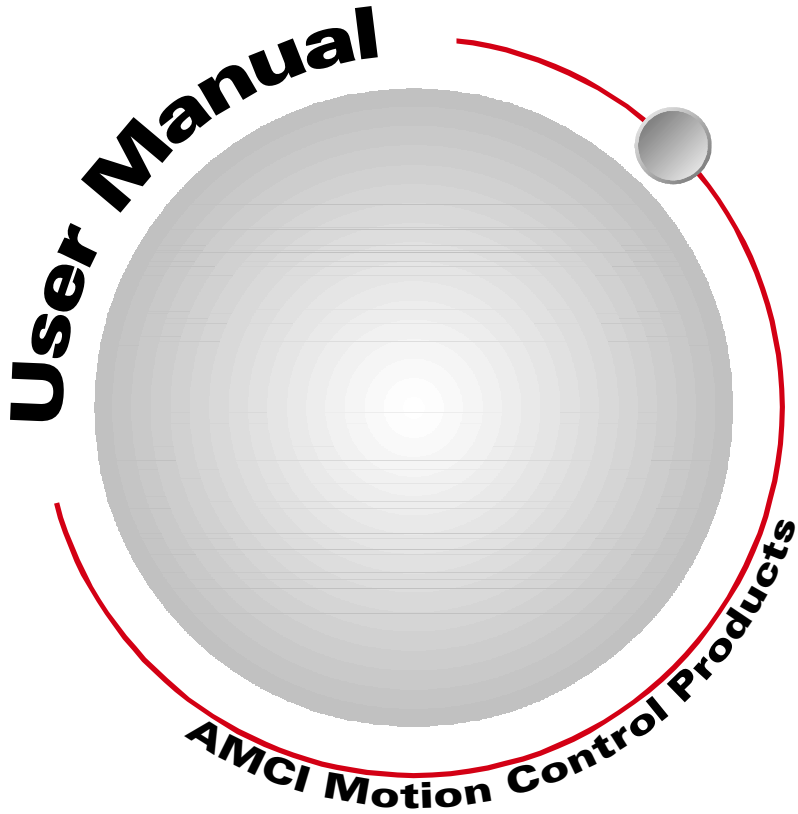
ADVANCED MICRO CONTROLS INC.

Manual #: 940-0S080

SD17040B
SD17040B-24
Stepper Drives



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GENERAL INFORMATION

Important User Information

The products and application data described in this manual are useful in a wide variety of different applications. Therefore, the user and others responsible for applying these products described herein are responsible for determining the acceptability for each application. While efforts have been made to provide accurate information within this manual, AMCI assumes no responsibility for the application or the completeness of the information contained herein.

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ADVANCED MICRO CONTROLS, INC. warrants that all equipment manufactured by it will be free from defects, under normal use, in materials and workmanship for a period of [18] months. Within this warranty period, AMCI shall, at its option, repair or replace, free of charge, any equipment covered by this warranty which is returned, shipping charges prepaid, within eighteen months from date of invoice, and which upon examination proves to be defective in material or workmanship and not caused by accident, misuse, neglect, alteration, improper installation or improper testing.

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All equipment being returned to AMCI for repair or replacement, regardless of warranty status, must have a Return Merchandise Authorization number issued by AMCI. Call (860) 585-1254 with the model number and serial number (if applicable) along with a description of the problem. An "RMA" number will be issued. Equipment must be shipped to AMCI with transportation charges prepaid. Title and risk of loss or damage remains with the customer until shipment is received by AMCI.

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24 Hour technical support is available on this product. Start at our website, *www.amci.com* if you have internet access. Product documentation and FAQ's are available on the site that answer most common questions.

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We Want Your Feedback

Manuals at AMCI are constantly evolving entities. Your questions and comments on this manual are both welcomed and necessary if this manual is to be improved. Please direct all comments to: Technical Documentation, AMCI, 20 Gear Drive, Terryville CT 06786, or fax us at (860) 584-1973. You can also e-mail your questions and comments to *techsupport@amci.com*

INTRODUCING THE SD17040B

This manual is designed to get you up and running quickly using the SD17040B or SD17040B-24 stepper drives. As such, it assumes you have some basic knowledge of stepper systems, such as the resolution you want run your motor at, and the reasons why you'd want to use Idle Current Reduction and the reasons why you wouldn't. If these terms or ideas are new to you, we're here to help. AMCI has a lot of information on our website and we are adding more all the time. If you can't find what you're looking for at http:///www.amci.com, send us an e-mail or call us. We're here to back you up with all of our knowledge and experience.

