Module Overview

When you must control rotational position or velocity, stepper motors have several advantages over servo control systems. The first is cost. Opposed to 'closed loop' servo systems that require position feedback to the drive, stepper systems operate 'open loop', accurately controlling position and velocity without feedback. Eliminating the feedback loop can result in a great cost savings. The stepper motor itself is also tough, easy to install, and offers high output torque for its size. There are three basic components to a stepper system.

➢ **The Indexer –** The indexer, sometimes called the controller, generates directional pulses that control the position, velocity, and rotational direction of the stepper motor. Indexers can take on many forms, from a fully programmable card for a programmable logic controller or PC, to a 'black box' that runs a fixed profile whenever an operator presses a button.

➢ **The Drive –** The drive converts the directional pulses from the indexer into the current waveforms needed to drive the stepper motor. The SD17060 accepts differential signals from the indexer and outputs 170Vdc digitized waveforms to the motor with a maximum current of 6.3Arms. The SD17060 also has fault diagnostics that warn you of problems with the motor connections or directional pulses from the indexer. The SD17060's fault output is typically fed back to the indexer.

➢ **The Motor –** Stepper motors are available in many different sizes to met specific torque requirements. AMCI offers motors that range in size from NEMA 23 to NEMA 42. A position feedback device, such as an optical encoder or resolver, can be added to the system if desired. The feedback is between the motor and the indexer, and therefore its specification and installation is not covered in this manual.

AMCI's SD17060 is an advanced, high-power microstepping drive for NEMA 17 through NEMA 42 frame size motors. The drives many features include:

➢ Self Test
➢ Programmable RMS current control
➢ Detection of seven different faults
➢ Disable input
➢ Fault Output
➢ Programmable Idle Current Reduction
➢ Programmable Current Loop Gain
➢ Programmable Output Waveform (for microstepping applications)
➢ Connections to the indexer are made through opto-isolated differential inputs. Differential inputs have greater noise immunity than single ended inputs. This means you can run longer cables, (up to 300 feet), from the indexer to the SD17060, and place the drive closer to the motor. A shorter motor cable means less power loss from cable resistance, which means more torque from the motor.

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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. Throughout this manual the following two notices are used to highlight important points.

WARNINGS tell you when people may be hurt or equipment may be damaged if the procedure is not followed properly.

CAUTIONS tell you when equipment may be damaged if the procedure is not followed properly. No patent liability is assumed by AMCI, with respect to use of information, circuits, equipment, or software described in this manual. The information contained within this manual is subject to change without notice. UNDER NO CIRCUMSTANCES WILL ADVANCED MICRO CONTROLS, INC. BE RESPONSIBLE OR LIABLE FOR ANY DAMAGES OR LOSSES, INCLUDING INDIRECT OR CONSEQUENTIAL DAMAGES OR LOSSES, ARISING FROM THE USE OF ANY INFORMATION CONTAINED WITHIN THIS MANUAL, OR THE USE OF ANY PRODUCTS OR SERVICES REFERENCED HEREIN.

Standard Warranty

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 18 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. The provisions of the "STANDARD WARRANTY" are the sole obligations of AMCI and excludes all other warranties expressed or implied. In no event shall AMCI be liable for incidental or consequential damages or for delay in performance of this warranty.

Returns Policy

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 and serial numbers along with a description of the problem. A "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.

24 Hour Technical Support Number

Technical Support, in the form of documents, FAQs, and sample programs, is available from our website, www.amci.com. 24 Hour technical support is also available on this product. For technical support, call (860) 583-7271. Your call will be answered by the factory during regular business hours, Monday through Friday, 8AM - 5PM EST. During non-business hours, an automated system will ask you to leave a detailed message and the telephone number that you can be reached at. The system will page an engineer on call. Please have your product model number and a description of the problem ready before you call.

Specifications

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

Physical Dimensions
Width: 2.7 inches
Depth: 4.7 inches
Height: 6.2 inches
7.0 inches with mounting tabs

Weight
4.3 lbs. (2.0 kg.)

Inputs
Electrical Characteristics for all Inputs:
Differential. 1500 Vac/dc opto-isolated. Can be wired as single ended inputs.
Step .... Motor steps on high going pulse. 150μS min. pulse width, 2 MHz maximum input frequency.
Disable ...... Active high. Disables current to motor. Drive does not accept steps while disabled.

Single Ended Current Limiting Resistors

Vdc	R_{Limit}
5 Volts	None
12 Volts	2.0kΩ
15 Volts	2.0kΩ
24 Volts	3.9kΩ

Fault Output
Electrical Characteristics:
Open Collector/Emitter. 1500 Vac/dc optoisolated. 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 Phaseto Ground
Over Temp ...... Heat Sink temperature exceeds 90° C (195° F)
No Motor .... The motor interlock terminals are not connected.

Pulse Train Input
Switch selectable to CW/CCW or Step/Direction.

Motor Current
Switch selectable from 0.0 to 6.3 Armp in 0.1Amp steps.

Idle Current Reduction
Switch selectable to *Not reduced, 69%, 50%, or 0%.* Motor current is reduced to selected level if a step pulse is not received for one second. Current restored to full value on next pulse.

Resolution
16 switch selectable steps/rev: 200, 400, 1000, 2000, 5000, 10,000, 12,800, 18,000, 20,000, 21,600, 25,000, 25,400, 25,600, 36,000, 50,000, and 50,800. Settings are latchable and changes only occur when power is cycled.

Internal Power Fuses
5 Amp Slow Blow. Both Line and Neutral are fused. Fuses are not field replaceable.

