PACIFIC SCIENTIFIC

HIGH PERFORMANCE MOTORS & DRIVES

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5630 Drive

Installation & Hardware Reference Manual

Pacific Scientific Company has attempted to insure that the information contained in this manual was correct and accurate at the time of printing. Pacific Scientific Company cannot be responsible for any typographical errors or mistakes contained in this manual. The information in this manual is subject to change without notice.

WARNING

The 5630 contains hazardous voltages that can cause severe shock or burn. The hazardous voltage symbol, shown above, is displayed in this manual whenever a warning about hazard voltage is required. Refer to Section 2.3, "Safety Guidelines," for a summary of the safety guidelines.

As the user or person applying this unit, you are responsible for determining suitability of this product for any application you intend. In no event will Pacific Scientific Company be responsible or liable for indirect or consequential damage resulting from the use of this product.

Table of Contents

1 Overview of the 5630 Stepper Motor Drive

In this Chapter

This Chapter introduces the 5630 Stepping Motor Drive. Topics covered are:

- 5630 definition
- Other system components
- How to use this manual
- Warranty

1.1 5630 Definition

The Pacific Scientific® 5630 Stepper Motor Drive is an electronics package that converts step and direction inputs to motor winding currents to control a two-phase bipolar stepping motor.

The output current of the 5630 is switch selectable from 5.0 to 8.0 amps/phase RMS (7.1 to 11.3 amps peak) with a 160-volt nominal dc bus. The 5630 leaves the factory set at 5.0 amps/phase RMS.

Standard features

Bipolar chopper drive -controls motor current at 20 kHz chopper frequency.

Internal power supplies - operate from the 115-volt ac input. The main motor supply consists of a full wave bridge rectifier into a capacitive input filter with in-rush current limiting.

Shunt regulator circuitry -protects the drive by removing energy from the supply if the dc bus voltage exceeds 200 volts. This feature protects the circuitry from excessive voltage that may be generated under certain motor deceleration conditions.

Features (cont'd)

Short circuit protection circuitry - latches the drive off and lights the POWER FAULT LED if a short circuit occurs on the motor outputs.

Optical isolation circuitry - isolates the user signals from the drive power circuits for the step, direction, enable, and reset command lines.

User adjustments

Mid-range instability control - eliminates loss of torque and possible motor stalling conditions when operating at mid-range speeds. This instability is a phenomenon of the electronic, magnetic, and mechanical characteristics of a stepping motor system. The enabled function damps mid-range oscillations by advancing or delaying the switching of the output transistors relative to the incoming pulse train.

Step size - sets the amount of shaft rotation per step. The five settings range from full step to fractions of a full step (microsteps). The microstep settings range from 1/2 to 1/125 for up to 25,000 steps/revolution with a standard 1.8° stepper motor.

Idle current reduction (ICR) - reduces motor winding current by 50% during motor dwell periods. ICR begins one second after the last input step pulse occurs.

Current setting - sets the current supplied to the motor. The available RMS current settings are 5, 6, 7.5, and 8 amps.

1.2 Other System Components

Overview

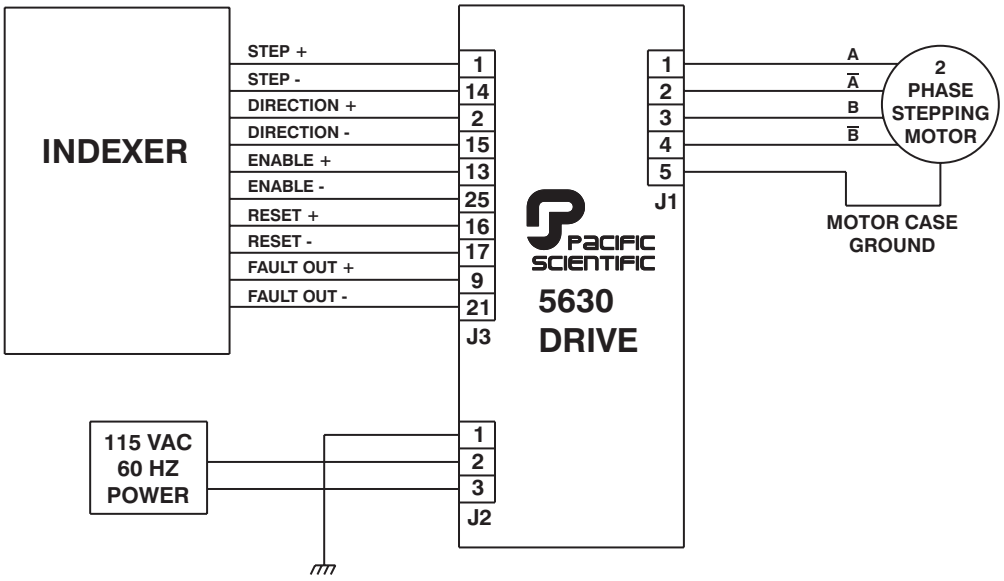
The other components that, along with the drive, comprise a complete motor control system are:

- Indexer or step source
- Motor

Pacific Scientific supplies a complete range of these components for your needs. Selection and installation guidelines for these components are described in Chapter 2, Installing the 5630 Stepper Motor Drive.

System diagram

The following diagram shows an installation of the drive in a typical system. Your installation may vary from this configuration.



1.3 How to Use this Manual

Description

This manual contains information and procedures to install, set up, and troubleshoot the 5630 Stepper Motor Drive.

The most effective way to use the manual is to follow the instructions in Chapter 2, “Installing the 5630 Stepper Motor Drive,” and Chapter 3, “Powering Up the 5630 Stepper Motor Drive.”

For quick reference during installation, use Appendix C, “Connections Summary,” and Appendix D, “Switch Summary.”

2 Installing the 5630 Stepper Motor Drive

In this Chapter

This Chapter explains how to install the 5630 Stepper Motor Drive. Topics covered are:

- Unpacking and inspecting the 5630
- Selecting other system components
- 5630 safety
- Mounting the 5630 in your installation
- Connecting input/output cabling
- Selecting switch functions

2.1 Unpacking and Inspecting the 5630

Unpacking procedure

1. Remove the 5630 from the shipping carton. Make sure all packing materials are removed from the unit.
2. Check the items against the packing list. A label located on the side of the unit identifies the unit by model number, serial number, and date code.

Inspection procedure

Inspect the unit for any physical damage that may have been sustained during shipment.

If you find damage, either concealed or obvious, contact your buyer to make a claim with the shipper. Do this as soon as possible after receipt of the unit.

Storing the unit

Store the 5630 in a clean, dry place. The storage temperature must be between -25 degrees C and 85 degrees C. To prevent damage during storage, store the unit in the original shipping carton after completing the inspection for damage.

2.2 Selecting Other System Components

Selecting an indexer

The 5630 requires step, direction, and enable inputs. Select an indexer that provides, as a minimum, these commands. A compatible indexer will provide the capability to drive the input circuits shown in the Table in section 2.5.3, "J3 Signal Interface Connection." For most applications that operate at speeds above 300 rpm, an indexer that can ramp the output pulse train is required.

