Modules

Flexible I/O

Option

User Supplied 24V AC RMS or 24V DC. (Non-Polarized)

Optional External Shunt

Drive OK

DS1

Solid Green = Bus Up, Axis Enabled
Flashing Green = Bus Up, Axis Not Enabled
Flashing Red/Green = Ready, Bus Not Up
Flashing Red = Fault
Solid Red = Hardware Failure

P1

DC Minus Bus

DC Bus Pos.

DC Bus Neg.
AXIS MODULE (TYPICAL)

MOTOR CABLE (TYPICAL)
NOTE 4

1326Ax AC Servomotor

RESOLVER

ENCODER (OPTIONAL)

IMPORTANT: GROUND BAR MUST BE AS CLOSE TO DRIVE AS POSSIBLE

3.3 MM² (12 AWG)

TERMINATOR CONNECTOR REQUIRED ON LAST AXIS

TO OTHER AXES

NOTES 20, 21, 22

OPTIONAL THREE-PHASE INPUT NEUTRAL

3.3 MM² (12 AWG)

3.3 MM² (12 AWG)

FACILITY GROUND

SOLID GREEN = BUS UP, AXIS ENABLED
FLASHING GREEN = BUS UP, AXIS NOT ENABLED
FLASHING RED/GREEN = READY, BUS NOT UP
FLASHING RED = FAULT
SOLID RED = HARDWARE FAILURE

* INDICATES USER SUPPLIED COMPONENT

DS1

THERMOSTAT AND BRAKE FEEDTHRU

TB1

TB2

NOTE 14

GROUND BAR

TO OTHER AXES (PE GND)

3.3 MM² (12 AWG)

3.3 MM² (12 AWG)

3.3 MM² (12 AWG)

Interfaces to Other Axes

USER BRAKE CONTROL INPUT

TO OTHER AXES

3.3 MM² (12 AWG)

GROUND BAR

FACTORY GROUND

NOTES 20, 21, 22

3.3 MM² (12 AWG)

3.3 MM² (12 AWG)

FACILITY GROUND

SOLID GREEN = BUS UP, AXIS ENABLED
FLASHING GREEN = BUS UP, AXIS NOT ENABLED
FLASHING RED/GREEN = READY, BUS NOT UP
FLASHING RED = FAULT
SOLID RED = HARDWARE FAILURE

* INDICATES USER SUPPLIED COMPONENT

Spare Allen-Bradley Parts
**Figure 14**
Servo System Interconnect Diagram

### System Module
- **DB1**
  - Solid Green = Bus Up, Axis Enabled
  - Flashing Green = Bus Up, Axis Not Enabled
  - Flashing Red/Green = Ready, Bus Not Up
  - Flashing Red = Fault
  - Solid Red = Hardware Failure

### Servo Input Wiring Board
- **Common**
- **Drive O.K. Relay**
  - Rated at 115VAC, 24VDC, 1A Inductive

### Contactor Enable Relay
- Rated at 115VAC, 24VDC, 1A Inductive

### Servo Control Board
- **RS-232**

### AQB Board
- **Encoder Emulation Output**

**NOTE:** 1394-SA15 Cable (Optional)

---

**User Supplied 24V AC RMS or 24V DC. (Non-Polarized)**

**Three-Phase Input**
- 380-460V AC RMS

**Control Power & Signals**
- DC Bus Pos.
- DC Bus Neg.

**Slave Interconnect**
- DC+ COL W1 U W2 V W V W

**INPUT FUSING**
- M1

**OPTIONAL EXTERNAL SHUNT**
- User Supplied 24V AC RMS or 24V DC (Non-Polarized)

**Encoder Emulation Output Input From Motion Controller**

**Feedback Output To Motion Controller**

**CONTACTOR ENABLE RELAY**
- Rated at 115VAC, 24VDC, 1A Inductive

**STOP**
- Contactors

**START**
- Contactors

**NOTE:**
- 1, 2
- 3, 5
- 3, 6
- 4
- 7
- 10
- 11
- 12
- 13
- 17
Although not everyone will use the same exact method for selecting the equipment they need, the steps below describe the general process that most people will use to determine the equipment necessary to meet their needs. You will determine:

- The type of system module
- The motor required
- Which axis module is required for the motor you selected
- The system module output rating in kW
- If you selected GMC, whether you will use RIO or AxisLink
- The accessories that you need

1. Use the table below to determine the type of system module you need.

<table>
<thead>
<tr>
<th>If you:</th>
<th>Select this system module:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Need a motion controller and drive combination</td>
<td>The GMC System Module (1394–SJTx–C or C–RL)</td>
</tr>
<tr>
<td>Have a 9/Series CNC control (digital 1394 servo interface)</td>
<td>The CNC Interface System Module (1394–SJTx–E)</td>
</tr>
<tr>
<td>with which you will use this system module</td>
<td></td>
</tr>
<tr>
<td>Need an integrated CNC and drive combination</td>
<td>The 9/440 CNC System Module (8520–xxSx)</td>
</tr>
<tr>
<td>Have an existing stand-alone motion controller</td>
<td>The Stand–Alone Servo System Modul (1394–SJ Tx–A)</td>
</tr>
<tr>
<td>with which you will use this system module</td>
<td></td>
</tr>
</tbody>
</table>

2. Use the 1326AB 460V Torque Plus Series Servomotor Product Data (publication 1326A–2.9) and 1326AS Series Low Inertia, Brushless Servomotor Product Data (publication 1326A–2.10) to choose a motor that meets the speed, torque and inertia requirements of your application.

**Important:** 1326AS–Bxx (rare earth) motors cannot be used with the 9/Series and 9/440 Series controllers.

3. Use Table A and Table B to determine which axis module you need for the motor you selected in step 2.
## Table A
Performance data for 1326AS Series Motors and 1394 Axis Module Combinations ¹

<table>
<thead>
<tr>
<th>Motor Catalog Number</th>
<th>Rated Speed rpm at 460V</th>
<th>380V</th>
<th>Motor Rated Torque N-m (lb-in.)</th>
<th>Motor Rated Current Amperes</th>
<th>Motor Rated Output kW</th>
<th>Rotor Inertia kg·m² (lb-in.–s²)</th>
<th>System Cont. Torque N-m (lb-in.)</th>
<th>System Peak Stall Torque N-m (lb-in.)</th>
<th>System Cont. Stall Current Amperes</th>
<th>System Peak Stall Current Amperes</th>
<th>1394 Axis Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>1326AS–B310H</td>
<td>6000 5000</td>
<td></td>
<td>0.7 (6)</td>
<td>0.8</td>
<td>0.3</td>
<td>0.0000333 (0.0003)</td>
<td>0.7 (6)</td>
<td>2.1 (18)</td>
<td>0.8</td>
<td>2.5</td>
<td>AM03</td>
</tr>
<tr>
<td>1326AS–B330H</td>
<td>6000 5000</td>
<td></td>
<td>2.0 (18)</td>
<td>2.1</td>
<td>0.9</td>
<td>0.0000900 (0.0008)</td>
<td>2.1 (18)</td>
<td>5.6 (50)</td>
<td>2.1</td>
<td>6.0</td>
<td>AM03</td>
</tr>
<tr>
<td>1326AS–B420G</td>
<td>5000 4000</td>
<td></td>
<td>3.2 (28)</td>
<td>2.6</td>
<td>1.2</td>
<td>0.0003327</td>
<td>3.2 (28)</td>
<td>7.3 (65)</td>
<td>2.6</td>
<td>1.0</td>
<td>AM04</td>
</tr>
<tr>
<td>1326AS–B440G</td>
<td>5000 4000</td>
<td></td>
<td>6.4 (56)</td>
<td>5.4</td>
<td>2.0</td>
<td>0.0000504</td>
<td>5.3 (47)</td>
<td>10.6 (94)</td>
<td>4.5</td>
<td>9.0</td>
<td>AM07</td>
</tr>
<tr>
<td>1326AS–B460F</td>
<td>4000 3000</td>
<td></td>
<td>9.0 (80)</td>
<td>6.2</td>
<td>2.8</td>
<td>0.0000702</td>
<td>6.6 (58)</td>
<td>12.9 (114)</td>
<td>4.5</td>
<td>9.0</td>
<td>AM07</td>
</tr>
</tbody>
</table>

¹ All ratings are for 40°C motor ambient, 100°C case and 50°C amplifier ambient. For extended ratings at other than rated ambient temperatures, contact Allen-Bradley.