Environmental Specifications
Input Power: 95 to 132Vac, 50/60 Hz, 5.0 Apk max.
Drive will retain control of motor down to 85Vac at reduced torque.
An installed Step Down Transformer must be rated for 1.1kVa
Operating Temp   32° to 122°F (0° to 50°C)
Storage Temp: -40° to 185°F (-40° to 85°C)
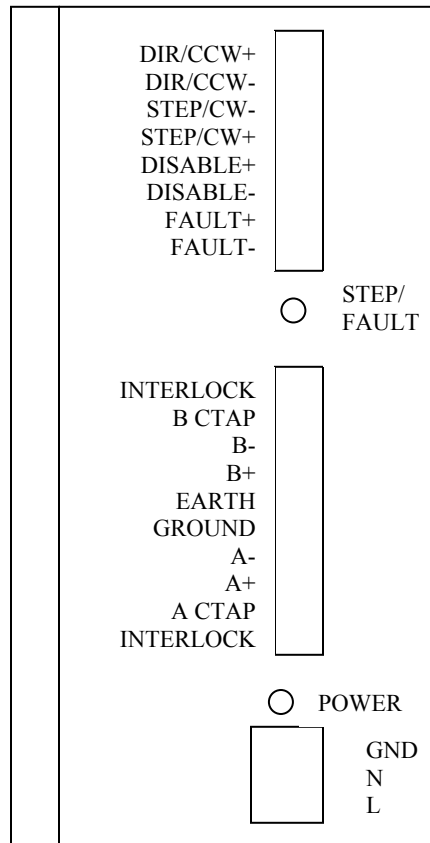Humidity: 0 to 95%, non-condensing

Motor Specifications
Type ....2 phase hybrid. 4, 6, or 8 lead motor
Insulation ... Minimum 500Vdc phase-to phase and phase-to-case
Inductance .. 1 mH minimum. 2.5 to 45 mH Recommended

The SD17060 has thee input connectors and two status LEDs as the following diagram shows.

```
DIR/CCW+
DIR/CCW-
STEP/CW-
STEP/CW+
DISABLE+
DISABLE-
FAULT+
FAULT-
                        ○   STEP/
                            FAULT

INTERLOCK
B CTAP
B-
B+
EARTH
GROUND
A-
A+
A CTAP
INTERLOCK
                        ○   POWER
                            GND
                            N
                            L
```

The following section gives brief descriptions of the SD17060's features. They are presented so that you can familiarize yourself with the drive.

Pulse Train Input
Most indexers output their directional pulses in one of two formats, *CW/CCW* or *Pulse and Direction.* By default, the SD17060 uses the *CW/CCW* format, but can be configured for either.

Current Loop Gain
This feature sets the gain of the current loop used to control the motor current and allows the SD17060 driver to be more closely matched to the driver.

Idle Current Reduction
This feature reduces current to the motor when it is idle, which significantly reduces motor heating. Four setting are available. *To 0%* removes the motor current when it is idle. No holding torque is available. To 69% reduces the current to 69%of its value. *To 50%* reduces the current to one-half its maximum value. *Not Reduced* keeps the full current applied to the motor for maximum holding torque.

Output Waveform
This feature allows you to compensate for problems associated with a motor's physical characteristics by altering the shape of the current waveform used to drive the motor. This feature has four options, Pure Sine, -4%, -6%, and −10%, and is only used when you are half-stepping or micro-stepping the motor.

Step Resolution

The Step Resolution feature sets the number of steps needed to complete one rotation. Standard stepper motors have an inherent resolution of 1.8° per step. The SD17060 can further divide this 1.8° step by controlling the current through each motor winding. This is commonly called *microstepping*. The maximum resolution of the SD17060 is 50,800 steps per turn. Your step resolution choice is usually dependent on your application.

Motor Current

The SD17060 can have its motor output current set from 0.0 to 6.3 amps in 0.1 amp increments. The exact current setting is based on your motor's size and application requirements. Motors that are rated for more than 6.3 amps can be used with the SD17060. The maximum current through the motor will be limited to 6.3 amps.

Self Test

This feature allows you to verify motor wiring and drive operation without an indexer. When the drive is set for self test, the drive rotates the motor counter-clockwise at 72 RPM with a resolution of 50,000 steps per turn.

Disable Input

When active, the Disable Input removes power from the motor. The driver does not accept steps while this input is active. The disable input is active high.

Fault Output

The fault input is normally on. This output will turn off when the driver detects a fault condition.

Interlock Terminals

The two INTERLOCK terminals are a safety feature. The SD17060 will not power the motor unless a short wire connects these two terminals. If these terminals are not connected, the Step Fault LED will be on Solid Red.

