Record of Document Revisions

<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>05/1990</td>
<td>Initial Release</td>
</tr>
<tr>
<td>2</td>
<td>10/2004</td>
<td>Update corporate identity and contact information</td>
</tr>
<tr>
<td>B</td>
<td>09/2020</td>
<td>Rebrand, CE and Declaration of Conformity removed</td>
</tr>
</tbody>
</table>

IMPORTANT NOTICE

Copyright© Kollmorgen™1990 – 2020. All rights reserved.

Technical changes which improve the performance of the device may be made without prior notice!

This document is the intellectual property of Kollmorgen. All rights reserved. No part of this work may be reproduced in any form (by photocopying, microfilm or any other method) or stored, processed, copied or distributed by electronic means without the written permission of Kollmorgen.

SAFETY – READ ALL INSTRUCTIONS BEFORE INSTALLING THIS MOTOR

⚠️ WARNING ⚠️  Dangerous voltages exist in this equipment. Do not attempt connecting or probing this equipment with power on.

The fold back feature must limit the over current to no more that 300% of rated current for a maximum period of 8 seconds.

⚠️ CAUTION ⚠️  Do not install the amplifier in a hazardous (classified) location unless the amplifier is listed for such location. The motor is U.L. listed for class I, C, and D, but the amplifier might not be suitable for such locations.

Do not operate the motor outside the parameters shown on the respective performance curve.

Do not service unless area is known to be non-hazardous. Keep covers tight while circuits are live.

Connect internal thermostat to limit motor surface temperature.

Instructions are provided indicating that motor thermostat is an automatic resetting device.

NOTE

Upon receipt of the equipment, closely inspect the components to ensure that no damage has occurred in shipment. If damage has occurred, notify the appropriate carrier at once.

Save these instructions for future reference. Should any question arise regarding any step outlined in this manual, please call the factory.

Proprietary Information of the Kollmorgen Corporation is furnished for customer user only. No other uses are authorized without written permission of Kollmorgen.
## CONTENTS

1. **INTRODUCTION** .................................................................................................. 4
   1.1 Amplifier and Power Supply Ratings ................................................................. 5

2. **WIRING** ................................................................................................................ 6
   2.1 TYPICAL AMPLIFIER ............................................................................. 7
      2.1.1 OUTLINE DIMENSIONS ......................................................................... 7
      2.1.2 FRONT VIEW .......................................................................................... 8
      2.1.3 SIDE VIEW .............................................................................................. 8
   2.2 TYPICAL POWER SUPPLY ................................................................... 9
      2.2.1 OUTLINE DIMENSIONS ......................................................................... 9
      2.2.2 FRONT VIEW ........................................................................................ 10
      2.2.3 SIDE VIEW ............................................................................................ 10
   2.3 SYSTEM WIRING ................................................................................ 11
   2.4 TYPICAL MOTOR WIRING .................................................................. 13
   2.5 GROUNDING ........................................................................................ 14
   2.6 INPUTS ........................................................................................................ 14
   2.7 PRELIMINARY CHECKS ...................................................................... 14
      2.7.1 CHECK AC INPUT VOLTAGE .............................................................. 15
      2.7.2 CHECK DC OUTPUT VOLTAGE ......................................................... 15
      2.7.3 ZERO SYSTEM RESOLVER ................................................................ 15
   2.8 3-PHASE POWER TRANS ................................................................... 16

3. **MOTOR DATA PACKAGE** ................................................................................. 18
   3.1 MODEL NUMBER......................................................................................... 18
   3.2 EB-20X .................................................................................................. 19
      3.2.1 EB-20X-11 ............................................................................................. 19
   3.3 EB-202 .................................................................................................. 20
      3.3.1 SPECIFICATIONS CD-26716 ............................................................... 20
      3.3.2 PERFORMANCE CURVES .................................................................. 22
   3.4 EB-204 .................................................................................................. 25
      3.4.1 SPECIFICATIONS CD-26717 ............................................................... 25
      3.4.2 PERFORMANCE CURVES .................................................................. 27
   3.5 EB-206 .................................................................................................. 30
      3.5.1 SPECIFICATIONS CD-26718 ............................................................... 30
      3.5.2 PERFORMANCE CURVES .................................................................. 32
   3.6 TYPICAL CURRENT AND VOLTAGE (WAVE FORMS AT MOTOR) ) 35
      3.6.1 CURRENT PHASE C ............................................................................. 35
      3.6.2 VOLTAGE LINE A-C ............................................................................ 35
   3.7 INTERMITTENT DUTY OPERATION ................................................... 35

4. **TYPICAL AMPLIFIER DATA PACKAGE** .......................................................... 39
   4.1 TYPICAL AMPLIFIER SPECIFICATIONS ................................................. 39

5. **INDEX** ................................................................................................................. 40
1 INTRODUCTION

This installation and service manual is a general document and is applicable to a typical amplifier needed to properly control the EB-20X motor series. Since servo amplifiers drive motors of varying sizes with different operating characteristics (voltage and current, internal resistance, inductance, rotor inertia, etc.), these amplifiers must vary with the specific motor. Consult the manufacturer of the amplifier to assure operation per the motor’s nameplate data.

The customer data (CD) and performance curve (PC) are specific documents and are applicable only to individual motors. They contain such information as maximum operating speed, peak current limits, and values that make the amplifier motor combinations compatible. Do not operate the motor outside the parameters shown on the respective performance curves.

Typical amplifiers are 3-phase sine wave, pulse-width modulated type. They are fully regenerative four-quadrant bi-directional velocity loop amplifiers designed to be used with Kollmorgen's high-performance permanent magnet brushless motors.

An unregulated 300 VDC bus, derived from full-wave rectification of a 3-phase 230 AC line by the power supply unit, is used to power the motor amplifier.

Kollmorgen's brushless motors feature the latest in permanent magnet technology, utilizing high-energy Samarium Cobalt and Neodymium Iron Boron alloys. These brushless motors consist of permanent magnet rotors and 3-phase Y-stator windings. Brushless motors have no commutators or associated brushes. These motors run as synchronous motors, meaning the rotor speed is the same as the speed (frequency) of the rotating stator's magnetic field. A brushless resolver is used as the feedback device and is mounted internally as part of the overall motor construction.