² Limited by the axis module continuous current.

³ Limited by axis module peak current.
<table>
<thead>
<tr>
<th>Motor Catalog Number</th>
<th>Rated Speed (rpm)</th>
<th>Motor Rated Torque (N-m)</th>
<th>Motor Rated Current (Amperes)</th>
<th>Motor Rated Output (kW)</th>
<th>Rotor Inertia (kg-m²)</th>
<th>System Cont. Torque (N-m)</th>
<th>System Peak Stall Torque (N-m)</th>
<th>System Cont. Stall Current (Amperes)</th>
<th>System Peak Stall Current (Amperes)</th>
<th>1394 Axis Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>1326AB–B410J</td>
<td>7250</td>
<td>2.7 (24)</td>
<td>3.48</td>
<td>1.4</td>
<td>0.0005 (0.004)</td>
<td>2.3 (21)²</td>
<td>4.7 (42)³</td>
<td>3.0</td>
<td>6.0</td>
<td>AM03</td>
</tr>
<tr>
<td>1326AB–B410G</td>
<td>5000</td>
<td>2.7 (24)</td>
<td>2.45</td>
<td>1.0</td>
<td>0.0005 (0.004)</td>
<td>2.7 (24)</td>
<td>6.6 (58)³</td>
<td>2.45</td>
<td>7.32</td>
<td>AM07</td>
</tr>
<tr>
<td>1326AB–B420H</td>
<td>6000</td>
<td>5.1 (45)</td>
<td>5.46</td>
<td>2.2</td>
<td>0.0008 (0.007)</td>
<td>2.8 (25)²</td>
<td>5.6 (50)³</td>
<td>3.0</td>
<td>6.0</td>
<td>AM03</td>
</tr>
<tr>
<td>1326AB–B420E</td>
<td>3000</td>
<td>5.0 (44)</td>
<td>2.84</td>
<td>1.1</td>
<td>0.0008 (0.007)</td>
<td>5.0 (44)</td>
<td>10.6 (94)³</td>
<td>2.84</td>
<td>8.0</td>
<td>AM07</td>
</tr>
<tr>
<td>1326AB–B430G</td>
<td>5000</td>
<td>6.4 (57)</td>
<td>5.6</td>
<td>2.3</td>
<td>0.001 (0.01)</td>
<td>5.2 (46)²</td>
<td>10.3 (92)³</td>
<td>4.5</td>
<td>9.0</td>
<td>AM04</td>
</tr>
<tr>
<td>1326AB–B430E</td>
<td>3000</td>
<td>6.6 (58)</td>
<td>3.9</td>
<td>1.4</td>
<td>0.001 (0.01)</td>
<td>5.1 (45)²</td>
<td>10.1 (89)³</td>
<td>3.0</td>
<td>6.0</td>
<td>AM03</td>
</tr>
<tr>
<td>1326AB–B515G</td>
<td>5000</td>
<td>10.4</td>
<td>9.5</td>
<td>2.9</td>
<td>0.0043 (0.038)</td>
<td>7.9 (70)²</td>
<td>15.8 (140)³</td>
<td>7.5</td>
<td>15.0</td>
<td>AM07</td>
</tr>
<tr>
<td>1326AB–B515E</td>
<td>3000</td>
<td>10.4</td>
<td>6.1</td>
<td>2.3</td>
<td>0.0043 (0.038)</td>
<td>7.7 (68)²</td>
<td>15.4 (136)³</td>
<td>4.5</td>
<td>9.0</td>
<td>AM04</td>
</tr>
<tr>
<td>1326AB–B520F</td>
<td>3500</td>
<td>13.1</td>
<td>8.8</td>
<td>2.9</td>
<td>0.006 (0.05)</td>
<td>11.2 (99)²</td>
<td>22.4 (198)³</td>
<td>7.5</td>
<td>15.0</td>
<td>AM07</td>
</tr>
<tr>
<td>1326AB–B520E</td>
<td>3000</td>
<td>13.0</td>
<td>6.7</td>
<td>2.9</td>
<td>0.006 (0.05)</td>
<td>8.8 (78)²</td>
<td>17.7 (157)³</td>
<td>4.5</td>
<td>9.0</td>
<td>AM04</td>
</tr>
<tr>
<td>1326AB–B530E</td>
<td>3000</td>
<td>18.0 (160)</td>
<td>9.5</td>
<td>4.2</td>
<td>0.009 (0.08)</td>
<td>14.2 (126)²</td>
<td>28.4 (251)³</td>
<td>7.5</td>
<td>15.0</td>
<td>AM07</td>
</tr>
<tr>
<td>1326AB–B720E</td>
<td>3500</td>
<td>30.9 (273)</td>
<td>17.5</td>
<td>6.8</td>
<td>0.015 (0.140)</td>
<td>30.9 (273)</td>
<td>88.1 (780)³</td>
<td>17.5</td>
<td>50.0</td>
<td>AM75</td>
</tr>
<tr>
<td>1326AB–B730E</td>
<td>3350</td>
<td>39.0 (345)</td>
<td>22.8</td>
<td>8.6</td>
<td>0.024 (0.22)</td>
<td>39.0 (345)</td>
<td>85.4 (756)³</td>
<td>22.8</td>
<td>50.0</td>
<td>AM75</td>
</tr>
<tr>
<td>1326AB–B740C</td>
<td>2200</td>
<td>53.0 (469)</td>
<td>20.9</td>
<td>7.8</td>
<td>0.032 (0.29)</td>
<td>53.0 (469)</td>
<td>126.8 (1122)³</td>
<td>20.9</td>
<td>50.0</td>
<td>AM75</td>
</tr>
</tbody>
</table>