The SD17040B and SD17040B-24

The SD17040B and SD17040B-24 drives are the latest in AMCI's growing line of motion control products. They are designed for use with a variety of stepper motors including AMCI's size 23 and size 34 motors.

NOTE The only difference between the SD17040B and the SD17040B-24 is the input voltage required to activate the indexer and disable inputs. On the SD17040B, the input voltage is 5Vdc. On the SD17040B-24, the input voltage is 24Vdc. Most of the information in this manual applies to both drives. The "SD17040B" part number will be used when talking about both drives. When giving information that only applies to the SD17040B-24, the "SD17040B-24" part number will be used

The many features of the drives include:

- Programmable Steps per Turn (Full Step / Half Step)
- Programmable motor current setting from 0.9 to 4.0 amps
- Programmable Pulse Train Input (Step/Direction or CW/CCW)
- Programmable idle current reduction
- Detection of motor wiring shorts (Both winding to winding and winding to case)
- Motor Disable input
- Fault Output to signal the indexer or other device of a problem with the drive.

The most noticeable feature of the SD17040B is its small size. Using advanced technology, the SD17040B can drive a stepper motor at 4.0A without the need of heat sink fins or an internal fan that can fail over time.

Upgrading from the SD17040

The SD17040B replaces the AMCI SD17040 in all applications. The SD17040B has several advantages:

- A thinner front panel means you can space the drives closer together in an enclosure.
- The Disable Input on the SD17040B can be used to clear fault conditions. The SD17040 requires you to cycle power to clear the faults.

However, improvements sometimes require changes, and there are a few changes between the SD17040 and the SD17040B.

- The most noticeable is the change in wiring from connectors to terminal blocks. Switching to terminal blocks allowed AMCI to design in oversized 30A blocks for improved reliability. The general wiring layout is very similar, but the SD17040B's do not have an interlock jumper and the "B CTAP" and "A CTAP" pins on the SD17040 have been renamed "NC" (No Connection) on the SD17040B's. The "B CTAP" and "A CTAP" have always been an isolated pin that is available for wiring convenience, so this is not a change in functionality.
- The SD17040 required external resistors to use 24 Vdc inputs. The standard SD17040B needs the same external resistors. If you are converting a system with 24 Vdc I/O from a SD17040 to a SD17040B-24, the external resistors are not needed and must be eliminated for proper operation.
- The spacing between the lower mounting tabs is changed from 1.00 inch on the SD17040 to 0.75 inches on the SD17040B and SD17040B-24. The SD17040B and SD17040B-24 also have the option to mount the drive by the heatsink using #10-32 bolts.

SPECIFICATIONS

Drive Type

Two bipolar MOSFET H-bridges with 170Vdc output bus. 22KHz PWM current control.

Physical Dimensions

Width: 2.11 inches max.

Depth: 4.00 inches max.

Height: 6.15 inches
7.0 inches with mounting tabs

Weight

1.5 lbs. (0.71 kg.)

Inputs

Electrical Characteristics for all Inputs: .....
Differential. 1500 Vac/dc opto-isolated. Can be wired as single ended inputs.

Indexer ..... Motor steps on high going pulse. 150 µS min. pulse width, 25 KHz maximum input frequency. 300 µS minimum dwell time between direction changes.

Disable ..... Active High. Disables current to motor. Drive does not accept steps while disabled.

SD17040B:
Off State Voltage: 0 to 1Vdc
On State Voltage: 3.5 to 5Vdc
Input requires 10mA to activate.

SD17040B-24:
Off State Voltage: 0 to 5Vdc
On State Voltage: 20 to 27Vdc
Input requires 10mA to activate.

Fault Output

Electrical Characteristics:
Open Collector/Emitter. 1500 Vac/dc opto-isolated. 30Vdc, 20 mA max.

The Fault Output is normally on. Turns off under the following conditions:

Reset ..... The drive initialization is not yet complete on power up.

Short Circuit .... Motor Phase to Phase or Phase to Earth Ground

Over Temp ..... Heat Sink temperature exceeds 90° C (195° F)

Pulse Train Input

Switch selectable to CW/CCW or Step/Direction.

Motor Current

Switch selectable from 0.9 to 4.0APK in 0.1 Amp increments.

Idle Current Reduction

Switch selectable to *Not reduced*, *To 50%*, or *To 0%*. Motor current is reduced to selected level if a step pulse is not received for one second. Current is restored to full value on next pulse.