Benefits resulting from the typical amplifier and brushless motor construction are:

- Lower rotor inertia permits higher acceleration rates.
- The motor is thermally more efficient since all heat is generated in the stator windings, which are in the outside shell.
- Higher speed operation and high peak horsepower are achieved. There is no commutation limit.
- Smaller physical motor size for a given horsepower rating.
- Higher reliability and less motor maintenance. There is no commutator or brushes.
- Smooth output torque.
## 1.1 Amplifier and Power Supply Ratings

<table>
<thead>
<tr>
<th>Ratings</th>
<th>Input Power: 235 V(_{\text{RMS}}) (L-L) 3-phase (±10%); isolation transformer not required – provided short circuit (inrush) current remains limited to less than 1000 amps.115 VAC 1-phase control power.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Power</td>
<td>Power Supply DC Bus 325 VDC nominal, no load</td>
</tr>
<tr>
<td></td>
<td>325 VDC nominal, no load 230 V(_{\text{RMS}}) (L-L), Nominal ±10%</td>
</tr>
<tr>
<td></td>
<td>Intermittent Current (5 sec. max., 30% duty cycle)</td>
</tr>
<tr>
<td></td>
<td>(A(_{\text{RMS}})/Phase)</td>
</tr>
<tr>
<td></td>
<td>As required to produce motors rated current 200% of continuous</td>
</tr>
<tr>
<td>Ambient Operating Temperature:</td>
<td>0-55° C</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>10 kHz</td>
</tr>
<tr>
<td>Cooling</td>
<td>Fan, Convection (cold plate)</td>
</tr>
</tbody>
</table>
2. **WIRING**

   **NOTE** Install this motor and typical amplifier per the national electrical code.

To adhere to suitable engineering practices, connect the 115 VAC circuit so the 115 VAC is applied first in order to activate the control and fault circuits before applying the main bus voltage. Provide over-current protection, based on continuous rated current, per article 430 of the NEC. If possible, adjust the amplifier accordingly. Otherwise, provide external protection.

See the Typical Motor Wiring section for the correct method of wiring the motor stator. Connect the BROWN, RED, and WHITE leads to the points identified as Ma, Mb, and Mc on the power terminal block. Connect the green/yellow lead to the ground point of the same terminal block.

Bring the 3-phase 230 input power through a customer supplied circuit breaker and connect it to points identified as L_a, L_b, and L_c on the power terminal block mounted on the power supply. The system is not AC line phase sensitive. (See the System Wiring section). Connect the 325 VDC output, the 115 VAC amplifier with the strapping bars and the small 115 VAC and regen cable. Check to ensure that the small cable is connected to the correct pins and that it is not offset to one side. To access the control terminal strips to wire the typical amplifier, review the wiring diagrams and:

1. Wire the typical amplifier control terminal strips per the system-wiring diagram. The wiring should be neatly dressed so it does not interfere with remounting the cover.
2. Unplug the C1, C2, and C3 point terminal strips from their connectors on the amplifier motor control board. This prevents over flexing the board when wiring up the connectors.
3. After unplugging the terminal strips from the motor control board, wire them per the appropriate wiring diagram.
4. Neatly dress the wire cable so it enters the amplifier chassis and does not interfere with the front cover. Dress signal cables separately - not with the AC or power wiring.
5. Leave sufficient length in the wiring to allow the motor control board to slide out enough to expose the small compensation board. Insert the wired terminal strips back on their connectors.

The following precautions are also recommended:

1. Twist all AC leads to minimize electromagnetic emissions and pick-up. Maintain the shield over resolver leads.
2. Avoid running signal leads near power leads, armature leads, or other sources of electromagnetic noise.
3. Minimize lead lengths as much as practical.
4. Double-check all interface wiring. Carefully inspect all connections.
5. Do not use the main contactor for control functions.

**CAUTION** Motor and resolver phasing are critical for proper operation.
2. 1 TYPICAL AMPLIFIER

2.1.1. OUTLINE DIMENSIONS

![Diagram of typical amplifier with dimensions and control labels]

A-84471
2.1.2. FRONT VIEW

2.1.3. SIDE VIEW
2.2 TYPICAL POWER SUPPLY

2.2.1. OUTLINE DIMENSIONS

THIS RESISTOR NOT USED ON 12 AMP VERSION

A-84468
2.2.2. FRONT VIEW

- REGEN LED
- OVERLOAD LED
- BLOWN REGEN FUSE LED
- FAULT OUTPUT & 115 VAC CONTROL POWER INPUT
- +18 & +10 VOLT CONTROL VOLTAGE OUTPUT
- MAIN D.C. BUS OUTPUT
- MAIN INPUT POWER
- REGEN LED
- OVERLOAD LED
- BLOWN REGEN FUSE LED
- FAULT OUTPUT & 115 VAC CONTROL POWER INPUT
- +18 & +10 VOLT CONTROL VOLTAGE OUTPUT
- MAIN D.C. BUS OUTPUT
- MAIN INPUT POWER
- CHASSIS GND

2.2.3. SIDE VIEW

- REGENERATIVE LOAD RESISTORS
- REGENERATIVE POWER TRANSISTOR
- INPUT DIODE MODULE
- LOGIC POWER SUPPLY TRANSFORMER
- HIGH VOLTAGE COVER PLATE
- REGEN LED
- OVERLOAD LED
- BLOWN REGEN FUSE LED
- FAULT OUTPUT & 115 VAC CONTROL POWER INPUT
- +18 & +10 VOLT CONTROL VOLTAGE OUTPUT
- MAIN D.C. BUS OUTPUT
- MAIN INPUT POWER
- CHASSIS GND
2.3 SYSTEM WIRING

*Notes are on the following page.*
Notes for System Wiring

1. All signal and control wire must be 22-18 AWG wire. If 16 AWG is desired, use Molex #39-00-0078 crimp pins (not supplied) instead of the parts supplied.

2. Resolver must be wired with three (3) sets of 2-conductor shielded pairs as shown. Thermostat wiring must be a twisted pair.