Center Tap Terminals

The two center tap terminals, A CTAP and B CTAP, are for wiring convenience only. These terminals are electrically isolated from the rest of the driver and are not used to power the motor. These terminals are to be used to connect two motor wires together, such as when an eight lead motor is wired in series.
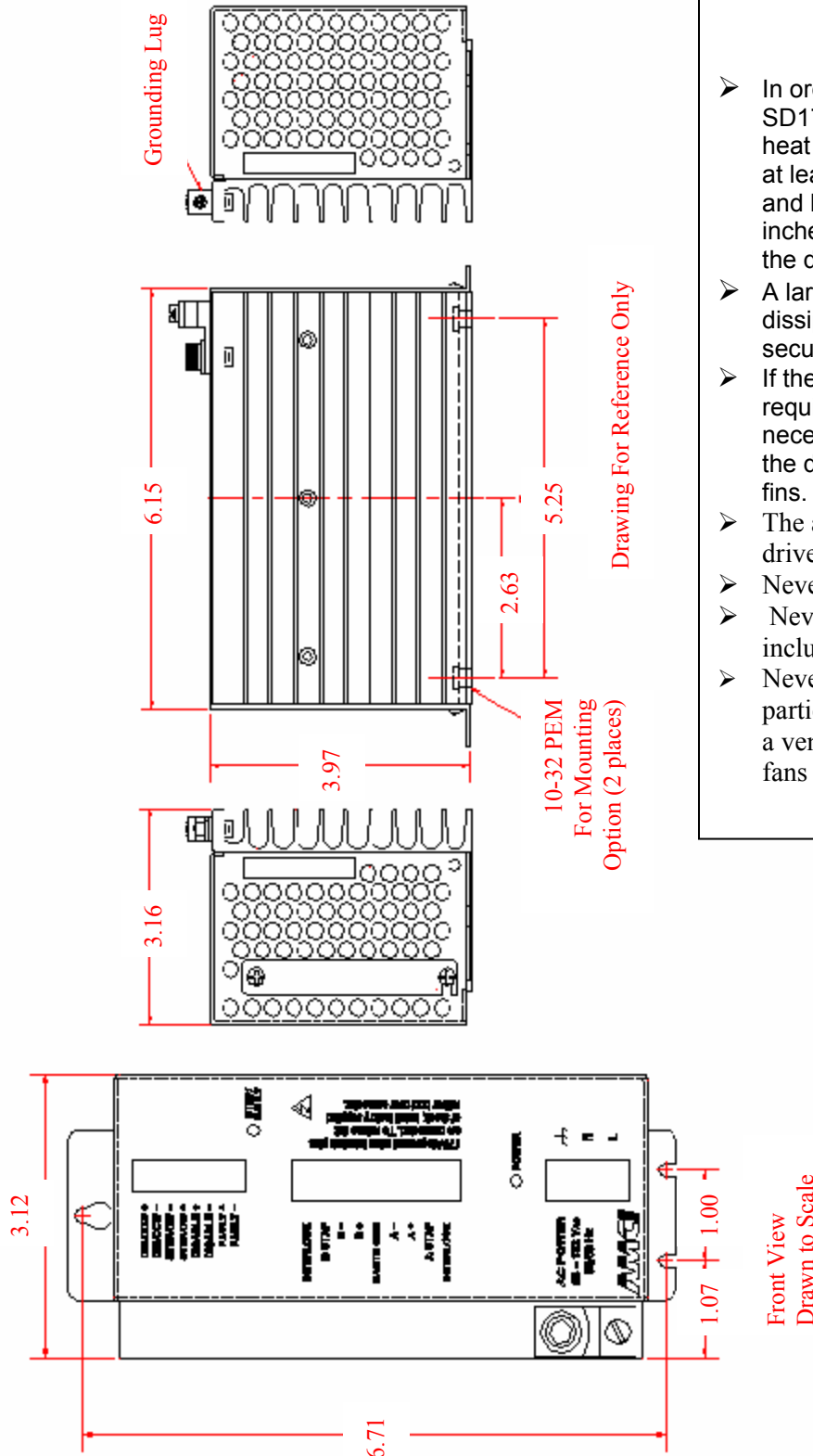
Power Connector

Input power must be between 95 and 132 Vac, 50/60 Hz for proper operation.

WARNING : When power is applied, 120 Vac is on the power connector pins. To reduce the risk of electrical shock, always install the supplied rubber boot on the power connector.

➢ Because the SD17060 derives motor power directly from the AC line, it cannot be modified to use 230 Vac power. If your installation only has 230 Vac, you must install a step down transformer to power the SD17060. The transformer must be rated for a minimum of 1.1KVa.

➢ Both the Neutral (**N**) and Line (**L**) terminals are internally fused with 5 amp slow blow fuses. If you plan to use external circuit breakers or fuses, they should also be rated for 5 amps.

SD17060 Outline Drawing

Grounding Lug

6.15

2.63

5.25

Drawing For Reference Only

10-32 PEM For Mounting Option (2 places)

3.97

3.16

3.12

1.00

1.07

Front View Drawn to Scale

6.71

Installation Notes

➢ In order to dissipate heat correctly, the SD17060 <u>must</u> be mounted with the heat sink fins vertical. There should be at least 2 inches of space both above and below the driver, and at least 1.5 inches of space to the left and right of the driver.

➢ A large amount of heat can also be dissipated if the back of the driver is securely mounted to a metal panel.

➢ If there is some reason that the above requirements cannot be met, it may be necessary to mount a small fan below the driver to blow air over the heat sink fins.

➢ The ambient temperature around the drive must not exceed 120°F (50°C).

➢ Never block the fins of the heat sink.

➢ Never expose the SD17060 to liquids, including condensing humidity.

➢ Never expose the SD17060 to metal particles. If the SD17060 is mounted in a ventilated enclosure, the ventilation fans should have dust covers.

LED Function

LED	Color/Pattern	Function
POWER	Green	Supply Voltage over 40Vac
	Off	Supply Voltage under 40Vac or internal fuses are blown
STEP/FAULT	Off	Driver functioning, no motion in progress
	Solid Green	Driver functioning, no motion in progress
	Blinking Green	Driver functioning, motion occurring. The LED blinks at the input step rate
	Solid Red	Fault Condition. 1. Over temperature fault: The temperature of the SD17060's heat sink exceeded 90°C (195°F). 2. Interlock Fault: The two Interlock Terminals on the driver's motor connector are not connected together. 3. Phase to Phase short: There is an electrical short between two motor windings. The short exists in the motor cable or in the motor itself. 4. Phase to Ground Short: One of the motor's windings is shorted to earth ground. (The Earth GND terminal of the driver's motor connector is referenced.) The fault can be in the motor cable or in the motor itself. 5. Attempting an Automatic Current Loop gain identification with the motor current set to zero. 6. An Automatic Current Loop gain identification was attempted with only the interlock wire attached. That is, there was no motor attached to the driver. Because the fault is latched, you will have to correct the fault and cycle power before it will clear.
	Blinking Red/Green	STEP VIOLATION. Indicates that a step violation condition was present. Step Violation means that step signals were received when the drive was inactive (Power Up or when DISABLE input is Active). Power must be cycled to clear the fault

Switch Settings

Four banks of five dip switches are used to configure the stepper driver. These switches are located on the top of the driver and can be accessed by loosening two screws and rotating the cover up and out of the way. Switch one is located towards the front of the driver. When ON, the switches are pushed towards the heat sink fins. The switch settings are latched at power up. Any changes made to the switches while power is applied will be ignored. Power must be removed from the driver before adjusting the switch settings.