Resolution

Switch selectable to Full Step or Half Step (200 or 400 steps per turn)

Environmental Specifications

Input Power ..... 95 to 132Vac, 50/60 Hz, 5.0 Apk max.
Drive will retain control of motor down to 40Vac at reduced torque.

Ambient Operating Temperature
..... 32° to 122°F (0° to 50°C)

Storage Temperature
..... -40° to 185°F (-40° to 85°C)

Humidity ..... 0 to 95%, non-condensing

Motor Specifications

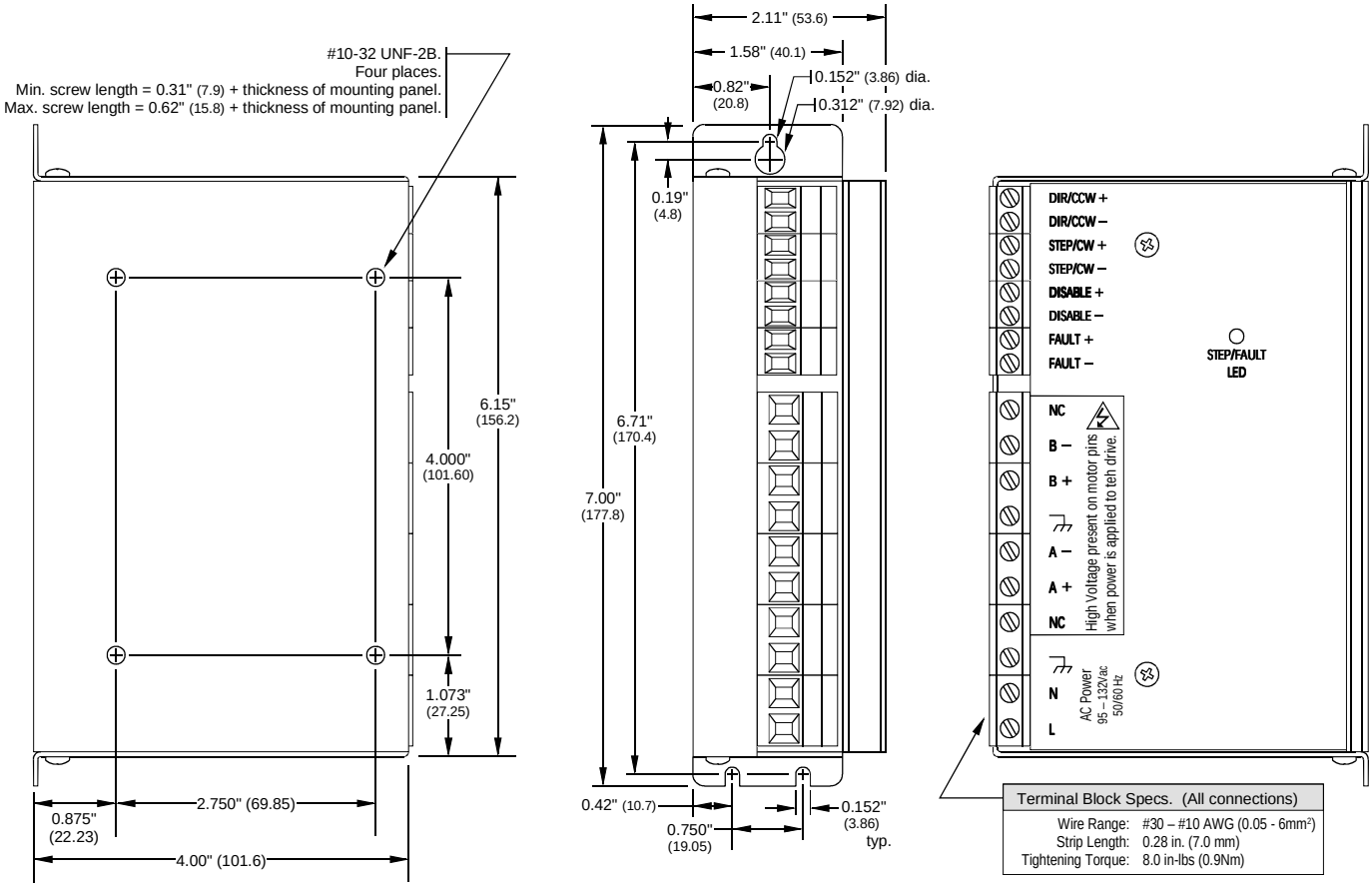
Type ..... 2 phase hybrid. 4, 6, or 8 lead motor

Insulation .... Minimum 500Vdc phase-to-phase and phase-to-case

Inductance .. 1.0 mH minimum. 2.5 to 45 mH recommended

MOUNTING THE SD17040B

Outline Drawing



There are two ways to mount the SD17040B. The preferred method is with four #10-32 screws into its heat sink. When this method of mounting is used, the drive can be mounted in any orientation as long as the drive is mounted to a large thermal mass such as an steel enclosure wall or metal mounting panel.