1 All ratings are for 40°C motor ambient, 110°C case and 50°C amplifier ambient. For extended ratings at other than rated ambients contact Allen-Bradley.
2 Limited by axis module continuous current.
3 Limited by axis module peak current.
4.

<table>
<thead>
<tr>
<th>If you:</th>
<th>And:</th>
<th>Do the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Require another motor</td>
<td>Have selected fewer than four motors for this system module so far</td>
<td>Go to step 2.</td>
</tr>
<tr>
<td>Require another motor</td>
<td>Have selected four motors for this system module already</td>
<td>Go to step 5.</td>
</tr>
<tr>
<td>Don’t require another motor</td>
<td>Have selected between one and four motors for this system module</td>
<td>Go to step 5.</td>
</tr>
</tbody>
</table>

5. Using the information below, determine the system module size required.

**Understanding How to Calculate Shaft Power**

The average power required from the system module is the net sum of the average shaft power and losses (efficiency). Shaft power is the product of speed (N) and torque (T).

\[
P = \frac{N \times T}{9549.29}
\]

Where:  
\(N\) = speed (rpm)  
\(T\) = torque (N-m)

**For example:** If you have a 1326AB–B720 motor running continuously at 500 rpm and producing 30 N-m of torque; it is producing 1.57 kW.

When a motor accelerates, it requires more torque. For a constant load and a constant rate of acceleration, the average power consumed during acceleration is approximately:

\[
P = \frac{\frac{1}{2} \Delta N \times T}{9549.29}
\]

Where:  
\(\Delta N\) = change in speed (rpm)  
\(T\) = Torque (N-m)

**For example:** If the same motor is accelerating from 0 to 2000 rpm at a constant torque of 60 N-m, it will consume an average power of approximately 2.09 kW during acceleration.

Motors that run at low speeds produce less power than motors that run at high speeds; and therefore require less of the 1394 system module even though the current may be high at the axis module. The system module must supply the average power needed after accounting for losses and regeneration.

The sum of these conditions (both motoring and regeneration) are used to determine system module size. Actual conditions can be used in place of the calculation method shown on the following page.

Table A and Table B show the rated power for each motor. This ultimately is the maximum RMS power that should be produced by any application using that motor.
**Sizing a System Module**

Use the equations in the table below to determine the size of your system module.