The following diagrams show the layout of the four switch banks.
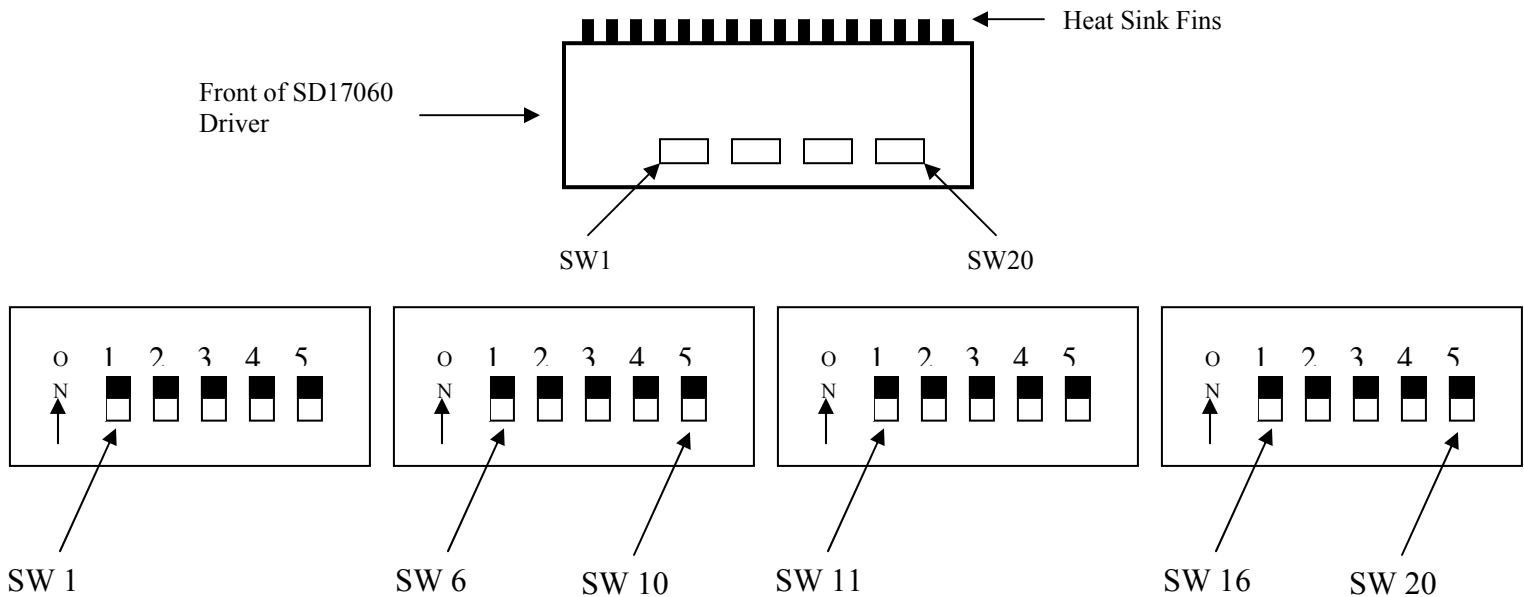
| Sw 1 - | OFF | - STEP/DIR |
| | ON | - CW/CCW |

Sw 2,3 -	OFF, OFF	- No Idle Current Reduction.
	ON, OFF	- 69% Idle Current After 0.01seconds (10ms)
	OFF, ON	- 50% Idle Current After 1 second
	ON, ON	- 0% Idle Current After 1 second

Sw 4,5 -	OFF, OFF	- Pure Sin OUTPUT CURRENT.
	ON, OFF	- -4% Third Harmonic.
	OFF,ON	- -6% Third Harmonic.
	ON,ON	- -10% Third Harmonic.

Note 1: When No Idle Current Reduction and a resolution of other than 200steps/rev are both selected, the current is automatically reduced to 69% of its value after 0.2 seconds of no motion. This prevents overheating of the motor. When working with resolutions above 200 steps/rev, the phase current follows a *sin* pattern with a peak value 1.414 times higher than the RMS value set with the switches.

Note 2: When 200 steps/rev are selected and any Third Harmonic value other than Pure Sin (switches 4 and 5 off) is selected, the driver will enter SELF-TEST mode. The motor will run at 50,000steps/rev with 72 rev/min.

Switches 6 to 10, Selecting the Current Loop Gain

Sw6	Sw7	Sw8	Sw9	Sw10	GAIN
OFF	OFF	OFF	OFF	OFF	Automatic Identification*
ON	OFF	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	OFF	2
ON	ON	OFF	OFF	OFF	3
OFF	OFF	ON	OFF	OFF	4
ON	OFF	ON	OFF	OFF	5
OFF	ON	ON	OFF	OFF	6
ON	ON	ON	OFF	OFF	7
OFF	OFF	OFF	ON	OFF	8
ON	OFF	OFF	ON	OFF	9
OFF	ON	OFF	ON	OFF	10
ON	ON	OFF	ON	OFF	11
OFF	OFF	ON	ON	OFF	12
ON	OFF	ON	ON	OFF	13
OFF	ON	ON	ON	OFF	14
ON	ON	ON	ON	OFF	15
OFF	OFF	OFF	OFF	ON	16
ON	OFF	OFF	OFF	ON	17
OFF	ON	OFF	OFF	ON	18
ON	ON	OFF	OFF	ON	19
OFF	OFF	ON	OFF	ON	20
ON	OFF	ON	OFF	ON	21
OFF	ON	ON	OFF	ON	22
ON	ON	ON	OFF	ON	23
OFF	OFF	OFF	ON	ON	24
ON	OFF	OFF	ON	ON	25
OFF	ON	OFF	ON	ON	26
ON	ON	OFF	ON	ON	27
OFF	OFF	ON	ON	ON	28
ON	OFF	ON	ON	ON	29
OFF	ON	ON	ON	ON	30
ON	ON	ON	ON	ON	31

*_Automatic Identification Mode_ – With the motor connected at power up, and the driver's current set to match the motor, the driver starts a test procedure that takes about 20 seconds. This procedure identifies the parameters of the motor and when complete displays the recommended value for the **Current Loops GAIN** with the number of blinks of the Step/Fault LED. This pattern will be shown only once. After determining the gain, remove power from the SD17060 and set switches 6 through 10 to the obtained value of the gain.

- The Automatic Identification Mode must be performed with the motor current set to its appropriate value. If the motor current is set to zero, the Step/Fault Led will be on solid red and the Fault Output will be off.
- Set the gain switches to a value of 31 if the Step/Fault LED blinks more than 31 times.
- The driver will indicate a fault if Automatic Identification Mode is attempted and only the Interlock wire is attached to the driver's motor connector.
- It is not necessary to use the value obtained by the automatic identification function. For smoother operations at higher speeds, a higher value of the Current Loop Gain can be set. However, setting a higher than recommended value could result in noisier operations at both low speeds and when the motor is at rest.