WARNING The minimum and maximum screw lengths given in the outline drawing should be observed to prevent a screw from shorting to the PC Board.

The second method is by the mounting tabs. Mounting tabs are for #6 screws. When using the mounting tabs, the drive must be mounted in the orientation shown to ensure adequate convectional airflow.

Airflow and Wiring Space

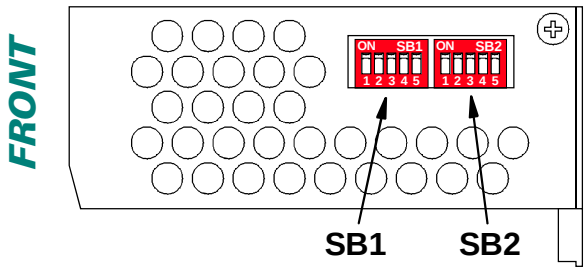
To ensure adequate airflow and wiring space, especially when you are using the mounting tabs, you need two inches (50 mm) of space above and below the drive, one and one-half inches (37 mm) of space to the left and right of the drive, and one inch (25 mm) of space in front of the drive. These dimensions are typical for convectional cooling. You will be able to mount the drives closer together if you have an active cooling system.

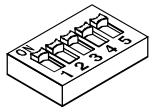
Grounding

The SD17040B must be grounded for proper operation. The **GND** connection on the power terminal block is connected to the SD17040B enclosure and is a sufficient grounding point for most applications. When mounting the SD17040B on a surface that is electrically conductive and grounded, you should also take steps to ensure that the two are electrically bonded together. If necessary, remove paint for the bolt mounting surfaces of the panel to ensure adequate electrical bonding.

SWITCH PLACEMENT

TOP VIEW





The SD17040B is configured by DIP switches on the top of the drive. The factory default setting has all switches in their ON (1) position.

SB1: 1 2 3 4 5 SB2: 1 2 3 4 5

Power *Must* Be Cycled When Changing These Switches

RESOLUTION (Steps per Turn)	
HALF STEP (400)	0
FULL STEP (200)	1

PULSE TRAIN INPUT	
CW/CCW	0
PULSE/DIR	1

IDLE CURRENT REDUCTION		
TO 0% CURRENT AFTER 1 SEC.	0	0
TO 0% CURRENT AFTER 1 SEC.	0	1
TO 50% CURRENT AFTER 1 SEC.	1	0
NO IDLE CURRENT REDUCTION	1	1

						OUTPUT CURRENT (APEAK)
0	0	0	0	0		4.0
0	0	0	0	1		3.9
0	0	0	1	0		3.8
0	0	0	1	1		3.7
0	0	1	0	0		3.6
0	0	1	0	1		3.5
0	0	1	1	0		3.4
0	0	1	1	1		3.3
0	1	0	0	0		3.2
0	1	0	0	1		3.1
0	1	0	1	0		3.0
0	1	0	1	1		2.9
0	1	1	0	0		2.8
0	1	1	0	1		2.7
0	1	1	1	0		2.6
0	1	1	1	1		2.5
1	0	0	0	0		2.4
1	0	0	0	1		2.3
1	0	0	1	0		2.2
1	0	0	1	1		2.1
1	0	1	0	0		2.0
1	0	1	0	1		1.9
1	0	1	1	0		1.8
1	0	1	1	1		1.7
1	1	0	0	0		1.6
1	1	0	0	1		1.5
1	1	0	1	0		1.4
1	1	0	1	1		1.3
1	1	1	0	0		1.2
1	1	1	0	1		1.1
1	1	1	1	0		1.0
1	1	1	1	1		0.9

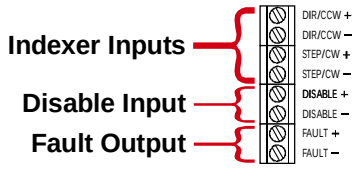
CAUTION

For safety reasons, AMCI *strongly* suggests removing power from the drive before making any changes to switch settings to avoid unexpected operation which may result in damage to equipment and/or injury to personnel.