<table>
<thead>
<tr>
<th>Number of Axes</th>
<th>Machine Tool Feed Axes</th>
<th>Repetitive Accel/Decel</th>
</tr>
</thead>
<tbody>
<tr>
<td>one</td>
<td>( kW_{system} = kW_{motor} \times 0.43 + 0.2 )</td>
<td>( kW_{system} = kW_{motor} \times 0.60 + 0.2 )</td>
</tr>
<tr>
<td>two</td>
<td>( kW_{system} = kW_{largestmotor} \times 0.61 + 0.4 )</td>
<td>( kW_{system} = kW_{largestmotor} \times 0.85 + 0.4 )</td>
</tr>
<tr>
<td>three</td>
<td>( kW_{system} = kW_{largestmotor} \times 0.86 + 0.6 )</td>
<td>( kW_{system} = kW_{largestmotor} \times 1.20 + 0.6 )</td>
</tr>
<tr>
<td>four</td>
<td>( kW_{system} = kW_{largestmotor} \times 1.28 + 0.8 )</td>
<td>( kW_{system} = kW_{largestmotor} \times 1.80 + 0.8 )</td>
</tr>
</tbody>
</table>

If the calculated power is:

<table>
<thead>
<tr>
<th>For 460V:</th>
<th>For 380V:</th>
</tr>
</thead>
<tbody>
<tr>
<td>less than 5 kW</td>
<td>less than 4 kW</td>
</tr>
<tr>
<td>less than 10 kW</td>
<td>less than 8 kW</td>
</tr>
</tbody>
</table>

Do this:

1. Recalculate the average power using the actual application shaft power consumed.
2. Reduce the number of axis modules on the system module.
3. If you are using multiple system modules, redistribute the motors to produce a lower net power.

6.

If, in step 1, you chose the: Then you have: Do the following:

<table>
<thead>
<tr>
<th>GMC System Module</th>
<th>More requirements to determine.</th>
<th>Go to step 7.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNC Interface System Module</td>
<td>Finished determining your base requirements.</td>
<td>Go to step 8.</td>
</tr>
<tr>
<td>CNC System (9/440)</td>
<td>To see publication 8520–2.1.1 for system module features and options.</td>
<td>Go to step 8.</td>
</tr>
</tbody>
</table>

7.

If you: Then:

<table>
<thead>
<tr>
<th>Want to connect to Allen–Bradley PLCs using remote I/O (RIO) or to other motion devices using AxisLink.</th>
<th>Select the RL option (and add “–RL” to the system catalog number).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t want to connect to Allen–Bradley PLCs using RIO or to other motion devices using AxisLink.</td>
<td>Go to step 8.</td>
</tr>
</tbody>
</table>

8. Select the accessories that you need. Refer to the appropriate publication as listed in the Referring to Other Publications section to determine your needs for the following:

- Cables
- Shunt Resistor
Referring to other Publications

Since each customer’s application of the 1394 is different, you may require information that appears in other publications to complete your assessment. The following related technical publications are available:

<table>
<thead>
<tr>
<th>Publication Name</th>
<th>Publication Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1394 Brochure</td>
<td>1394–1.0</td>
</tr>
<tr>
<td>9/series CNC Brochure</td>
<td>8520–1.1</td>
</tr>
<tr>
<td>IMC S Class Compact Motion Controller Product Data</td>
<td>4100–2.3</td>
</tr>
<tr>
<td>9/series CNC Product Specifications</td>
<td>8520–2.1.1</td>
</tr>
<tr>
<td>1326AB Torque Plus Series Servomotor Product Data</td>
<td>1326A–2.9</td>
</tr>
<tr>
<td>1326AS Series Low Inertia Servomotor Product Data</td>
<td>1326A–2.10</td>
</tr>
<tr>
<td>Flex I/O Product Profile</td>
<td>1794–1.14</td>
</tr>
<tr>
<td>Flex I/O Product Data</td>
<td>1794–2.1</td>
</tr>
<tr>
<td>Sensor Catalog (Encoders)</td>
<td>C111</td>
</tr>
<tr>
<td>PanelView 550 Operator Terminal Product Overview</td>
<td>2711–1.2</td>
</tr>
<tr>
<td>Grounding Guidelines</td>
<td>1770–4.1</td>
</tr>
</tbody>
</table>

Determining Catalog Numbers

Catalog numbers consist of various components that make up a 1394 system. Each character of the catalog number identifies a specific version or option for that component. The first four numbers represent the family of products (for example, 1394). The remaining characters represent a specific version or option of that module or family. Before you place an order, be sure to determine the catalog numbers for each individual item you need.