Switches 11 to 14, Selecting the Microstepping Resolution

Sw11	Sw12	Sw13	Sw14	RESOLUTION steps/revolution
OFF	OFF	OFF	OFF	200
ON	OFF	OFF	OFF	400
OFF	ON	OFF	OFF	1000
ON	ON	OFF	OFF	2000
OFF	OFF	ON	OFF	5000
ON	OFF	ON	OFF	10'000
OFF	ON	ON	OFF	12'800
ON	ON	ON	OFF	18'000
OFF	OFF	OFF	ON	20'000
ON	OFF	OFF	ON	21'600
OFF	ON	OFF	ON	25'000
ON	ON	OFF	ON	25'400
OFF	OFF	ON	ON	25'600
ON	OFF	ON	ON	36'000
OFF	ON	ON	ON	50'000
ON	ON	ON	ON	50'800

Note 1: When No Idle Current Reduction and a resolution of other than 200steps/rev are both selected, the current is automatically reduced to 69% of its value after 0.2 seconds of no motion. This prevents overheating of the motor. When working with resolutions above 200 steps/rev, the phase current follows a *sin* pattern with a peak value 1.414 times higher than the RMS value set with the switches.

Note 2: When 200 steps/rev are selected and any Third Harmonic value other than Pure Sin (switches 4 and 5 off) is selected, the driver will enter SELF-TEST mode. The motor will run at 50,000steps/rev with 72 rev/min.

## Switches 15 to 20, Selecting the Motor Current Value per Phase (RMS)

| Sw15	Sw16	Sw17	Sw18	Sw19	Sw20	Current RMS Amps
OFF	OFF	OFF	OFF	OFF	OFF	0
ON	OFF	OFF	OFF	OFF	OFF	0.1
OFF	ON	OFF	OFF	OFF	OFF	0.2
ON	ON	OFF	OFF	OFF	OFF	0.3
OFF	OFF	ON	OFF	OFF	OFF	0.4
ON	OFF	ON	OFF	OFF	OFF	0.5
OFF	ON	ON	OFF	OFF	OFF	0.6
ON	ON	ON	OFF	OFF	OFF	0.7
OFF	OFF	OFF	ON	OFF	OFF	0.8
ON	OFF	OFF	ON	OFF	OFF	0.9
OFF	ON	OFF	ON	OFF	OFF	1.0
ON	ON	OFF	ON	OFF	OFF	1.1
OFF	OFF	ON	ON	OFF	OFF	1.2
ON	OFF	ON	ON	OFF	OFF	1.3
OFF	ON	ON	ON	OFF	OFF	1.4
ON	ON	ON	ON	OFF	OFF	1.5
OFF	OFF	OFF	OFF	ON	OFF	1.6
ON	OFF	OFF	OFF	ON	OFF	1.7
OFF	ON	OFF	OFF	ON	OFF	1.8
ON	ON	OFF	OFF	ON	OFF	1.9
OFF	OFF	ON	OFF	ON	OFF	2.0
ON	OFF	ON	OFF	ON	OFF	2.1
OFF	ON	ON	OFF	ON	OFF	2.2
ON	ON	ON	OFF	ON	OFF	2.3
OFF	OFF	OFF	ON	ON	OFF	2.4
ON	OFF	OFF	ON	ON	OFF	2.5
OFF	ON	OFF	ON	ON	OFF	2.6
ON	ON	OFF	ON	ON	OFF	2.7
OFF	OFF	ON	ON	ON	OFF	2.8
ON	OFF	ON	ON	ON	OFF	2.9
OFF	ON	ON	ON	ON	OFF	3.0
ON	ON	ON	ON	ON	OFF	3.1
OFF	OFF	OFF	OFF	OFF	ON	3.2
ON	OFF	OFF	OFF	OFF	ON	3.3
OFF	ON	OFF	OFF	OFF	ON	3.4
ON	ON	OFF	OFF	OFF	ON	3.5
OFF	OFF	ON	OFF	OFF	ON	3.6
ON	OFF	ON	OFF	OFF	ON	3.7
OFF	ON	ON	OFF	OFF	ON	3.8
ON	ON	ON	OFF	OFF	ON	3.9
OFF	OFF	OFF	ON	OFF	ON	4.0
ON	OFF	OFF	ON	OFF	ON	4.1
OFF	ON	OFF	ON	OFF	ON	4.2
ON	ON	OFF	ON	OFF	ON	4.3
OFF	OFF	ON	ON	OFF	ON	4.4
ON	OFF	ON	ON	OFF	ON	4.5
OFF	ON	ON	ON	OFF	ON	4.6
ON	ON	ON	ON	OFF	ON	4.7
OFF	OFF	OFF	OFF	ON	ON	4.8
ON	OFF	OFF	OFF	ON	ON	4.9
OFF	ON	OFF	OFF	ON	ON	5
ON	ON	OFF	OFF	ON	ON	5.1
OFF	OFF	ON	OFF	ON	ON	5.2
ON	OFF	ON	OFF	ON	ON	5.3
OFF	ON	ON	OFF	ON	ON	5.4
ON	ON	ON	OFF	ON	ON	5.5
OFF	OFF	OFF	ON	ON	ON	5.6
ON	OFF	OFF	ON	ON	ON	5.7
OFF	ON	OFF	ON	ON	ON	5.8
ON	ON	OFF	ON	ON	ON	5.9
OFF	OFF	ON	ON	ON	ON	6.0
ON	OFF	ON	ON	ON	ON	6.1
OFF	ON	ON	ON	ON	ON	6.2
ON	ON	ON	ON	ON	ON	6.3

Input Wiring

The following diagrams show how to wire the SD17060's inputs to a single ended sinking or sourcing output. Note that current-limiting resistors <u>must</u> be installed if voltage levels above 5Vdc are being used.

The following diagrams are for both the Step and Direction inputs and the Disable Input.