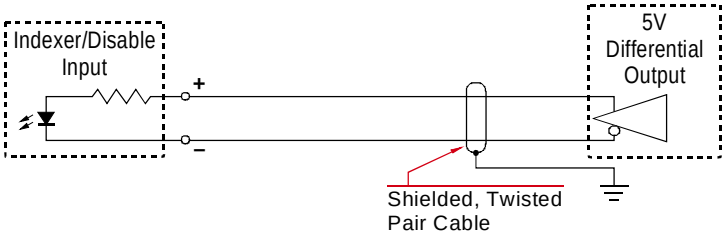
If you decide to change settings while power is applied, DO NOT make these changes while the motor is running.

CONNECTING YOUR INDEXER

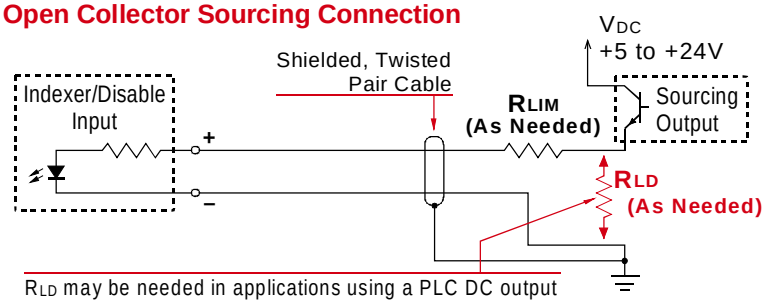
All inputs on the standard SD17040B are designed to accept 5 Vdc differential signals from the indexer, while the inputs on the SD17040B-24 are designed for 24 Vdc signals. Inputs on the standard SD17040B can be wired to accept sinking or sourcing outputs of up to 24Vdc by adding an external current limiting resistor to the circuit. Wiring diagrams and a table of common current limiting resistor values are given below. The SD17040B-24 has internal 3.9K resistors added to their input circuits. This makes it easier to integrate a SD17040B-24 into a 24 Vdc system, but makes it impossible to use the SD17040B-24 in a lower voltage system.



Differential Connection

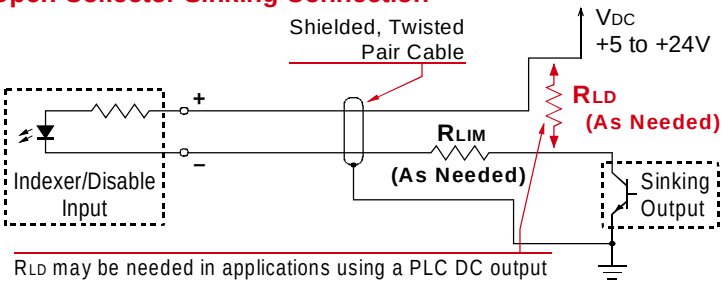


Open Collector Sourcing Connection



RLD may be needed in applications using a PLC DC output to generate index pulses at high speeds. See the note on this page for more information.

Open Collector Sinking Connection



RLD may be needed in applications using a PLC DC output to generate index pulses at high speeds. See the note on this page for more information.

Directional Pulse Inputs

Can be programmed to accept Pulse and Direction signals or CW/CCW signals. Set with switch SB1-2

Disable Input

When active, the motor current is off and the drive does not accept indexer pulses.

Fault Output

Normally on. Turns off when:

1) Short in motor (phase to phase or phase to ground)
2) Heatsink temperature exceeds 90°C (195°F).
3) Drive in its reset state and not ready to accept pulses.

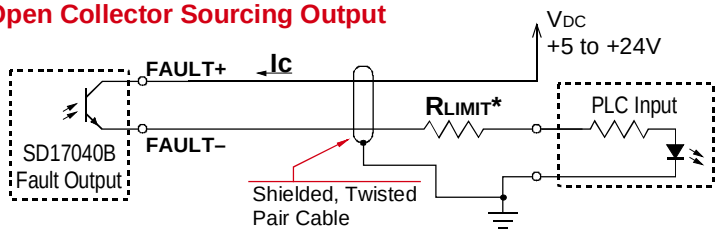
Common Values of RLIM (SD17040B only)

VDC	RLIM
5 Volts	None
12 Volts	2.0 KΩ
15 Volts	2.0 KΩ
24 Volts	3.9 KΩ

RLD

An additional load resistor may be required on some PLC outputs to improve switching time. A symptom of this problem is that the motor will begin run rough at high speeds. A 470 or 560 ohm resistor should be used. For 5V and 12V systems use a 1W resistor. For 24V systems use a 2W resistor. These power ratings assume that the output can be normally on. For systems where you are sure the output is always normally off, the wattage ratings can be cut in half.