The Pacific Scientific 5645 Advanced Indexer combines 5630 functionality and BASIC Motion Control indexing in a single package.

Selecting a motor

The 5630 is designed for use with Pacific Scientific's line of hybrid stepper motors. The drive works with either the standard line or the enhanced high performance line of stepper motors. The motor winding current rating must be compatible with the output current of the drive package - 5.0, 6.0, 7.5, or 8.0 amps RMS (7.1, 8.5, 10.6, or 11.3 amps peak).

The electrical and magnetic losses of the motor must not exceed the motor power dissipation rating. This is a concern at higher speeds and with low inductance motors (less than 4-inch frame size). The motor case temperature should not exceed 100° C.

Contact your local Pacific Scientific Distributor for sizing and motor compatibility assistance.

2.3 5630 Safety

Your responsibility

As the user or person applying this unit, you are responsible for determining the suitability of this product for any application you intend. In no event will Pacific Scientific Company be responsible or liable for indirect or consequential damage resulting from the use of this product.

Safety background

Under direct off-line conditions, all the logic and power circuitry is electrically "hot" with respect to earth ground. The only circuitry that is not "hot" under these conditions is the optical isolator inputs and the optically isolated fault output.

The internal drive circuitry will vary from 160 volts above to 160 volts below earth ground potential.

If desired, use an isolation transformer for additional safety benefits.

Warning

The circuits in the 5630 are a potential source of severe electrical shock. Follow the safety guidelines to avoid shock.

Safety guidelines

To avoid possible personal injury whenever you are working with the 5630:

- Do not power up the drive without the cover on and the chassis tied to earth ground.
- Do not operate the drive without the motor case tied to earth ground.
- Do not make any connections to the internal circuitry. The optically isolated input and output signals are the only safe connection points.

- Always remove power before making or removing connections from the unit.
- Before removing the cover of the unit, shut off power and allow the unit to sit for 5 minutes to discharge the bus capacitors.
- Be careful of the motor terminals when disconnected from the motor. With the motor disconnected and power applied to the drive, the motor terminals have high voltage present, even with the motor disconnected.
- Do not use the enable input as a safety shutdown. Always remove power to the drive for a safety shutdown.

2.4 Mounting the 5630 in Your Installation

Cabinet selection

Select a standard 8-inch (205 mm) deep NEMA (National Electrical Manufacturers Association) enclosure appropriate for industrial applications.

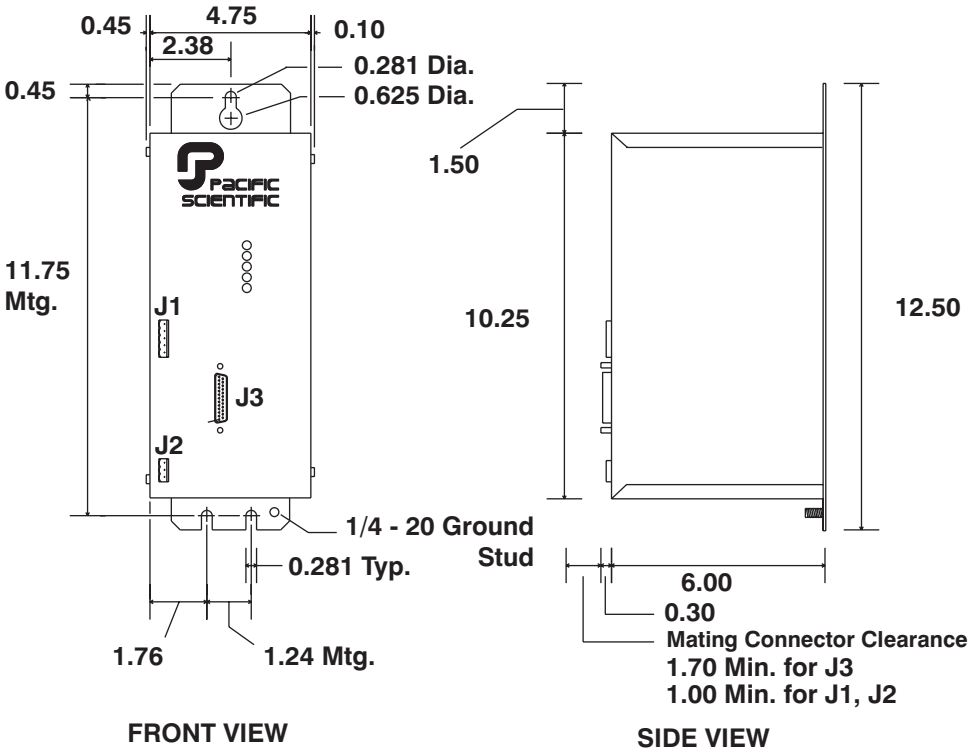
Caution

The internal cabinet temperature should not exceed 50°C (60°C with derating). If the cabinet is ventilated by filtered or conditioned air make sure to prevent the accumulation of dust and dirt on the unit's electronic components. The air should also be free of corrosive or electrically conductive contaminants.

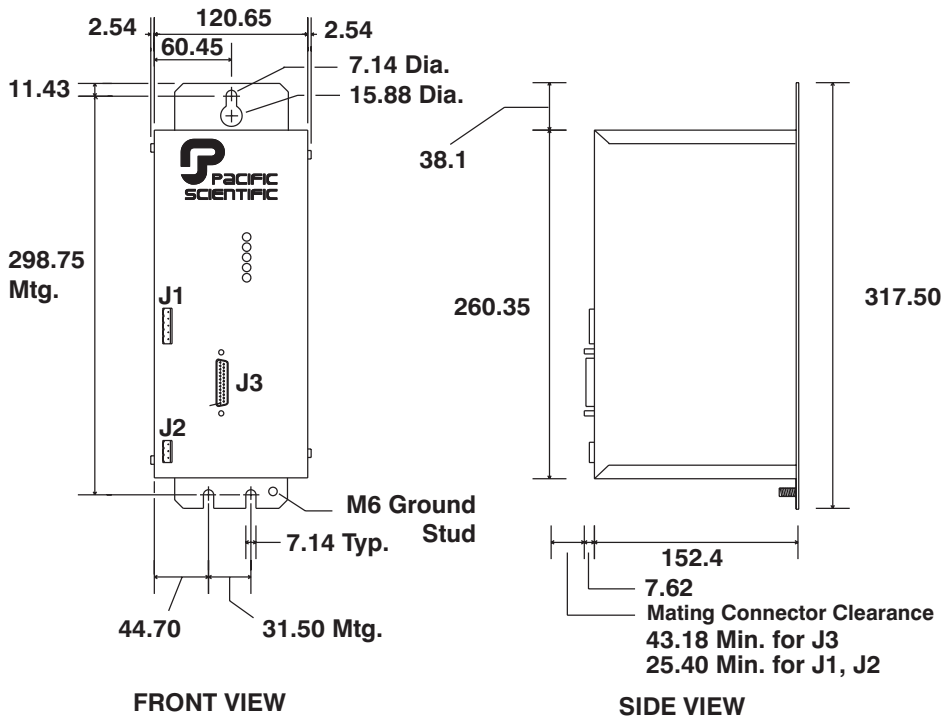
Mounting dimensions

Prepare the cabinet for the 5630 using the dimensions in inches or millimeters as shown in the following figures.