3. Caution, the screws in the power terminal blocks are captive. Do not attempt to remove them for using ring terminals. Use locking type spring spade terminals such as Hollingsworth #XSS20954S or #SS20947SF for 16/14 AWG wire and #XSS20836 or #SS20832F for 12/10 AWG wire.

4. Wire gauge is dependent on application. For total axis currents less than 9-amps, use 16 AWG. For total axis currents greater than 20-amps, use 10 AWG.

5. Wire the power supply fault contact (rated 115 VAC 1 amp) to drop main 3-phase power (La, Lb, Lc) in fault conditions. (This contact is normally open, closed on power-up (approx. 0.250 ms) and opens in fault conditions.)

6. Fuse or circuit breaker sizing dependent on application.
   - PSR4  
     - Recommended Fuse
     - 12-amp  Buss #FAN-A-12 or equivalent
     - 20-amp  Buss #FAN-A-20 or equivalent

7. Resistor must be mounted away from any flammable material. A 400 VDC potential is present (maintain electrical isolation for this voltage rating).

8. All AC lines should be twisted cables.
2.4 TYPICAL MOTOR WIRING

*Notes are on the following page.
Notes for Typical Motor Wiring

1. The motor thermostat is an automatic resetting device and should be connected into a
latched (lock-out) power down type circuit.
2. Thermostat to be wired with twisted pair.
3. Energize the brake before switching the motor on and while it is in operation. For proper
operation, use an electrical interlock circuit to ensure that the brake is not engaged while the
motor is energized.

<table>
<thead>
<tr>
<th>Model</th>
<th>Holding VDC</th>
<th>Holding ADC</th>
</tr>
</thead>
<tbody>
<tr>
<td>EB-20X-X-XX-B2</td>
<td>90</td>
<td>0.09</td>
</tr>
<tr>
<td>EB-20X-X-XX-B3</td>
<td>24</td>
<td>0.52</td>
</tr>
</tbody>
</table>

4. Application resolver leads will exit at a different location from system resolver leads.

2.5 GROUNDING

Ground the motor at the amplifier motor terminal block or at the main ground point. Connect
shielded cables at one end only. Butt the other end.

2.6 INPUTS

The drive-up contact closure (internal) is provided at pins 10 and 20. When this internal contact is
closed, it indicates to the outside world (software) that the typical amplifier is ready to operate. When open, it is an indication that it is in the inhibit mode. The contact is rated at 115 VAC at 2
amps.

⚠️ CAUTION ⚠️  The motor is provided with two, normally-closed thermostat reset
devices connected in series. They are auto-resetting devices intended
to shut off power from the amplifier to limit the surface temperature of
the motor and prevent ignition in hazardous atmospheres.

The remote inhibit disables the amplifier without removing the main power. When a contact is
closed between pins (2 and 15) D common, the amplifier is placed in drive-up or ready-to-operate
mode. Opening the contact places the amplifier in the inhibit, or non-operable mode. These pins
(2 and 15) are connected through the latched power down circuit to the motor thermostat (see B-
84470). The motor thermostat is an automatic resetting device that is used to shut the power
down from the controller should an over-temperature condition occur in the motor windings.
Connect the thermostat to a latched (locked out) power-down type circuit that requires a manual
reset. This prevents inadvertent restart of the motor when it cools down below the thermostats set
value.

2.7 PRELIMINARY CHECKS

Once the typical amplifier system has been installed and wired in, use the following steps to
ensure proper operation before the main power is applied.
2.7.1. CHECK AC INPUT VOLTAGE

Open the circuit breaker or remove the fuses in the secondary of the large 3-phase isolation transformer.

Apply power with an AC voltmeter to check the 3-phase secondary line-to-line voltage. The voltage should be approximately 230 V_{RMS} ±10%. Remove power and close the circuit breaker or replace the fuses in the secondary of the large 3-phase isolation transformer.

2.7.2. CHECK DC OUTPUT VOLTAGE

Do not apply the 115 VAC. Apply power to the large 3-phase transformer only. With a DC voltmeter, monitor the 325 VDC bus bars of the power supply and amplifier units. The voltage from the power supply should be approximately ±325 VDC, ±10%. Remove power.

2.7.3. ZERO SYSTEM RESOLVER

1. Do not remove the cover while the motor is in a hazardous location.
2. Remove power.
3. Remove the motor and cover.
4. Loosen, but do not remove the resolver servo clamp screws.
5. Rotate the outer remover of the resolver as needed for adjustment.
6. Replace end cover. All bolts must be tightened securely before applying power to the motor or resolver.
2.8 3-PHASE POWER TRANS
3. MOTOR DATA PACKAGE

Typical product features are:

- UL listed explosion-proof for Class I, Groups C & D hazardous locations
- Neodymium-Iron-Boron magnets
- Aluminum end bells
- Frameless, shaft-mounted resolver
- Rugged construction

3.1 MODEL NUMBER

\[ EB - \# 0x - A \]

- **EB** - is the prefix designating basic motor and optional modules
- **E** - stands for explosion-proof U.L. listed for Class I, Groups C & D hazardous locations.
- **B** - stands for brushless motor
- **#** - is the winding designation
- **0x** - is the stack length designation
- **A** - is the series designation - in this case 2
3.2 EB-20X

3.2.1. EB-20X-11

NOTE

1-LEAD EXIT POTTED WITH CHICO COMPOUND #A5.
2-MOTOR CAN BE MOUNTED IN ANY POSITION.
3-ELECTRICAL HOOK-UP PER HD-202.