Open Collector Sourcing Output



FAULT OUTPUT Electrical Specifications

VDC max: 30Vdc	$V_{CE\ SAT}$: 1Vdc @ 20 mA
Ic max: 20 mA	Power Dissipation: 20 mW max.

The ±Fault output is an optically isolated transistor capable of driving a typical PLC input. Both ends are uncommitted, so it can be wired as a sourcing or sinking output. The figure shows a typical connection as a sourcing output.

*RLIMIT

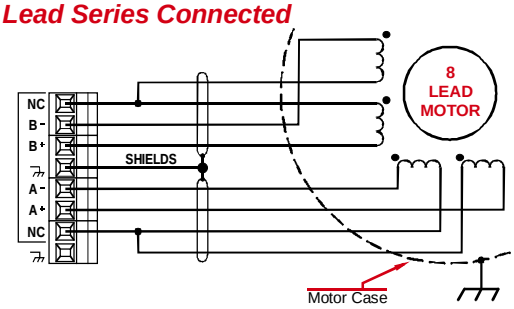
A resistor may be needed to limit the current through the Fault Output. The value, and power rating of the resistor is dependent on the value of VDC, the voltage drop across the input, and the current requirements of the input.

CONNECTING YOUR MOTOR

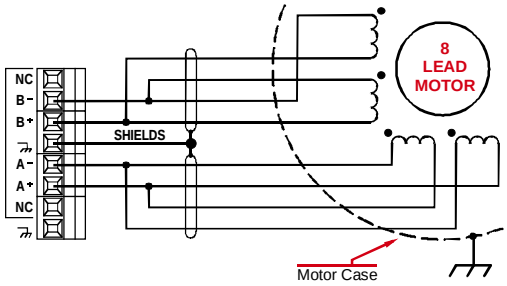
The SD17040B's will work with many different motors, including those not sold by AMCI. This section assumes that you have already chosen your motor and you are looking for wiring information. No wire colors are given because there is no single industry wide color coding scheme for stepper motor wires. You must refer back to your motor data sheets for this information.

AMCI offers several different stepper motors in sizes 23, 34 and 42. Refer to our website, www.amci.com for additional information on these products.

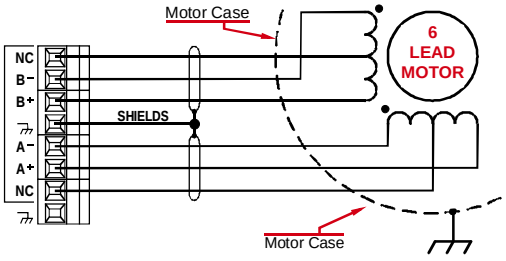
Eight Lead Series Connected



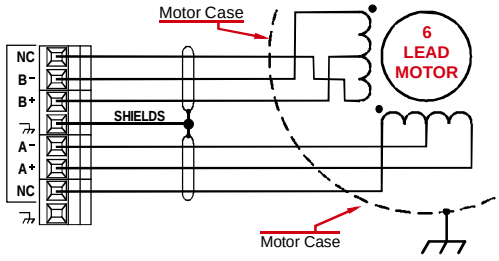
Eight Lead Parallel Connected



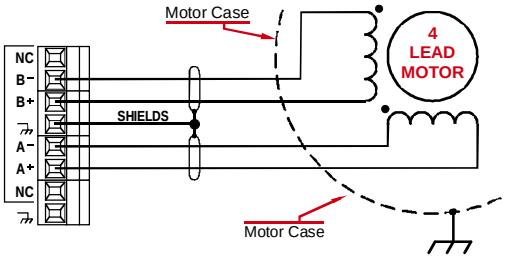
Six Lead Series Connected



Six Lead Center Tap Connected



Four Lead Connected

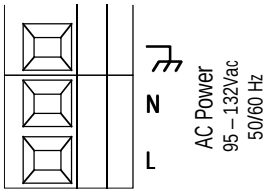


NOTES

1) Refer to the torque vs. speed curves on your motor's specifications sheet to determine if you should wire the motor to the SD17040B in series, parallel, or centertap configuration.
2) 170Vdc is present on the connector when power is applied to the motor. Do not wire the motor to the SD17040B when power is applied to the drive.
3) Motor connections should be tight. Loose connections may lead to arcing which will heat the terminal. The terminal block manufacturer specifies a strip length of 0.28 " (7.0 mm) and a tightening torque of 8.0 in-lbs. (0.9 Nm).