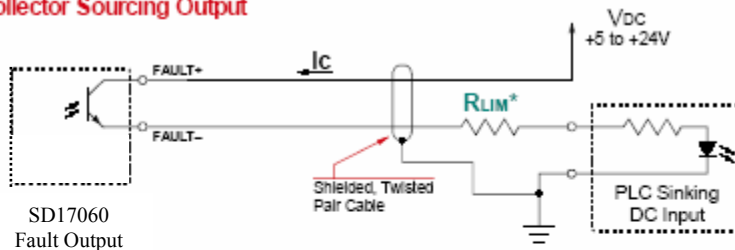| V_{DC}	R_{LIMIT}
5 Volts	None
12 Volts	2.0 KΩ
15 Volts	2.0 KΩ
24 Volts	3.9 KΩ
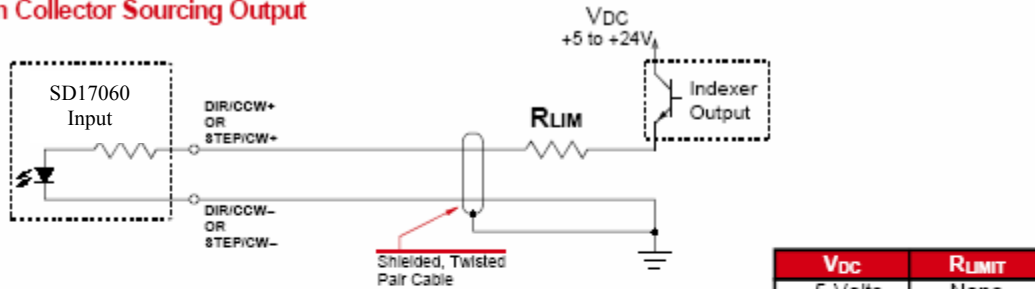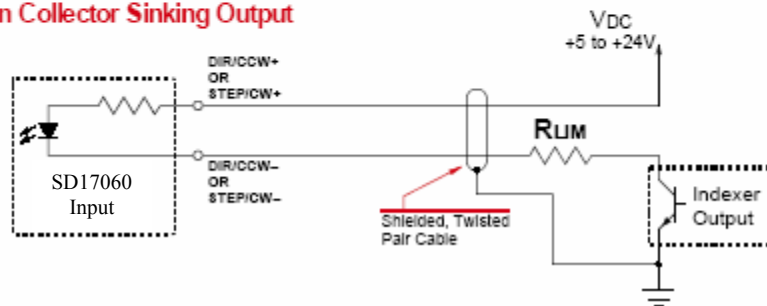
Fault Output Wiring

The ±Fault Output is an optically isolated transistor capable of driving a typical DC PLC input or equivalent. As shown in the following figure, both ends of the output are floating. Therefore, you can connect the fault output in a sourcing or sinking configuration.
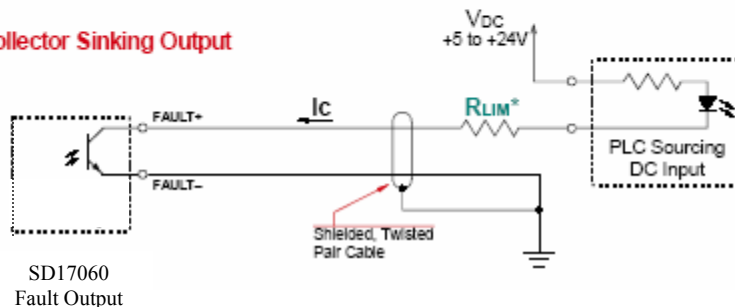

Fault Output
Electrical Specifications

Vdc max: 30Vdc
Vce sat: 1Vdc @20mA
Ic max: 20mA
Power Dissipation: 20mW max
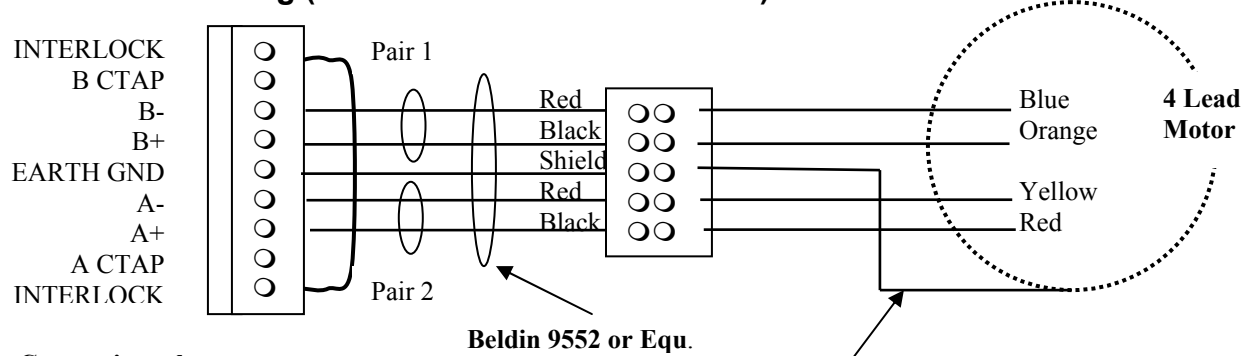
Rlim
A Resistor may be needed to limit the current through the Fault Output. The value and power rating of the resistor is dependent on the value of Vdc, the voltage drop across the input, and the current requirements of the input.
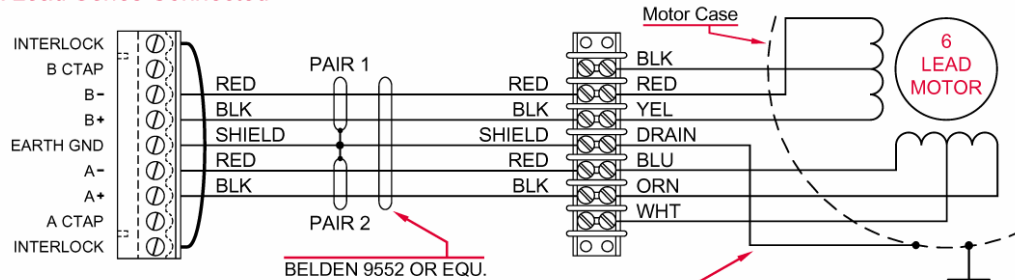
SM42 Motor Wiring (Includes SM42-1800D motors)

INTERLOCK
B CTAP
B-
B+
EARTH GND
A-
A+
A CTAP
INTERLOCK

Pair 1

Pair 2

Red
Black
Shield
Red
Black

Blue
Orange

Yellow
Red

4 Lead Motor

Beldin 9552 or Equ.