A-43083
3.3 EB-202

3.3.1. SPECIFICATIONS CD-26716

<table>
<thead>
<tr>
<th>Specification</th>
<th>Tol</th>
<th>Symbol</th>
<th>Units</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Continuous Torque (stall) at 40° C Ambient</td>
<td>Nom.</td>
<td>TC</td>
<td>lb-ft</td>
<td>13.0</td>
<td>12.8</td>
<td>12.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N-m</td>
<td>17.63</td>
<td>17.36</td>
<td>17.36</td>
</tr>
<tr>
<td>Cont. Line Current</td>
<td>Nom.</td>
<td>IC</td>
<td>ARMS</td>
<td>10.0</td>
<td>20.0</td>
<td>15.0</td>
</tr>
<tr>
<td>†Max. Speed</td>
<td>Nom.</td>
<td>N max.</td>
<td>rpm</td>
<td>2000</td>
<td>4000</td>
<td>3000</td>
</tr>
<tr>
<td>*Peak Torque</td>
<td>Nom.</td>
<td>TP</td>
<td>lb-ft</td>
<td>37.7</td>
<td>36.7</td>
<td>36.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N-m</td>
<td>51.2</td>
<td>49.8</td>
<td>49.5</td>
</tr>
<tr>
<td>Peak Line Current</td>
<td>Nom.</td>
<td>IP</td>
<td>ARMS</td>
<td>30.5</td>
<td>61.4</td>
<td>45</td>
</tr>
<tr>
<td>129.2†Theoretical Acceleration</td>
<td>Nom.</td>
<td>ωm</td>
<td>rad/sec²</td>
<td>48681</td>
<td>48417</td>
<td>48945</td>
</tr>
<tr>
<td>†Horsepower</td>
<td>Rated</td>
<td>Hp rtd</td>
<td>Hp</td>
<td>4.4</td>
<td>7.7</td>
<td>6.1</td>
</tr>
<tr>
<td>†Speed</td>
<td>Rated</td>
<td>N rtd</td>
<td>rpm</td>
<td>2000</td>
<td>4000</td>
<td>3000</td>
</tr>
<tr>
<td>†Torque</td>
<td>Rated</td>
<td>T rtd</td>
<td>lb-ft</td>
<td>11.6</td>
<td>10.1</td>
<td>10.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N-m</td>
<td>15.7</td>
<td>13.7</td>
<td>14.5</td>
</tr>
<tr>
<td>Volts (line to line)</td>
<td>Rated</td>
<td>V rtd</td>
<td>VRMS</td>
<td>230</td>
<td>230</td>
<td>230</td>
</tr>
<tr>
<td>*Torque Sensitivity</td>
<td>± 10%</td>
<td>KT</td>
<td>lb-ft / ARMS</td>
<td>1.302</td>
<td>0.629</td>
<td>0.854</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N-m / ARMS</td>
<td>1.765</td>
<td>0.853</td>
<td>1.158</td>
</tr>
<tr>
<td>Back EMF (line-to-line)</td>
<td>± 10%</td>
<td>KB</td>
<td>V/krpm</td>
<td>106.8</td>
<td>51.6</td>
<td>70.0</td>
</tr>
<tr>
<td>Max. line-to-line volts</td>
<td>Max.</td>
<td>V max</td>
<td>VRMS</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>DC Res at 25° C (line-to-line)</td>
<td>± 10%</td>
<td>Rm</td>
<td>ohms</td>
<td>1.548</td>
<td>0.382</td>
<td>0.674</td>
</tr>
<tr>
<td>Inductance (line-to-line)</td>
<td>± 30%</td>
<td>LM</td>
<td>mH</td>
<td>32</td>
<td>9.0</td>
<td>14.0</td>
</tr>
<tr>
<td>Time Constant at 25° C</td>
<td>Mech. Elec.</td>
<td>TM</td>
<td>ms</td>
<td>0.77</td>
<td>0.81</td>
<td>0.77</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>ms</td>
<td>20.7</td>
<td>23.6</td>
<td>20.8</td>
</tr>
<tr>
<td>System Performance Curve</td>
<td></td>
<td></td>
<td></td>
<td>26614</td>
<td>26615</td>
<td>26804</td>
</tr>
</tbody>
</table>

*At ultimate winding temperature - for ambient data, multiply by 1.06.
<table>
<thead>
<tr>
<th>†</th>
<th>Symbol</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotor Inertia</td>
<td>$J_M$</td>
<td>lb ft sec$^2$</td>
<td>0.000758</td>
</tr>
<tr>
<td></td>
<td></td>
<td>kg m$^2$</td>
<td>0.001028</td>
</tr>
<tr>
<td>Weight</td>
<td>$W_t$</td>
<td>lb</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td></td>
<td>kg (f)</td>
<td>16.8</td>
</tr>
<tr>
<td>Static Friction</td>
<td>$T_F$</td>
<td>lb-ft</td>
<td>0.360</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N-m</td>
<td>0.490</td>
</tr>
<tr>
<td>Thermal Time Constant Peak</td>
<td>TCTP</td>
<td>Minutes</td>
<td>12</td>
</tr>
<tr>
<td>Viscous Damping ∞Z Source</td>
<td>$F_1$</td>
<td>lb-ft/krpm</td>
<td>0.053</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N-m/krpm</td>
<td>0.072</td>
</tr>
</tbody>
</table>

† If brush type tach is used, these parameters may be affected. Consult the factory.
3.3.2. PERFORMANCE CURVES