POWER CONNECTOR AND INDICATOR LED

Power Connector



The SD17040B operates on 115Vac. If 230Vac is the only power available, consider using AMCI's SD31045. If this is not an option, a step-down transformer must be installed to power the SD17040B. The transformer must have a minimum power rating of 600 VA.

The SD17040B must be grounded for proper operation. Grounding is accomplished with the GND pin on the power connector, and through proper bonding to the enclosure.

Terminals will accept a maximum #10 AWG wire. Strip length should be 0.28" (7mm), and tightening torque should be 8.0 in-lbs. (0.9 nM).

Indicator LED

STEP/FAULT ◯

Green:
Drive is powered and operational

Flashing Green:
Drive Operational, receiving pulses.

Red:
Drive Fault

1) Over Temperature Fault: Heatsink temperature exceeds 90°C (195°F)
2) Over Current Fault: Generally, a short exists in the system. This can be a short in the motor or in the drive itself.
   A) Phase–Phase Short: There is an electrical short between the two motor windings. The short exists in the motor cable or in the motor itself.
   B) Phase–Ground Short: One of the motor's windings is shorted to earth ground. (The EARTH GND terminal of the Motor Connector is used as the reference point.) The fault can be in the motor cable or in the motor itself.

VERIFYING SYSTEM SETUP

System Checkout

1) Verify all wiring and grounding before applying power to the SD17040B. Pay close attention to the wire terminations and verify that wires cannot short together and the terminals are properly tightened.

2) Apply 115Vac power. With the motor attached, the power LED should come on green. A problem exists if the LED is red. Remove power and refer to the *Troubleshooting* section of this manual which begins on the following page.

3) Check for holding torque on the motor. If you have less then you expected, the most common causes are improper motor current switch settings or having the Idle Current Reduction turned on. If you change the Idle Current Reduction setting, you must cycle power to the drive before the changes are recognized by the SD17040B.

4) Have your indexer make a slow move in the clockwise direction for one turn. While the turn is in progress, the STEP LED should blink. Verify that the motor rotated in the correct direction for one complete turn. If you are using an optical encoder or other position feedback, verify that the indexer or controller is reading it properly.

5) Repeat step 4 with a one turn move in the counter-clockwise direction. Again verify that the motor rotated in the correct direction for one turn.

NOTE Any failures at steps 4 or 5 are usually caused by not setting the Pulse Train Input switch to match your indexer's setting or programming the wrong number of pulses in the indexer profile. If the motor rotates in the wrong direction you can swap the +B and –B connections instead of altering your programming.

6) If you are using the Disable Input, verify its operation with the motor stopped. Note that the motor will have no holding torque while this input is active and the motor's shaft will be free to rotate.

7) If you are using the Fault Output, verify that it is *On* (conducting). Remove power from the SD17040B, disconnect the motor, and re-apply power. The STEP/FAULT LED should be red and the Fault Output should be off (not conducting).

8) Remove power and re-attach the motor. Power the drive.

9) Consider altering the motor current or enabling the Idle Current Reduction if it is not already enabled. Lowering the motor current or enabling Idle Current Reduction can greatly reduce motor heating.

TROUBLESHOOTING

Indexer Problems

Symptom	Solution
My indexer/PLC reports a fault from the SD17040B when everything seems fine.	Your logic may be reversed. On the SD17040B, the Fault Output is on (conducts current) when the drive is working correctly and turns off (stops current flow) when there is a fault with the drive. Therefore, losing power to the drive appears as a fault. If you're expecting the fault output to turn on and conduct current when there is a fault, then your logic is reversed.
The motor is running faster/slower than expected and the distance traveled is father/shorter than expected.	Most likely a problem with the SD17040B's Step Resolution setting or the indexer's programming. If the motor is running too fast, the Step Resolution on the SD17040B may to Full Step while the indexer's programmer assumed it would be set to Half Step. If the motor is running slow, the Step Resolution may be set to Half Step while the indexer's programmer assumed it would be set to Full Step.