Mounting dimensions (in inches)



Mounting dimensions (in millimeters)



Mounting guidelines

Select a cabinet position that meets these guidelines:

- Flat, solid surface capable of supporting the approximate 9 pound (4 kilogram) weight of the unit.
- Free of excessive vibration or shock.
- Minimum unobstructed space of two inches (50 mm) at the fan input on the unit bottom and the exhaust on the unit top.
- Operating temperature of:
  - 0 to 50 degrees C at full rated current
  - 0 to 60 degrees C at 5.0 to 6.0 amp current setting with idle current reduction enabled

Mounting procedure

Bolt the unit to the cabinet using the three slots (refer to the dimensions figure) using a 1/4 - 20 (M6 metric equivalent) bolt.

Power dissipation for cabinet

The 5630 dissipates power causing cabinet heating. Power dissipation is determined by a number of factors, such as output current, motor winding impedance, input step rates, and idle current reduction. The 5630 is shipped with current set at 5 amps/phase and with idle current reduction enabled.

For an estimate of the power dissipation for use in calculating cabinet cooling requirements, use the values shown:

For an RMS current of (amps):	Use a value of (watts):
8.0	90
7.5	80
6.0	50
5.0	35

2.5 Connecting the Three Input/Output Cables

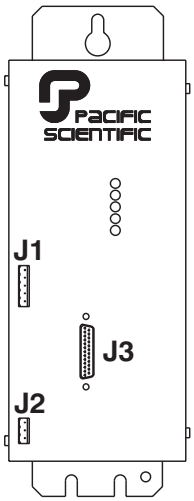
Introduction

The three input/output (I/O) connectors are:

- J1-Motor
- J2-115 Vac power
- J3-Drive signal interface

This section describes these connectors, their cables and the procedures for installing them.

I/O connector diagram



Wiring is application specific

Wiring sizes, wiring practices, and grounding/shielding techniques described in the following section represent common wiring practices and should prove satisfactory in the majority of applications.

Caution

Non-standard applications, local electrical codes, special operating conditions, and system configuration wiring needs take precedence over the information included here. Therefore, you may need to wire the drive differently than described here.

Noise pickup reduction

Use shielded and twisted cabling for the signal and power cables. This precaution reduces electrical noise.

Shock hazard reduction

Refer to section 2.3 for safety information that must be followed to reduce shock hazard.

In this section

To install connector:	Refer to Section:
J1	2.5.1
J2	2.5.2
J3	2.5.3

2.5.1 J1 Motor Connection

Introduction

The J1 motor cable connects the drive to the motor windings. Motor cables are available from Pacific Scientific, or you can make your own.

Note: *Refer to Appendix C, "Series/Parallel Connections" for additional information.*

Mating connector

The J1 motor connector is for a PCD 5-pin screw mating connector. The mating connector, supplied with the unit, is type ELFH05110.

Making your own cable

If you need to build the cable, refer to the appropriate subsection as follows:

To build the cable for motor type:	Refer to Section:
4-lead	2.5.1.1
8-lead series	2.5.1.2
8-lead parallel	2.5.1.3

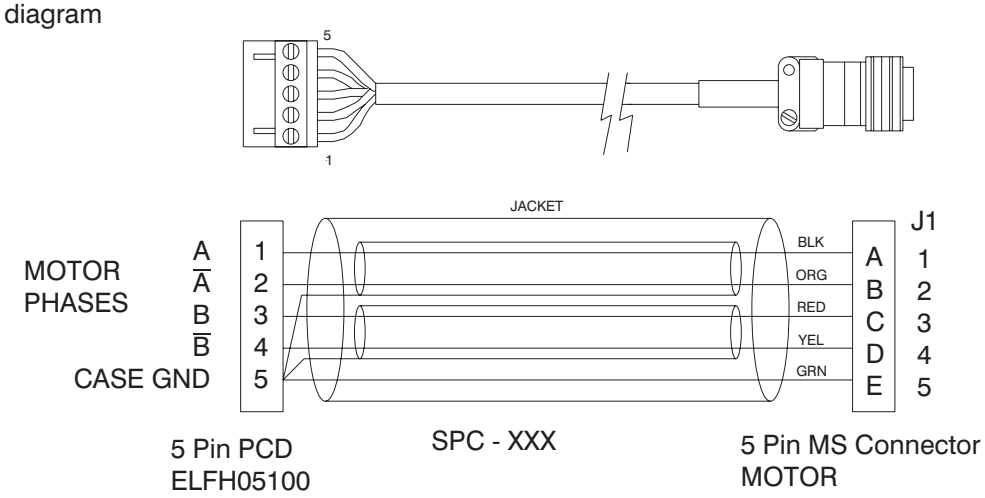
Pacific Scientific cable

If the motor cable is purchased from Pacific Scientific, install as follows. The Pacific Scientific order number is SPC-xxx , where "xxx" is the length in one-foot increments up to 50 feet. For example, SPC-050 is a cable 50 feet long.

PacSci cabling installation

If you are using Pacific Scientific motor cable with the mating connectors already attached, install as follows:

PacSci cable diagram



Procedure

1. Remove power from the 5630.

WARNING

Always remove power before making or removing connections to the unit. The motor terminals have high voltage present when the 5630 is On.

2. Plug the mating connector firmly into the 5630.
3. Plug the other mating connector into the motor and screw down the retaining collar.
4. Reconnect power to the 5630.

2.5.1.1 4-Lead Motor

Introduction

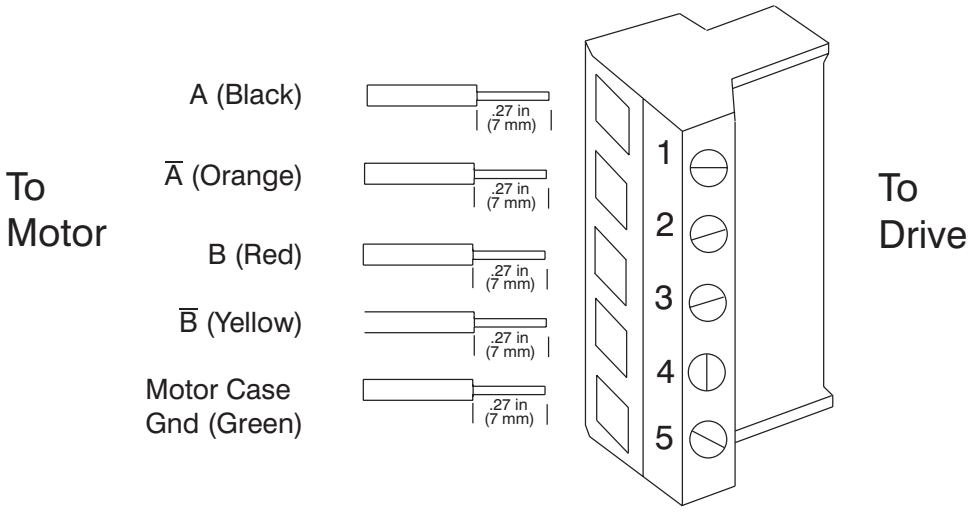
For the 4-lead standard systems motor with MS connector, build and install the cable as follows.