3.3.2.1. EB-202-A PC-26721

**NOTE**  Do not operate this motor outside the parameters shown on this performance curve.

Motor  EB-202-A  
Drive  BDS4-230/3  
Test  T3-1339
3.3.2.2. EB-202-B PC-26722

**NOTE** Do not operate this motor outside the parameters shown on this performance curve.

Motor EB-202-B  
Drive BDS4-230/3  
Test Calculated
3.3.2.3. EB-202-C PC-26723

**NOTE**  Do not operate this motor outside the parameters shown on this performance curve.

Motor  EB-202-C  
Drive  BDS4-230/6  
Test  Calculated
### 3.4 EB-204

#### 3.4.1. SPECIFICATIONS CD-26717

<table>
<thead>
<tr>
<th>Specification</th>
<th>Tol</th>
<th>Symbol</th>
<th>Units</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Continuous Torque (stall) at 40° C Ambient</td>
<td>Nom.</td>
<td>(T_C)</td>
<td>lb-ft</td>
<td>3.60</td>
<td>3.60</td>
<td>3.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N-m</td>
<td>4.88</td>
<td>4.88</td>
<td>4.88</td>
</tr>
<tr>
<td>Cont. Line Current</td>
<td>Nom.</td>
<td>(I_{C})</td>
<td>(A_{RMS})</td>
<td>2.9</td>
<td>5.80</td>
<td>10.0</td>
</tr>
<tr>
<td>†Max. Speed</td>
<td>Nom.</td>
<td>(N_{max.})</td>
<td>rpm</td>
<td>1900</td>
<td>3600</td>
<td>6200</td>
</tr>
<tr>
<td>*Peak Torque</td>
<td>Nom.</td>
<td>(T_P)</td>
<td>lb-ft</td>
<td>9.43</td>
<td>10.33</td>
<td>8.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N-m</td>
<td>12.80</td>
<td>14.00</td>
<td>12.14</td>
</tr>
<tr>
<td>Peak Line Current</td>
<td>Nom.</td>
<td>(I_{P})</td>
<td>(A_{RMS})</td>
<td>8.10</td>
<td>17.4</td>
<td>26.1</td>
</tr>
<tr>
<td>129.2†Theoretical Acceleration</td>
<td>Nom.</td>
<td>(\alpha_m)</td>
<td>rad/sec²</td>
<td>73961</td>
<td>81020</td>
<td>70196</td>
</tr>
<tr>
<td>†Horsepower</td>
<td>Rated</td>
<td>(H_{P \ rtd})</td>
<td>(H_P)</td>
<td>1.20</td>
<td>2.30</td>
<td>3.70</td>
</tr>
<tr>
<td>†Speed</td>
<td>Rated</td>
<td>(N_{rtd})</td>
<td>rpm</td>
<td>1900</td>
<td>3600</td>
<td>6200</td>
</tr>
<tr>
<td>†Torque</td>
<td>Rated</td>
<td>(T_{rtd})</td>
<td>lb-ft</td>
<td>3.20</td>
<td>3.41</td>
<td>3.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N-m</td>
<td>4.34</td>
<td>4.62</td>
<td>4.25</td>
</tr>
<tr>
<td>Volts (line to line)</td>
<td>Rated</td>
<td>(V_{rtd})</td>
<td>(V_{RMS})</td>
<td>230</td>
<td>230</td>
<td>230</td>
</tr>
<tr>
<td>*Torque Sensitivity</td>
<td>± 10%</td>
<td>(K_T)</td>
<td>lb-ft / (A_{RMS})</td>
<td>1.226</td>
<td>0.625</td>
<td>0.361</td>
</tr>
<tr>
<td>Back EMF (line-to-line)</td>
<td>± 10%</td>
<td>(K_E)</td>
<td>V/krpm</td>
<td>100.5</td>
<td>51.2</td>
<td>29.6</td>
</tr>
<tr>
<td>Max. line-to-line volts</td>
<td>Max.</td>
<td>(V_{max})</td>
<td>(V_{RMS})</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>DC Res at 25° C (line-to-line)</td>
<td>± 10%</td>
<td>(R_M)</td>
<td>ohms</td>
<td>9.46</td>
<td>2.48</td>
<td>0.786</td>
</tr>
<tr>
<td>Inductance (line-to-line)</td>
<td>± 30%</td>
<td>(L_M)</td>
<td>mH</td>
<td>133</td>
<td>38</td>
<td>12</td>
</tr>
<tr>
<td>Time Constant at 25° C</td>
<td>Mech.</td>
<td>(T_M)</td>
<td>ms</td>
<td>0.888</td>
<td>0.896</td>
<td>0.850</td>
</tr>
<tr>
<td></td>
<td>Elec.</td>
<td>(T_E)</td>
<td>ms</td>
<td>14.06</td>
<td>15.32</td>
<td>15.27</td>
</tr>
<tr>
<td>System Performance Curve</td>
<td></td>
<td></td>
<td></td>
<td>26724</td>
<td>26725</td>
<td>26719</td>
</tr>
</tbody>
</table>

*At ultimate winding temperature - for ambient data, multiply by 1.06.*
<table>
<thead>
<tr>
<th>†</th>
<th>Symbol</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rotor Inertia</td>
<td>$J_M$</td>
<td>lb ft sec$^2$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>kg m$^2$</td>
</tr>
<tr>
<td></td>
<td>Weight</td>
<td>$W_T$</td>
<td>lb</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>kg (f)</td>
</tr>
<tr>
<td></td>
<td>Static Friction</td>
<td>$T_F$</td>
<td>lb-ft</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N-m</td>
</tr>
<tr>
<td></td>
<td>Thermal Time Constant Peak</td>
<td>TCTP</td>
<td>Minutes</td>
</tr>
<tr>
<td></td>
<td>Viscous Damping ∞Z Source</td>
<td>$F_1$</td>
<td>lb-ft/krpm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>N-m/krpm</td>
</tr>
</tbody>
</table>

† If brush type tach is used, these parameters may be affected. Consult the factory.
3.4.2. PERFORMANCE CURVES

3.4.2.1. EB-204-A PC-26724

**NOTE**

Do not operate this motor outside the parameters shown on this performance curve.

Motor: EB-204-A

Drive: BDS4-230/3

Test: Calculated
3.4.2.2. **EB-204-B PC-26725**

**NOTE**  Do not operate this motor outside the parameters shown on this performance curve.

**Motor**  EB-204-B  
**Drive**  BDS4-230/6  
**Test**  T3-1393

---

**Chart:**
- **Nmax** and **Nrated**
- **Continuous Duty Zone**
- **Intermittent Duty Zone**
- **Tp** (Peak Torque)
- **Tc** (Continuous Torque)

**Speed (rpm):** 0 to 4000  
**Torque (lb-ft):** 0 to 8

---

**Graph:**
- Speed (rpm) vs. Torque (lb-ft) for different duty zones.
- Key points for 2.3 HP indicated.
3.4.2.3. EB-204-C PC-26719