Drive Problems

Symptom	Solution
The Status LED is off, and the Fault Output is active. (Not conducting) Power is applied to the drive.	The AC line voltage may be too low. It must be greater than 40Vac for the SD17040B to operate properly.
The Status LED is green, the Fault Output is inactive, (conducting) but the motor is not powered.	The Idle Current Reduction may be set to its *To 0%* setting. With this setting, current is removed from the motor if a directional pulse is not received for one second.
The Status LED does not blink when the indexer sends pulses to the drive. The motor does not turn.	1) Verify that your two directional inputs on the Indexer Connector are not swapped or cross-wired. 2) If the inputs are wired as a sinking or sourcing instead of differential, verify that the proper current limiting resistor is installed and that they are wired correctly when using the standard SD17040B. When using the SD17040B-24, the indexer inputs must be 24Vdc. If your indexer has sourcing outputs, then the inputs of the SD17040B must be wired as sinking inputs and vice versa. 3) If you are using a 24Vdc system and you are converting from a standard SD17040B to a SD17040B-24, you must remove the external 3.9K resistors from your wiring. The SD17040B-24 has this current limiting resistor built into the drive.
The STEP/FAULT LED is red.	The drive is experiencing a fault condition. All faults are latched, so power must be cycled to the drive or the Disable Input must be toggled before the fault will clear. **1) Over Temp Fault.** Is the drive very hot? It shuts down when its internal temperature exceeds 90°C (195°F). **3) Short in Motor.** Shut off the SD17040B and disconnect the motor. Verify the following with an ohmmeter. a) Open circuit from "A+" to "B+" wires on the motor. (Tests for short between phases.) b) Open circuit from "A+" to "Earth Ground" and "B+" to "Earth Ground" wires on the motor. (Tests for short between phase and case.) If any of these readings is not an open circuit, then check your wiring. The most common cause of a short between phases is cross-wiring the phases when wiring the connector. If you see a phase-to-case short, make sure you don't have a stray wire from the "B+" or "A-" terminals hitting the Earth Ground terminal on the terminal block.

Motor Problems

Symptom	Solution
The motor has no holding torque.	1) If the Step/Fault LED is red, then a problem exists with the drive or motor. Refer to *Power Connector and Indicator LED's* on page 9 for information. 2) If the motor rotates when commanded but has no holding torque, then your Idle Current Reduction switches are set to the *To 0%* setting. This setting removes motor current when the drive is idle for more than one second. There are other idle current reduction settings available. See *Switch Settings* on page 6 for more information. 3) The SD17040B ships with the motor current set to its minimum value of 0.9 amp. It's possible that it was not set for your application. See *Switch Settings* starting on page 6 for the proper switch settings.
The SD17040B blinks its STEP/FAULT LED green when pulses are applied to the drive, but the motor only emits a high pitch noise. It does not rotate.	1) The acceleration or starting speed values may have been set too high when the indexer was programmed. The motor may start to accelerate and stall as the acceleration increases. 2) The Step Resolution may be set to Full Step instead of Half Step, effectively doubling the acceleration value.
The motor only runs in one direction.	This problem is usually caused by the directional pulse inputs. If your indexer is sending pulses in the *CW/CCW* format and the drive is configured for the *Step & Direction* format, the motor will rotate counter-clockwise when the drive receives CW pulses, and it will not rotate at all when the drive receives CCW pulses. If the indexer is sending pulses in the Step & Direction format and the drive is configured for the CW/CCW format, the motor will only rotate clockwise, even when the indexer is commanding a counter-clockwise move.
The motor runs backwards. (CW instead of CCW and/or CCW instead of CW)	1) One of the motor phases may be reversed. The "quick fix" is to reverse the connections on the ±B windings. 2) There may be a problem with the directional inputs. Either they are wired incorrectly or the format is wrong. Check wiring and see the previous problem for more information on problems with format.
As its running speed increases, the motor begins to run rough, and eventually stops while pulses are being applied.	If you are using single ended outputs for your pulse and direction signals, you may have a problem with the outputs not switching fast enough. See the note on the RLD Resistor in the *Connecting Your Indexer* section on page 7.
The motor runs erratically.	1) The motor is not correctly coupled to the load. 2) The deceleration rate is set to high and the inertia of the load is carrying the motor past the point where it is supposed to stop. 3) You are performing a slow move, typically under 1 revolution/second. Try increasing the indexer's starting speed parameter to correct this problem. Do not increase the starting speed beyond your slowest running speed. 4) The motor current is set too low and the motor is unable to move the load. 5) The motor is not correctly wired. Eight lead motors can be wired in series or parallel. Series connection gives you more torque at lower speeds and parallel connection gives you more torque at higher speeds.

NOTE As noted above, sometimes a problem that appears to be with the motor is actually a problem with the indexer.

NOTES

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