Cable requirements

Use 16- to 14-gauge stranded wire for the cabling. Obtain cable with each winding pair (refer to diagram) twisted at about 3 to 4 turns per inch (1 to 1.5 turns per centimeter). Make sure the cable contains a lead for grounding. As an option, the cable may be shielded to reduce radiated noise. If a shield is used, connect as shown for Pacific Scientific cables.

Cabling diagram

The colors referenced in the diagram follow the Pacific Scientific stepper motor color code.



Procedure

1. Strip the wires to 0.27 inch (7 mm).
2. Attach the wires to the connector as indicated in the diagram.

Note: *Make sure the screws on the PCD connector are tightened down firmly to the wiring.*

CAUTION

Do not pre-tin (solder) the tips of the cables going into the PCD connector. This can result in a loose connection.

3. Remove power from the 5630.

WARNING

Always remove power before making or removing connections to the unit. The motor terminals have high voltage present when the 5630 is On.

4. Plug the mating connector firmly into the 5630.
5. Connect the cable shield to 5630 ground, if applicable.
6. Plug the other mating connector into the motor.
7. Switch On the 5630.

2.5.1.2 8-Lead Motor, Series Connected

Introduction

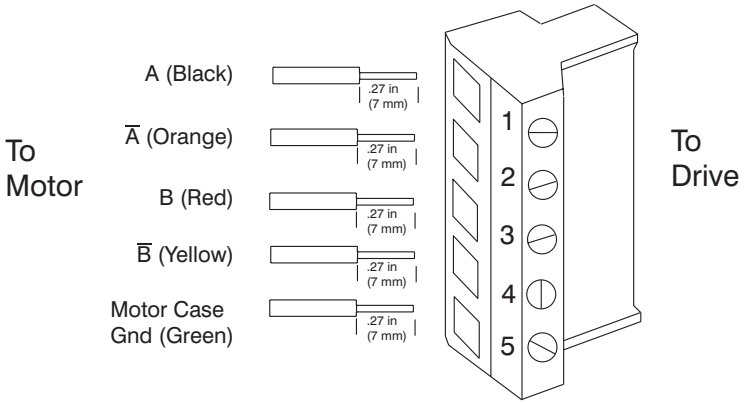
For an 8-lead motor to be wired in series, build and install the cable as follows:

Cable requirements

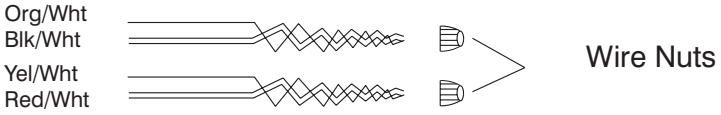
Use 16- to 14- gauge stranded wire for the cabling. Obtain cable with each winding pair (see diagram) twisted at about 3 to 4 turns per inch (1 to 1.5 turns per centimeter). Make sure the cable contains a lead for grounding. As an option, the cable may be shielded to reduce radiated noise.

Cabling diagram

The colors referenced in the diagram follow the Pacific Scientific stepper motor color code.



In addition, make the following connections at the motor:



Procedure

1. Strip the wires to 0.27 inch (7 mm).
2. Referring to the diagram, attach the wires to the connector. Connect the white-striped leads with wire nuts as shown.

Note: *Make sure the screws on the PCD connector are tightened down firmly on the wiring.*

CAUTION

Do not pre-tin (solder) the tips of the cables going into the PCD connector. This can result in a loose connection.

3. Remove power from the 5630.

WARNING

Always remove power before making or removing connections to the unit. The motor terminals have high voltage present when the 5630 is On.

4. Plug the mating connector firmly into the 5630.
5. Connect the cable shield to 5630 ground, if applicable.
6. Plug the other mating connector into the motor.
7. Switch On the 5630.

2.5.1.3 8-Lead Motor, Parallel Connected

Introduction

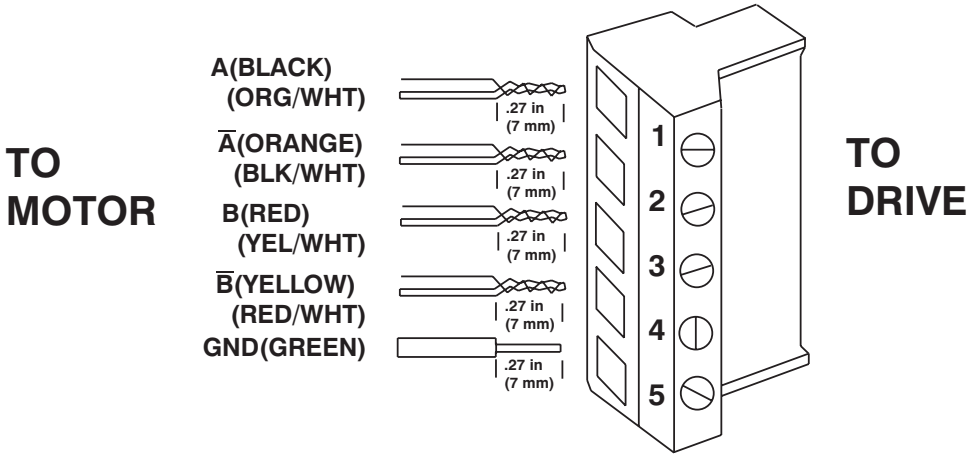
For an 8-lead motor to be wired in parallel, build and install the cable as follows:

Cable requirements

Use 16- to 14- gauge stranded wire for the cabling. Obtain cable with each winding pair (see diagram) twisted at about 3 to 4 turns per inch (1 to 1.5 turns per centimeter). Make sure the cable contains a lead for grounding. As an option, the cable may be shielded to reduce radiated noise.

Cabling diagram

The colors referenced in the diagram follow the Pacific Scientific stepper motor color code.



Procedure

1. Strip the wires so that the twisted ends will be the length shown.
2. Referring to the diagram, twist the striped and solid lead ends and attach the wires to the connector.

Note: *Make sure the screws on the PCD connector are tightened down firmly on the wiring.*

CAUTION

Do not pre-tin (solder) the tips of the cables going into the PCD connector. This can result in a loose connection.

3. Remove power from the 5630.

WARNING

Always remove power before making or removing connections to the unit. The motor terminals have high voltage present when the 5630 is On.

4. Plug the mating connector firmly into the 5630.
5. Connect the cable shield to 5630 ground, if applicable.
6. Switch On the 5630.

2.5.2 J2 115 Vac Power Connection

Introduction

The J2 115 Vac power cable connects voltage to the logic and the motor power supplies.