**NOTE** Do not operate this motor outside the parameters shown on this performance curve.

Motor EB-204-C  
Drive BDS4-230/10  
Test T3-1396

![Graph showing performance curves for EB-204-C PC-26719 motor.]
## 3.5 EB-206

### 3.5.1. SPECIFICATIONS CD-26718

<table>
<thead>
<tr>
<th>Specification</th>
<th>Unit A</th>
<th>Unit B</th>
<th>Unit C</th>
</tr>
</thead>
<tbody>
<tr>
<td>*Continuous Torque (stall) at 40° C Ambient</td>
<td>lb-ft</td>
<td>lb-ft</td>
<td>lb-ft</td>
</tr>
<tr>
<td></td>
<td>N-m</td>
<td>N-m</td>
<td>N-m</td>
</tr>
<tr>
<td>Cont. Line Current</td>
<td>A_RMS</td>
<td>2.9</td>
<td>5.80</td>
</tr>
<tr>
<td>†Max. Speed</td>
<td>rpm</td>
<td>1400</td>
<td>2800</td>
</tr>
<tr>
<td>*Peak Torque</td>
<td>lb-ft</td>
<td>14.03</td>
<td>14.03</td>
</tr>
<tr>
<td></td>
<td>N-m</td>
<td>19.03</td>
<td>19.03</td>
</tr>
<tr>
<td>Peak Line Current</td>
<td>A_RMS</td>
<td>9.3</td>
<td>18.6</td>
</tr>
<tr>
<td>129.2†Theoretical Acceleration</td>
<td>rad/sec^2</td>
<td>75715</td>
<td>75715</td>
</tr>
<tr>
<td>†Horsepower</td>
<td>H_P</td>
<td>1.20</td>
<td>2.50</td>
</tr>
<tr>
<td>†Speed</td>
<td>rpm</td>
<td>1400</td>
<td>2800</td>
</tr>
<tr>
<td>†Torque</td>
<td>lb-ft</td>
<td>4.5</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>N-m</td>
<td>6.1</td>
<td>6.24</td>
</tr>
<tr>
<td>Volts (line to line)</td>
<td>V_RMS</td>
<td>230</td>
<td>230</td>
</tr>
<tr>
<td>*Torque Sensitivity</td>
<td>lb-ft / A_RMS</td>
<td>1.588</td>
<td>0.794</td>
</tr>
<tr>
<td>Back EMF (line-to-line)</td>
<td>N-m / A_RMS</td>
<td>2.153</td>
<td>1.077</td>
</tr>
<tr>
<td>Max. line-to-line volts</td>
<td>V_RMS</td>
<td>130.2</td>
<td>65.1</td>
</tr>
<tr>
<td>DC Res at 25° C (line-to-line)</td>
<td>ohms</td>
<td>8.82</td>
<td>2.32</td>
</tr>
<tr>
<td>± 10%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inductance (line-to-line)</td>
<td>mH</td>
<td>130</td>
<td>32</td>
</tr>
<tr>
<td>± 30%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time Constant at 25° C</td>
<td>ms</td>
<td>0.717</td>
<td>0.754</td>
</tr>
<tr>
<td>Mech.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elec.</td>
<td>ms</td>
<td>14.74</td>
<td>13.79</td>
</tr>
<tr>
<td>System Performance Curve</td>
<td></td>
<td>26726</td>
<td>26460</td>
</tr>
</tbody>
</table>

*At ultimate winding temperature - for ambient data, multiply by 1.06.
<table>
<thead>
<tr>
<th>†</th>
<th>Symbol</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotor Inertia</td>
<td>$J_M$</td>
<td>lb ft sec$^2$</td>
<td>0.0001853</td>
</tr>
<tr>
<td></td>
<td></td>
<td>kg m$^2$</td>
<td>0.0002512</td>
</tr>
<tr>
<td>Weight</td>
<td>$W_t$</td>
<td>lb</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>kg (f)</td>
<td>9.5</td>
</tr>
<tr>
<td>Static Friction</td>
<td>$T_F$</td>
<td>lb-ft</td>
<td>0.005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N-m</td>
<td>0.007</td>
</tr>
<tr>
<td>Thermal Time Constant Peak</td>
<td>TCTP</td>
<td>Minutes</td>
<td>22</td>
</tr>
<tr>
<td>Viscous Damping &amp; Source</td>
<td>$F_I$</td>
<td>lb-ft/krpm</td>
<td>0.008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N-m/krpm</td>
<td>0.011</td>
</tr>
</tbody>
</table>

† If brush type tach is used, these parameters may be affected. Consult the factory.
3.5.2. PERFORMANCE CURVES

3.5.2.1. EB-206-A PC-26726

**NOTE**

Do not operate this motor outside the parameters shown on this performance curve.

<table>
<thead>
<tr>
<th>Motor</th>
<th>EB-206-A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drive</td>
<td>BDS4-230/3</td>
</tr>
<tr>
<td>Test</td>
<td>Calculated</td>
</tr>
</tbody>
</table>

![Performance Curve Diagram]
3.5.2.2. EB-206-B PC-26460

**NOTE**

Do not operate this motor outside the parameters shown on this performance curve.

Motor: EB-206-B  
Drive: BDS4-230/6  
Test: T3-1394
3.5.2.3. EB-206-C PC-26720

**NOTE**

Do not operate this motor outside the parameters shown on this performance curve.

Motor EB-206-C
Drive BDS4-230/10
Test T3-1397
3. 6  TYPICAL CURRENT AND VOLTAGE (WAVE FORMS AT MOTOR)

3.6.1.  CURRENT PHASE C

3.6.2.  VOLTAGE LINE A-C

The EB-206-C is illustrated at 1500 rpm, 4.4 lb-ft.

3. 7  INTERMITTENT DUTY OPERATION

If a motor operates intermittently, it is not necessary that the peak load torques fall within the motor's continuous torque capabilities. However, it is important that the RMS (root mean square) load torque be inside the continuous duty zone. The key here is that a sufficient OFF time follows each ON time of the motor.