Motor Connections shown for CW rotation. (Facing mounting flange.) For CCW rotation, reverse the Stepper Driver B+ and B- connections

NOTE: In order for the winding short circuit detection to function, you must connect a drain wire from the case of the motor to the shield of the extension cable.

SM34 Motor Wiring (Includes SM34-300, SM34-600, and SM34-900 motors)

Six Lead Series Connected

INTERLOCK
B CTAP
B-
B+
EARTH GND
A-
A+
A CTAP
INTERLOCK

PAIR 1

RED
BLK
SHIELD
RED
BLK

RED
BLK
SHIELD
RED
BLK

PAIR 2

Motor Case

BLK
RED
YEL
DRAIN
BLU
ORN
WHT

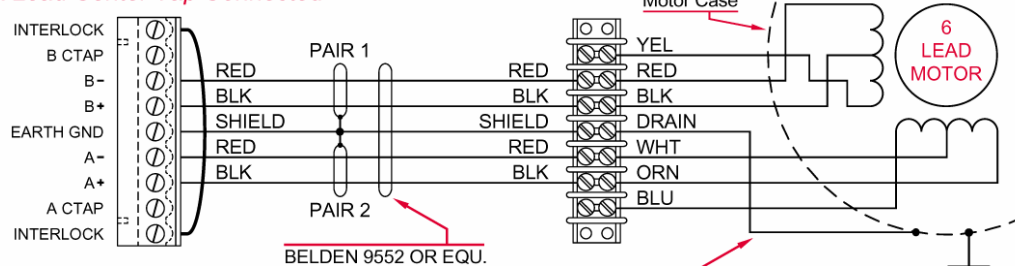**6 LEAD MOTOR**

BELDEN 9552 OR EQU.

Motor Connections shown for CW rotation. (Facing mounting flange.)

For CCW rotation, reverse Stepper Drive B+ and B– connections.

NOTE: In order for the winding short circuit detection to function, you must connect a drain wire from the case of the motor to the shield of the extention cable.

Six Lead Center Tap Connected

INTERLOCK
B CTAP
B-
B+
EARTH GND
A-
A+
A CTAP
INTERLOCK

PAIR 1

RED
BLK
SHIELD
RED
BLK

RED
BLK
SHIELD
RED
BLK

PAIR 2

Motor Case

YEL
RED
BLK
DRAIN
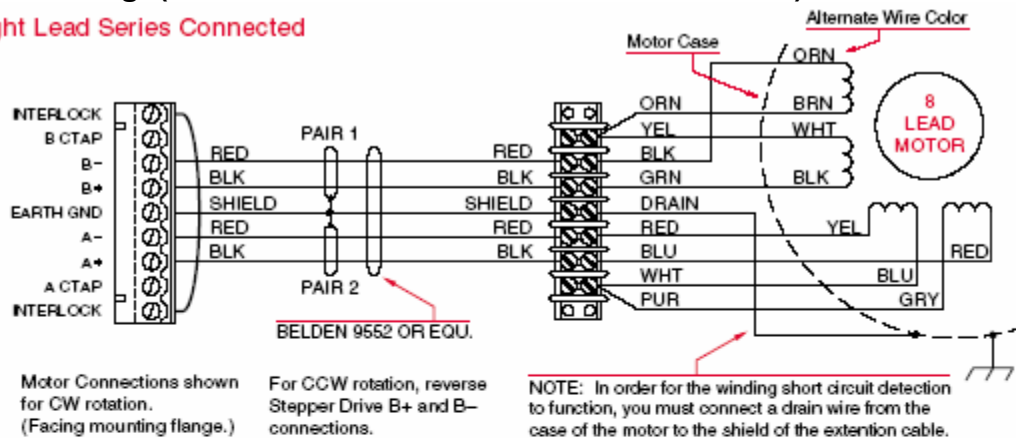WHT
ORN
BLU

6 LEAD MOTOR

BELDEN 9552 OR EQU.

Motor Connections shown for CW rotation. (Facing mounting flange.)

For CCW rotation, reverse Stepper Drive B+ and B– connections.

NOTE: In order for the winding short circuit detection to function, you must connect a drain wire from the case of the motor to the shield of the extention cable.

SM23 Motor Wiring (Includes SM23-130 and SM23-240 motors)

Eight Lead Series Connected

Motor Connections shown for CW rotation. (Facing mounting flange.)

For CCW rotation, reverse Stepper Drive B+ and B– connections.

BELDEN 9552 OR EQU.

NOTE: In order for the winding short circuit detection to function, you must connect a drain wire from the case of the motor to the shield of the extension cable.

Eight Lead Parallel Connected

Motor Connections shown for CW rotation. (Facing mounting flange.)

For CCW rotation, reverse Stepper Drive B+ and B– connections.

BELDEN 9554 OR EQU.