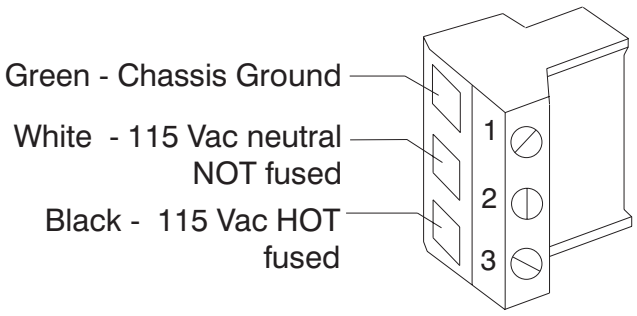
Mating Connector

The J2 115 Vac power input is for a PCD 3-pin screw mating connector. The connector, supplied with the unit, is type ELFH03110.

Cable requirements

Use 16-to 14-gauge shielded wire for the cabling.

Cabling diagram



WARNING

Make sure position 3 receives the "hot" 115 V ac input. This position is fused to avoid fire hazard.

Procedure

1. Strip the wires 0.27 inch (7 mm).
2. Attach the wires to the connector as indicated in the diagram.

Note: *Make sure the screws on the PCD connector are tightened down firmly on the wiring.*

CAUTION

Do not pre-tin (solder) the tips of the cables going into the PCD connector. This can result in a loose connection.

WARNING

The chassis ground must be tied to earth ground. Failure to do this leaves the potential for severe hazard. Make sure the ground is connected via the ground stud on the front of the 5630.

3. Plug the mating connector firmly into the 5630.

2.5.3 J3 Signal Interface Connection

Introduction

The J3 signal interface accepts input signals from the indexer or other step source for step, direction, enable and reset. The interface sends an output signal for faults.

Mating connector

The J3 serial port mating connector, supplied with the unit, is an ITT Cannon DB-25P 25-pin plug-in female D connector.

Cable requirements

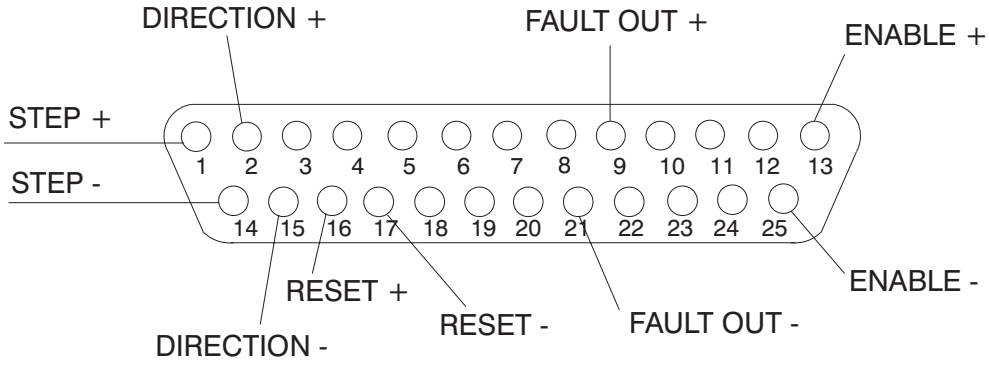
Use 22-gauge wire for the cabling. Obtain cable with each I/O pair (refer to the diagram) twisted at about 3 to 4 turns per inch (1 to 1.5 turns per centimeter). As an option, the cable may be shielded to reduce noise pickup.

CAUTION

To avoid ground loops, connect ground shield to indexer ground only.

Procedure

1. Solder the leads to the connector as shown.
2. Assemble the connector housing.



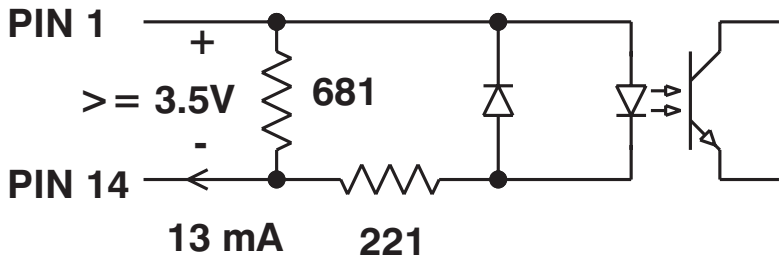
3. Plug the connector into the input and affix the connector to the unit with screws.
4. For non-Pacific Scientific indexers, adapt the indexer circuitry as shown in the table.

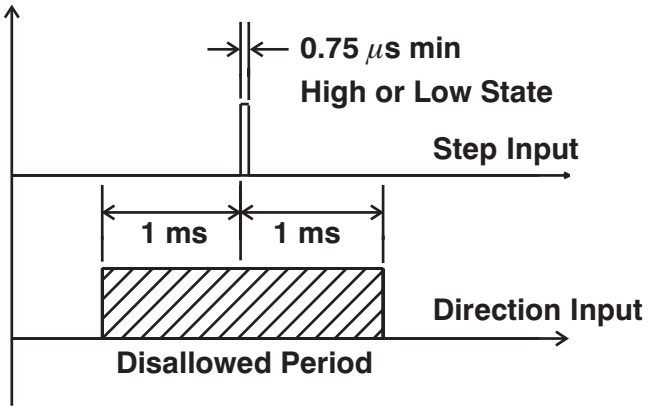
Indexer circuitry All inputs can be driven differentially or with an open collector device with pull-up resistor.

Inputs

Step

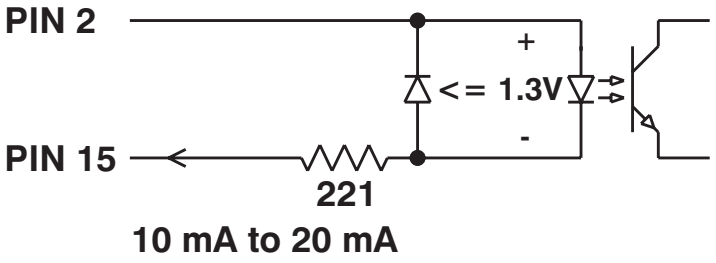
Function	Pins	Required Indexer Circuitry Conditions
Accepts pulse train to step motor. The step occurs on the low-to-high transition of the step pulse.	J3-1(+) J3-14(-)	13 mA to 20 mA for a minimum of 0.75 us. **Note:** *The direction input must not change for a minimum of 1 ms before or after the current step input goes high.*





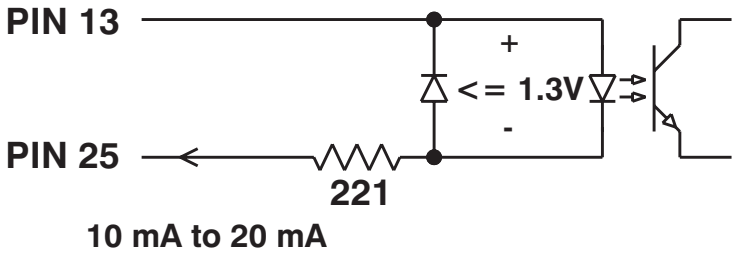
Direction

Function	Pins	Required Indexer Circuitry Conditions
Determines the direction of rotation.	J3-2(+) J3-15(-)	10 mA to 20 mA. A correctly phased motor will select clockwise rotation on a high or open input. **Note:** *You may reverse the effect of this input by reversing the connections of one of the stepper motor phase windings.*



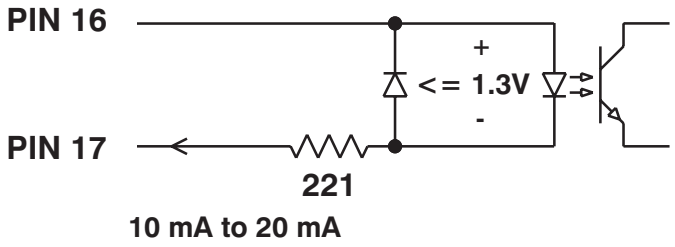
Enable

Function	Pins	Required Indexer Circuitry Conditions
Enables the drive. A signal is required at the input for operation.	J3-13(+) J3-25(-)	10 mA to 20 mA.