(EQ-1) gives the RMS torque:

$$T_{\text{RMS}} = \sqrt{\frac{T_1^2 t_1 + T_2^2 t_2 + \ldots + T_i^2 t_i}{t_1 + t_2 + \ldots + t_i}}$$

$T_i = $ Torque at Time $i$
$t_i = $ Duration of time $i$
This equation assumes $t_i$ is small compared to the thermal time constant for peak power of motor (TCTP) for torque values significantly larger than the continuous torque (TC). This is not always a good assumption. For cases where torque values significantly exceed TC, the following equation is used:

$$\frac{T_{OUT}}{T_C} = \sqrt{\frac{1-e^{-t_{ON}/Duty Cycle \times TCTP}}{1-e^{-t_{ON}/TCTP}}}$$

where duty cycle = $t_{ON}/(t_{ON} + t_{OFF})$

$T_{OUT}$ = output torque

$T_C$ = continuous torque at operating speed

$t_{ON}$ = time on

TCTP = thermal time constant for peak power of motor

The next equation expresses operating torques as a function of ON time. It also breaks the operating cycle down into individual periods of ON time and OFF time. Substituting for duty cycle and solving for $t_{OFF}$, the above equation yields:

**(EQ-2)**

$$T_{OFF} = -TCTP \ln \left[ 1 - \frac{(1-e^{-t_{ON}/TCTP}) \times T_{OUT}^2}{T_C^2} \right]^{t_{ON}}$$

Thus, for a specific output torque and a given ON time, the required OFF time is known. This OFF time is required so that the motor cools sufficiently so as not to exceed its thermal limits. The calculated OFF time should precede the initial ON time to ensure that ultimate temperature is not surpassed on the first cycle.

It may also be useful to calculate a time to ultimate temperature based on a one-time excursion from ambient temperature. Consider the following pair of equations:

**(EQ-3)**

$$T_{R \text{ Actual Above Ambient}} = \left(\frac{T_{OUT}}{T_C}\right)^2$$

$$T_{R \text{ Rated Above Ambient}} = \left(\frac{T_{OUT}}{T_C}\right)^2$$

**(EQ-4)**

$$T_{R \text{ Rated}} = T_{R \text{ Ultimate}} (1 - e^{-t})$$

where $TR \text{ Rated} = \text{time/TCTP}$

Substitute 3) into 4) and obtain:

To find the time to ultimate temperature, set $TR \text{ Actual} = TR \text{ Ultimate}$ and solve for $t$. This yields the following equation:

**(EQ-5)**

$$T_{MAX} = -TCTP \ln \left[ 1 - \left(\frac{T_{OUT}}{T_C}\right)^2 \right]$$

where:

$t = \text{max on time}$

TCTP = thermal time constant for peak power of motor

$T_c$ = continuous torque of the motor at the operating speed

$T_{OUT}$ = operating torque
This gives the maximum ON time for a given operating torque beginning at ambient temperature. Examination of this equation reveals that as $T_{\text{OUT}}$ approaches $T_c$, $t$ approaches infinity. This is expected since we can theoretically operate the motor indefinitely at continuous torque without exceeding its thermal limits. EQ5 with EQ2 define the motor’s operating time limits.

**Example #1**

An EB-206-C has the torque vs. speed performance characteristics described in the performance curve labeled EB-206-C PC 26720. The motor is operating intermittently at 4900 rpm with a torque of 6.6 lb-ft.

**FIND:**

a) maximum ON time without exceeding ultimate temperature.
b) the required OFF time for an ON time of 4 seconds.

given: $T_{\text{OUT}} = 6.6$ lb-ft

From the performance curve, the continuous torque at 4900 rpm is obtained. $T_c = 4.0$ lb-ft

From Specifications CD-26718 for the EB-206-C motor:

- $T_{\text{CTP}} = 22$ min.

(a) The maximum ON time is found from EQ5:

$$T_{\text{MAX}} = -T_{\text{CTP}} \ln \left[ \frac{1 - \left( \frac{T_{\text{OUT}}}{T_c} \right)^2}{2} \right]$$

$T_{\text{CTP}} = 22$ min., $T_c = 4.0$ lb-ft, $T_{\text{OUT}} = 6.6$ lb-ft

$$T_{\text{MAX}} = -22$ min. ln [0.6327]

$T_{\text{MAX}} = 10.0$ min.

This says that if the motor has an ON time greater than 10 minutes, it exceeds its thermal limits.

(b) The required OFF time for a given ON time is found from EQ2.

$$T_{\text{OFF}} = - T_{\text{CTP}} \ln \left[ \frac{1 - \frac{(1-e^{-\frac{t_{\text{ON}}}{T_{\text{CTP}}}}) T_{\text{OUT}}}{T_c}}{2} \right]^{-t_{\text{ON}}}$$

$t_{\text{ON}} = 4$ seconds

- $T_{\text{CTP}} = 22$ min. $60$ sec/min = 1320 seconds

- $T_{\text{OUT}} = 6.6$ lb-ft

- $T_c = 4.0$ lb-ft
For the EB-206-C motor operating at the load point in this example, an ON time of 4 seconds must be followed by an OFF time of 7.0 seconds so the motor does not exceed its thermal limits.

**Example #2**

The motor of Example #1 is running at 2500 rpm with an intermittent operating torque of 8.6 lb-ft.

**FIND:**
(a) max. ON time.
(b) required OFF time for an ON time of 4 seconds.

**GIVEN:** $T_{OUT} = 8.6$ lb-ft

From the performance curve EB-206-A PC-26726,
$T_C = 4.1$ lb-ft at 2500 rpm.

From Specifications CD-26718, $T_{CTP} = 22$ min.
(a) Using EQ5 and the values above:
$t_{MAX} = 5.6$ min.
(b) Using EQ2 and an On time of 4 seconds, an OFF time is:
$t_{OFF} = 13.7$ seconds

**Example #3**

The motor in Example 1 is running at 1000 rpm with an intermittent operating torque of 8.9 lb-ft.

**FIND:**
(a) max. ON time.
(b) required OFF time for an ON time of 4 seconds.

**GIVEN:** $T_{OUT} = 8.9$ lb-ft

From the performance curve EB-206-A PC-26726,
$T_C = 4.4$ lb-ft at 1000 rpm.