NOTE: In order for the winding short circuit detection to function, you must connect a drain wire from the case of the motor to the shield of the extension cable.
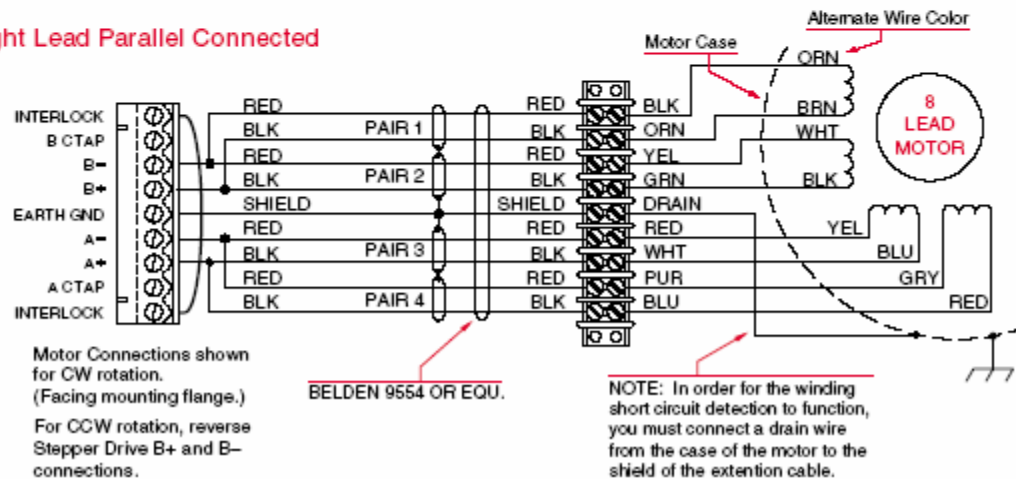
Extending the Motor Cable

As you extend the motor cable, you increase the chances of forming a ground loop between the motor and the drive. In order to keep this possibility to a minimum, connect the motor and drive to the same point on your earth grounding system.

Even though it is possible to extend the cable length up to forty feet, AMCI recommends installing the drive as close as possible to the motor. This will decrease the chance of forming a ground loop, and has the added benefit of limiting the amount of power loss in the motor cable. If you must extend the cable, you should use a cable with twisted pairs 18AWG or larger and an overall shield.

Installing the Motor Cable

All of the motor connections are high power, high voltage signals. The cable from the motor can be installed in conduit along with ac/dc power lines or high power ac/dc I/O as long as safety codes are followed. It cannot be installed in conduit with low power cabling such as cabling from the drive to the indexer, communication cables, or low power ac/dc/ I/O lines

When extending the motor cable, treat the shield as a signal carrying conductor. Do not connect the shield to earth ground at any junction box.

Troubleshooting

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 Status LED table on page 3 for information. 2) If the motor rotates when commanded but has no holding torque, then your Idle Current Reduction switch is set to the *0%* setting that removes motor current when the drive is idle for more than one second. See page 4 for information on setting the Idle Current Reduction switches. 3) The dipswitches that set the SD17060's current have not been changed from the default value of 0.0 amps.
The SD17060 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 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 Microstepping Resolution may be set to the desired 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. This is most commonly the problem with converting from a SD3520 or a SD8055 to a SD17060 because the sense of the ±B phase is reversed between the two drives. 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.

Indexer Problems

Symptom	Solution
My indexer/PLC reports a fault from the SD17060 when everything seems fine.	Your logic maybe reversed. On the SD17060, 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/or the distance traveled is farther/shorter than expected.	This is most likely a problem with the SD17060's Microstepping Resolution setting or the indexer's programming. If the motor is running too fast, then the Microstepping Resolution is set lower than the indexer's programmer expected. If the motor is running slow, the Microstepping Resolution is set higher than the indexer's programmer expected it to be.

Driver Problems

Symptom	Solution
Both LED's are off, and the Fault Output is active. (Not conducting) Power is applied to the drive.	1) The AC line voltage may be too low. It must be greater than 95Vac for the SD17060 to operate properly. The power LED will be on for values over 40Vac. 2) One or both of the 5A fuses may be blown. These fuses will not blow under normal circumstances, so call AMCI for assistance. Blown fuses may be a sign of a serious installation problems.
Both LEDs are green, the Fault Output is inactive, (conducting) but the motor is not powered.	1) The Motor Current may be set to 0. 2) The ±Disable input may be active. If this input is receiving power, the motor current is removed, but the drive does not go into a fault condition. 3) Idle Current Reduction to may be enabled to 0%. When the Idle Current Reduction is turned on, current is removed from the motor if a directional pulse is not received for one second.
The STEP/FAULT 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. If your indexer has sourcing outputs, then the inputs of the SD17060 must be wired as sinking inputs and vice versa.
The STEP/FAULT LED is red.	The drive is experiencing a fault condition. All faults are latched, so once the problem has been corrected, power must be cycled to the drive 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). **2) Interlock Fault.** The motor is not plugged into the drive or a wire jumper was not installed between the two Interlock pins on the Motor Connector. **3) Short in Motor.** Shut off the SD17060 and disconnect the motor. Pull back the rubber boot and verify the following with an ohmmeter. a) Open circuit from "A+" to "B+" pins. (Tests for short between phases.) b) Open circuit from "A+" to "Earth Ground" and "B+" to "Earth Ground". (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 4) An Automatic Current Loop gain identification was attempted with the motor current set to zero. 5) An Automatic Current Loop gain identification was attempted with only the interlock wire attached. That is, there was no motor attached to the driver.

Revision History

Revision 0.0 was the initial release of the specifications.

Revision 1.0 added motor wiring and general information, such as physical dimensions, power requirements, etc, to the specifications.

Revision 2.0 was released on 3/10/04. This revision added a diagram showing the location of the dip switch packages on the SD17060 driver. The function of the idle current reduction switches was also changed from none, 50%, 0%, and 0% to none, 69%, 50%, and 0%.

Revision 2.1 was released on 7/26/04. The following changes were made.
- Text was added describing the function of the interlock and center tap terminal on the motor connector.
- The Specifications were moved to beginning of the document.
- Details were added to the status LED function
- Details were added to the Automatic Current Loop gain function.
- Diagrams showing how to wire the SD17060 to single ended indexers were added.
- A diagram showing the wiring of the fault output was added.
- Trouble shooting tables were added.

Revision 2.2 was released on 11/3/04. This revision changed the maximum input frequency from the incorrect value of 25kHz to the correct value of 2MHz.

Revision 3.0 was released on 11/3/05. The following changes were made.
- An outline drawing showing the mechanical dimensions was added.
- Installation notes showing the minimum space required around the driver was added.
- The rating value of a step down input power transformer was added
- Table of Contents was added.
- General Warranty information was added.
- The SM23 motor wiring diagrams were modified showing the 3Men motor wiring