Reset

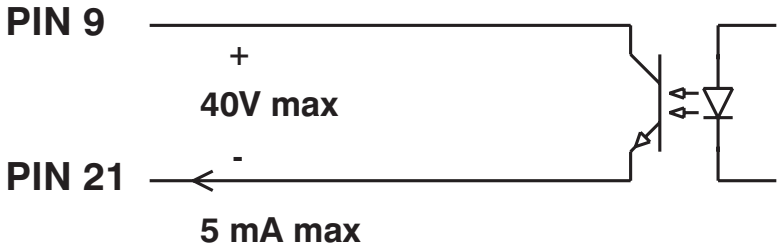
Function	Pins	Required Indexer Circuitry Conditions
Resets the drive after a fault such as a chort circuit or over temperature. When active, drive is disabled.	J3-16(+) J3-21(-)	10 mA to 20 mA.



Outputs

Fault

Function	Pins	Required Indexer Circuitry Conditions
When the drive is enabled, the output is on. When fault occurs, output is off.	J3-9(+) J3-21(-)	Output is capable of sinking 5 mA and is rated for 40 Vdc. Von @5mA < 0.4V.



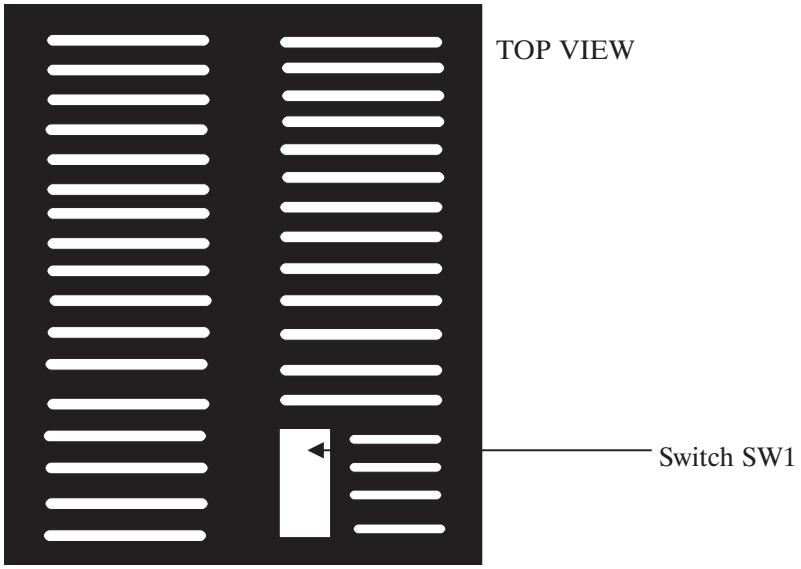
2.6 Setting Up Functions Using Switch SW1

Introduction

DIP Switch SW1 sets four functions:

- Step size
- Mid-range instability control
- Idle current reduction
- Current setting

Groups of individual switches on switch SW1 enable or disable these functions.



In this section

To understand and set up function:	Refer to section:
Step Size	2.6.1
Mid-range instability control	2.6.2
Idle current reduction	2.6.3
Current	2.6.4

2.6.1 Step Set Up

Definition

The step size sets the amount of rotation per input step. You may select from among five step sizes.

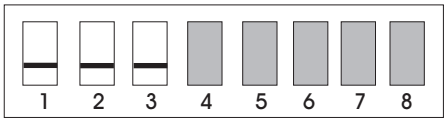
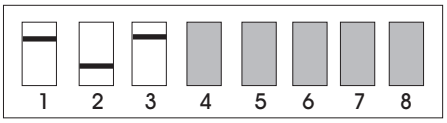
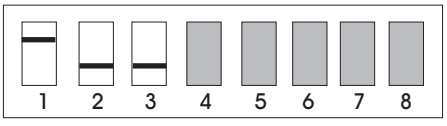
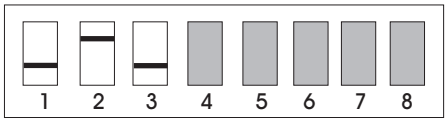
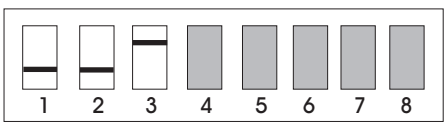
Benefits

Selecting a microstep size of 1/5 or smaller results in:

- Higher resolution
- Smoother low speed operation
- Ability to operate in low-speed resonance region

Procedure

With the power Off, select the step size you desire by setting the switches as follows:

To set step size as ...	Move switch SW1 settings to .....
full- 200 steps/motor rev. (Default factory setting)	
1/2 - 400 steps/motor rev.	
1/5 - 1,000 steps/motor rev.	
1/25 - 5,000 steps/motor rev.	
1/125 - 25,000 steps/motor rev.	

2.6.2 Mid-Range Instability Control Set Up

Definition

Mid-range frequency instability and the resulting loss of torque occurs in any step motor/drive system due to the motor BEMF modulating the motor winding currents. Enable the mid-range instability control function if your application is affected by loss of torque at mid-range speeds. When enabled, the circuitry advances or delays the switching of the output transistors with respect to the incoming pulse train to eliminate the instability.

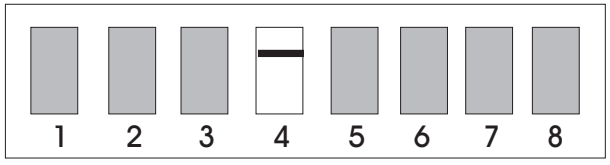
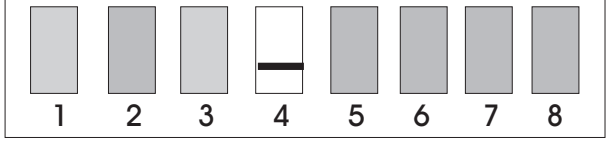
Note: *Mid-range instability control changes the pulse timing and so will affect any pulse placement techniques you may be using. Disable instability control if using pulse placement.*

Benefit

Mid-range instability control eliminates loss of torque at mid-range speeds.