From Specifications CD-26718, $T_{CTP} = 22$ min.
(a) Using EQ5 and the values above:
$t_{MAX} = 6.2$ min.
$t_{ON} = 4$ sec
(b) Using EQ2 and the values above:
$t_{OFF} = 12.4$ sec

**NOTE**

The applications engineers at Kollmorgen will assist in the proper sizing of the motor and amplifier based on the application’s duty cycle. Contact them if any questions arise in the derivation of $t_{MAX}$ or $t_{OFF}$ with a specific duty cycle.
4. TYPICAL AMPLIFIER DATA PACKAGE

The product features are:

- 30 microprocessor synthesized sine-wave control
- Three AC current loops – fully integrating velocity loop
- OK to Enable or Drive-Up relay
- Inhibit function
- Current monitor

4.1 TYPICAL AMPLIFIER SPECIFICATIONS

<table>
<thead>
<tr>
<th>Amplifier Specifications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Power to Amplifier</strong></td>
<td>230 VRMS L-L 30 (±15%)</td>
</tr>
<tr>
<td></td>
<td>Isolation Transformer Not Required</td>
</tr>
<tr>
<td></td>
<td>115 VAC 10 Control Power (+10%, -15%)</td>
</tr>
<tr>
<td><strong>Output Power to Motor</strong></td>
<td>Power Supply DC Bus</td>
</tr>
<tr>
<td></td>
<td>Output at rated load%</td>
</tr>
<tr>
<td></td>
<td>325 VDC nominal, no load</td>
</tr>
<tr>
<td></td>
<td>230 VRMS L-L, Nominal ±15%</td>
</tr>
<tr>
<td></td>
<td>Pulse Width Modulated</td>
</tr>
<tr>
<td></td>
<td>Cont. Current (ARMS/Phase)</td>
</tr>
<tr>
<td></td>
<td>Intermittent Current</td>
</tr>
<tr>
<td></td>
<td>(5 sec. max., 25% duty cycle)</td>
</tr>
<tr>
<td></td>
<td>As required to produce motors rated</td>
</tr>
<tr>
<td></td>
<td>current</td>
</tr>
<tr>
<td></td>
<td>200% of continuous</td>
</tr>
<tr>
<td><strong>Ambient Operating Temperature</strong></td>
<td>0-55° C</td>
</tr>
<tr>
<td><strong>Switching Frequency</strong></td>
<td>10 kHz</td>
</tr>
<tr>
<td><strong>Cooling</strong></td>
<td>Fan, Convection (cold plate)</td>
</tr>
</tbody>
</table>

Save these instructions for future reference.
5 INDEX

3 Phase Power Trans........................................17
Amplifier
  ambient temperature ..................................40
  continuous current ..................................40
  cooling .................................................40
  input power to amplifier ..........................40
  isolation transformer ................................40
  output at rated load ................................40
  power supply DC bus ................................40
  power supply settings ..............................6
  Ratings ................................................6
  specifications ........................................40
  switching frequency ................................40
  typical ................................................5
CD-26716 ................................................21, 22
CD-26717 ................................................26, 27
CD-26718 ................................................31, 32
Cooling ....................................................6
EB 206......................................................31
EB-202 .....................................................21
  performance curves ..................................23, 24, 25
  Specifications ........................................21, 22
EB-204 .....................................................26
  performance curves ..................................28, 29, 30
  Specifications ........................................26, 27
EB-206 .....................................................33, 34, 35
  performance curves ..................................31, 32
EB-20x.....................................................20
  amplifier data package ..............................40
  bus .......................................................5
  Introduction ..........................................5
Equation 1 ..............................................36
Equation 2 ..............................................37
Equation 3 ..............................................37
Equation 4 ..............................................37
Equation 5 ..............................................37
Example 1 ..............................................38
Example 2 ..............................................39
Example 3 ..............................................39
Grounding .............................................15
Input Power ...........................................6
Intermittent Duty Operation .........................36
Model Number .........................................19
motor ......................................................5
Motor
  data package .........................................19
Outline & Dimensions .................................10
Outline Dimensions ..................................8
Output Power ..........................................6
PC-26460 ..............................................34
PC-26719 ..............................................30
PC-26720 ..............................................35
PC-26721 ..............................................23
PC-26722 ..............................................24
PC-26723 ..............................................25
PC-26724 ..............................................28
PC-26725 ..............................................29
PC-26726 ..............................................33
Performance Curves ....................................23, 28, 33
  EB-202-A ..............................................23
  EB-202-B ..............................................24
  EB-202-C ..............................................25
  EB-204-A ..............................................28
  EB-204-B ..............................................29
  EB-204-C ..............................................30
  EB-206-A ..............................................33
  EB-206-B ..............................................34
  EB-206-C ..............................................35
  PC-26460 ..............................................34
  PC-26719 ..............................................30
  PC-26720 ..............................................35
  PC-26721 ..............................................23
  PC-26722 ..............................................24
  PC-26723 ..............................................25
  PC-26724 ..............................................28
  PC-26725 ..............................................29
  PC-26726 ..............................................33
Power Supply
  Ratings ................................................6
Preliminary Checks .....................................16
  AC Input Voltage ....................................16
  DC Output Voltage ..................................16
  zero system resolver ................................16
Rating
  Power Supply .........................................6
Signal Inputs
  Modes of Operation ................................15
Specifications
  CD-26716 ..............................................21, 22
  CD-26717 ..............................................26, 27
  CD-26718 ..............................................31, 32
  EB-202 ..............................................21, 22
  EB-204 ..............................................26, 27
  EB-206 ..............................................31, 32
Switching Frequency ...................................6
System Wiring ..........................................12
Temperature
  ambient ...............................................6
  operating .............................................6
Wave Forms ...........................................36
  current phase C ......................................36
<table>
<thead>
<tr>
<th>voltage line A-C</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiring</td>
<td></td>
</tr>
<tr>
<td>input power</td>
<td>6</td>
</tr>
<tr>
<td>National Code</td>
<td>6</td>
</tr>
<tr>
<td>typical motor</td>
<td>14</td>
</tr>
<tr>
<td>typical power supply</td>
<td>11</td>
</tr>
</tbody>
</table>
About Kollmorgen
Kollmorgen is a leading provider of motion systems and components for machine builders. Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions that are unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

Join the Kollmorgen Developer Network for product support. Ask the community questions, search the knowledge base for answers, get downloads, and suggest improvements.