# 1394 System Module

<table>
<thead>
<tr>
<th>Bulletin Number</th>
<th>Type</th>
<th>Input Voltage</th>
<th>Input Phase</th>
<th>kW Rating</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1394</td>
<td>S=System module</td>
<td>J=380/460V AC, 50/60 Hz</td>
<td>T=Three-phase</td>
<td>05=5 kW</td>
<td>10=10 kW</td>
</tr>
</tbody>
</table>

- A = With +/-10V DC analog input (no HIM)
- C = With integrated motion controller
- E = With 9/series interface

RL = With RIO and AxisLink (can only be ordered with the C option)
**9/440 System Module**

<table>
<thead>
<tr>
<th>Bulletin Number</th>
<th>Number of Axes</th>
<th>System Type</th>
<th>kW Rating</th>
<th>Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>8520</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 1 = 1 axis
- 3 = 3 axes
- 4 = 4 axes

S = 9/440

- 5 = 5 kW
- 10 = 10 kW

Blank = no option
A = CE compliant
G = GDST compliant
G1 = GDST and CE compliant

Refer to publication 8520–2.1.1 for more information.

**Axis Modules**

<table>
<thead>
<tr>
<th>Bulletin Number</th>
<th>Type</th>
<th>Output Designator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1394</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AM = Servo amplifier module

- 03 = 2 kW
- 04 = 3 kW
- 07 = 5 kW
- 75 = 23.8 kW
### External Shunt Resistor Kit

<table>
<thead>
<tr>
<th>Bulletin Number</th>
<th>Type</th>
<th>kW Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1394</td>
<td>SR</td>
<td></td>
</tr>
</tbody>
</table>

SR = Shunt Resistor

10A = 1000W continuous, 40,000W peak

### Control Personality Module

<table>
<thead>
<tr>
<th>Bulletin Number</th>
<th>Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1394</td>
<td>PM1</td>
<td></td>
</tr>
</tbody>
</table>

PM1 = Personality module for 1394–SJT.xx–A

### System Module Cables

<table>
<thead>
<tr>
<th>Bulletin Number</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1394</td>
<td>SA15</td>
<td>5.9m (15 ft) cable for the 1394 Servo AQB interconnect to the motion controller</td>
</tr>
<tr>
<td>1394</td>
<td>GE15</td>
<td>5.9m (15 ft) cable (drive-end connector on one end and flying leads on the other) from an external encoder to the 1394 GMC system module. You will also require 1326–CEU or equivalent cable to terminate to this cable.</td>
</tr>
<tr>
<td>1394</td>
<td>GR04</td>
<td>1.2m (4ft) cable from the REC (Resolver to Incremental Encoder Converter) to the 1394 GMC System Module</td>
</tr>
</tbody>
</table>
# Ordering Information

Use this section to record the catalog numbers of the products you are ordering.

<table>
<thead>
<tr>
<th>Axis Number</th>
<th>Axis Module</th>
<th>Motor</th>
<th>Motor Feedback Cable</th>
<th>Motor Power Cable</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1394–AM______</td>
<td>1326A__–B______–21____</td>
<td>1326–CCU__-________</td>
<td>1326–CP__1–________</td>
</tr>
<tr>
<td>2</td>
<td>1394–AM______</td>
<td>1326A__–B______–21____</td>
<td>1326–CCU__-________</td>
<td>1326–CP__1–________</td>
</tr>
<tr>
<td>3</td>
<td>1394–AM______</td>
<td>1326A__–B______–21____</td>
<td>1326–CCU__-________</td>
<td>1326–CP__1–________</td>
</tr>
<tr>
<td>4</td>
<td>1394–AM______</td>
<td>1326A__–B______–21____</td>
<td>1326–CCU__-________</td>
<td>1326–CP__1–________</td>
</tr>
</tbody>
</table>

**Other**