Procedure

With the power Off, enable or disable mid-range instability by moving the switches to the appropriate positions as follows:

To set control to ...	Move switch SW1 settings to .....
Enable (Default factory setting)	
Disable	

2.6.3 Idle Current Reduction Set Up

Definition

The Idle Current Reduction function reduces the phase current at times when no motor motion is commanded. With this function enabled, the drive:

- Reduces the current to both motor windings by one-half nominal value. This reduction occurs whenever greater than one second (approximately) elapses without a step input pulse.
- Keeps current at this power level until it receives a step pulse. Then it returns the phase currents to the previously set value and the step occurs.

Note 1: *When ICR is enabled, the holding torque generated by the motor is reduced by 50%.*

Note 2: *If you select a microstep setting and a current of 7.5 or 8.0 amps, ICR is automatically enabled, even if the switch is not set to enable.*

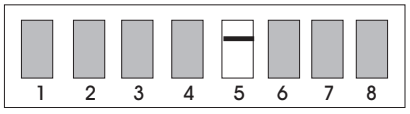
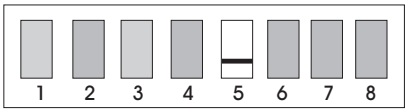
Benefits

The ICR function:

- Allows the motor to cool during standstill for higher duty-cycle applications.
- Reduces 5630 power dissipation.

Procedure

With the power Off, enable or disable idle current reduction by moving the switches to the appropriate positions as follows:

To set current reduction to ...	Move switch SW1 settings to .....
Enable (Default factory setting)	
Disable	

2.6.4 Current Set Up

Definition

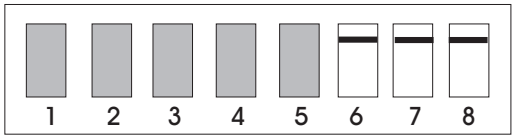
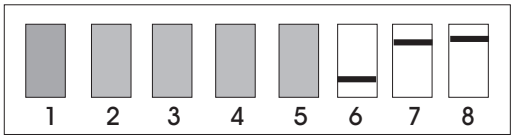
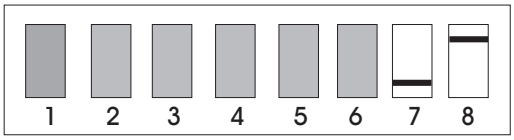
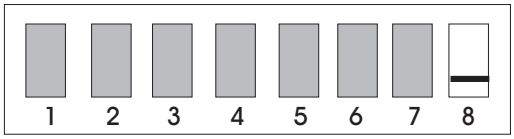
The current set up function determines the RMS current supplied to the motor.

Benefits

Current set up allows 5630 output to be matched to motor winding.

Procedure

With the power Off, select from among the four current values by setting the switches as follows:

To set RMS current to ...	Move switch SW1 settings to .....
5.0 amps (7.1 amps peak) (Default factory setting)	
6.0 amps (8.5 amps peak)	
7.5 amps (10.6 amps peak)	
8.0 amps (11.3 amps peaK)	

3 Powering Up the 5630 Stepper Motor Drive

In this Chapter

This chapter explains how to power up the 5630 Stepper Motor Drive after installation. Topics are:

- Testing the installation
- Troubleshooting
- Repairing or replacing the 5630

3.1 Testing the Installation

Background

Perform the following test procedure to verify that the 5630 is installed properly, and that it was not damaged internally during shipment.

Configuration

The installation test power-up procedure requires a motor and indexer (or step and direction source) to test the functionality of the 5630.

Procedure

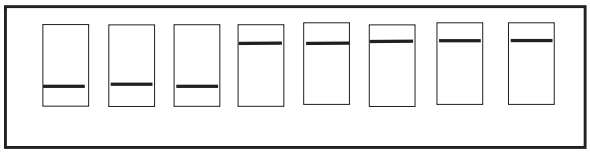
After performing the installation per the guidelines given in Chapter 2, “Installing the 5630 Stepper Motor Drive,” test your installation using the procedures on the following pages.

Warning

Perform this initial power-up with the motor shaft disconnected from the load. Improper wiring or undiscovered shipping damage could result in undesired motor motion. Be prepared to remove power if excessive motion occurs.

Connections test

1. Check over all wiring and mounting and verify correct installation. Especially check the 115 volt ac connections, the motor connections and the grounding.
2. With the power Off, verify that the switch SW1 settings are set as follows. The 5630 leaves the factory with these settings.



These settings enable the mid-range instability control, enable current reduction, set the step size to full step, and select a motor current of 5 A RMS.

Warning

Make sure the 115 volt ac power is removed before proceeding.

3. Unplug the J1 motor connector.
4. Switch On the 115 volt ac power. Check that the POWER LED is the only LED On. If the POWER FAULT LED is On, output is faulted. Refer to section 3.2.4 to solve the problem.
5. Again switch the power Off.
6. Connect the J1 motor connector.
7. Switch On the 115 volt ac power. Check that the POWER LED is the only LED On. If the POWER LED is On, the connections to the motor are not faulted. Refer to section 3.2.4 to solve the problem.

Signals test

1. Apply an enable input to the drive. The green ENABLE LED should be On. If the LED is not On, check for a valid DIP switch code per section 2.6.1, Step Set Up. If not, refer to section 3.2.2.
2. Verify that the motor has holding torque by attempting to rotate the motor shaft. The energized motor shaft is either immovable or very resistant to rotation when the 5630 is enabled.
3. Input a step command and verify that the motor moves.

   Note: *Do not change the direction input within 1 millisecond before or after the step input goes high.*
4. Input a direction signal and step the motor. The direction of rotation should change.
5. Continue exercising the unit, testing it in your application.

Getting help

If you need further help with your installation contact Pacific Scientific at 815-226-3100 from 8 am to 5 pm Eastern Standard Time, or contact your Pacific Scientific distributor.

3.2 Troubleshooting

Introduction

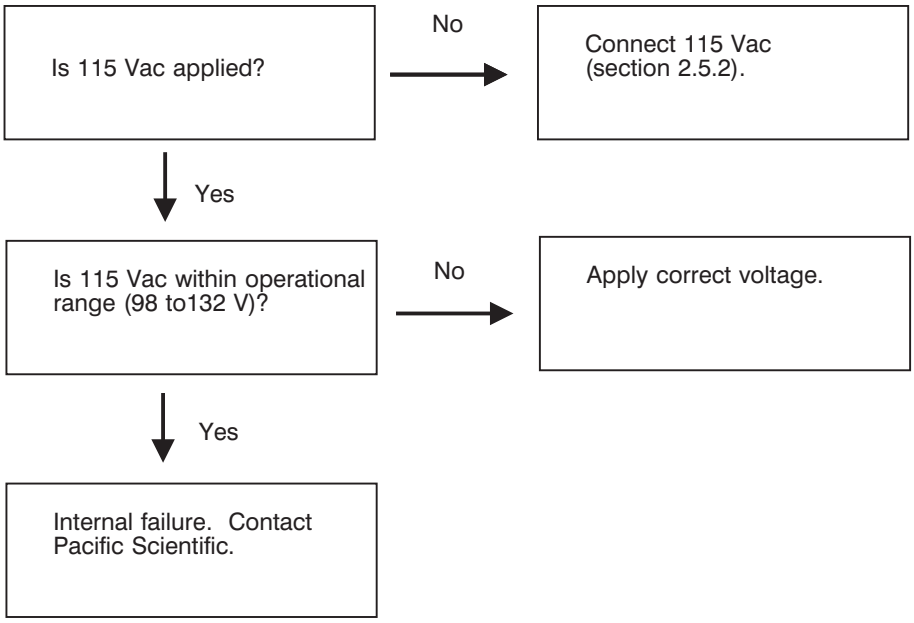
The LEDs located on the front panel indicate unit status and are useful for troubleshooting. A table of LEDs referencing the appropriate section for troubleshooting follows:

Fault output

When this LED is On ...	It signifies ...	Troubleshoot using section ...
Power	Connection to 115 Vac power and logic supply is within operational levels.	3.2.1
Enabled	Drive has received a valid Enable command. All internal circuits are enabled and the drive is not faulted. If the drive is faulted, this LED is off.	3.2.2
Step active	The Drive has received a step command.	3.2.3
Power fault	Either an external or internal short or internal power supply problem.	3.2.4
Over temp	Heatsink temperature over 85 degrees C.	3.2.5

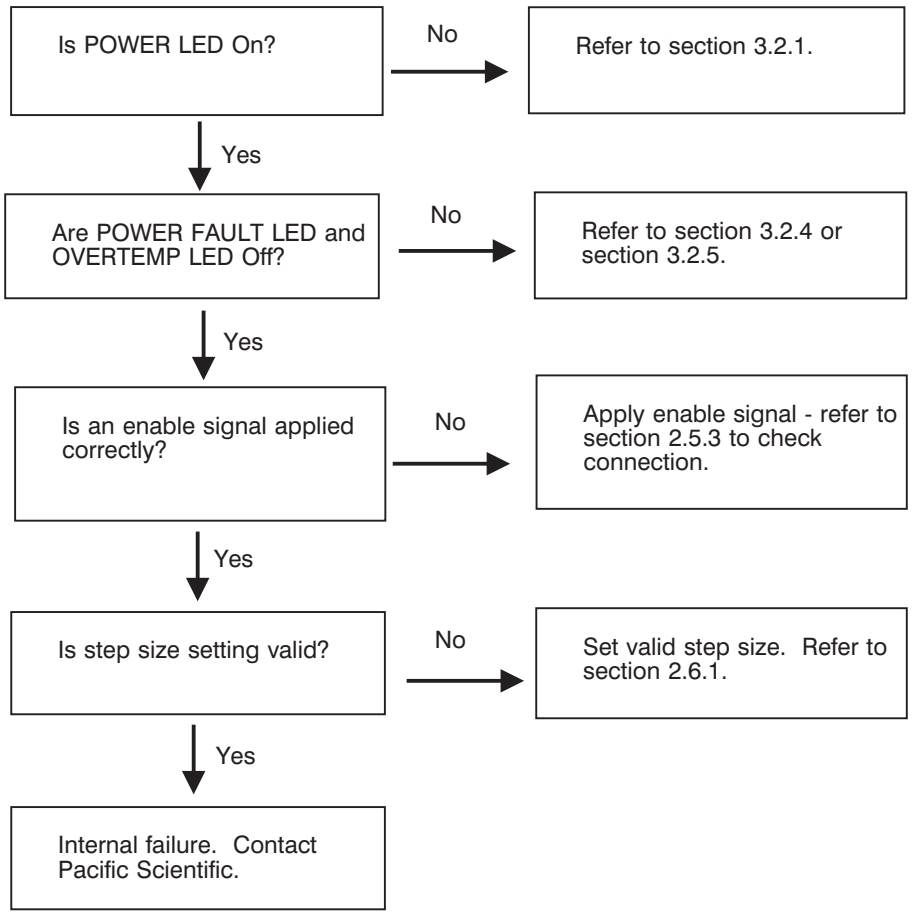
3.2.1 POWER LED Not ON - 5630 Does Not Power Up

Procedure Follow this procedure if the 5630 POWER LED will not light when power is applied:



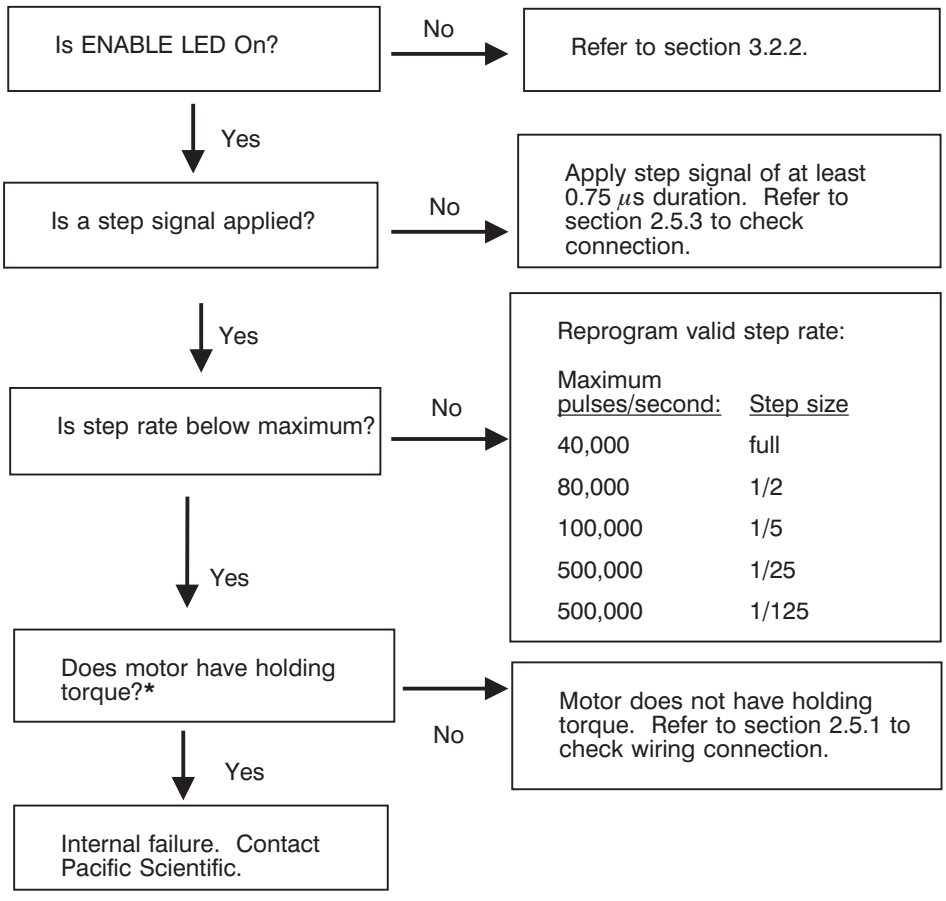
3.2.2 ENABLED LED Not On - 5630 Does Not Recognize Enable Input

Procedure Follow this procedure if the 5630 ENABLED LED will not light when an enable input is applied.



3.2.3 STEP ACTIVE LED Not On or Motor Doesn't Step - 5630 Does Not Recognize Step Input or Defective Connection

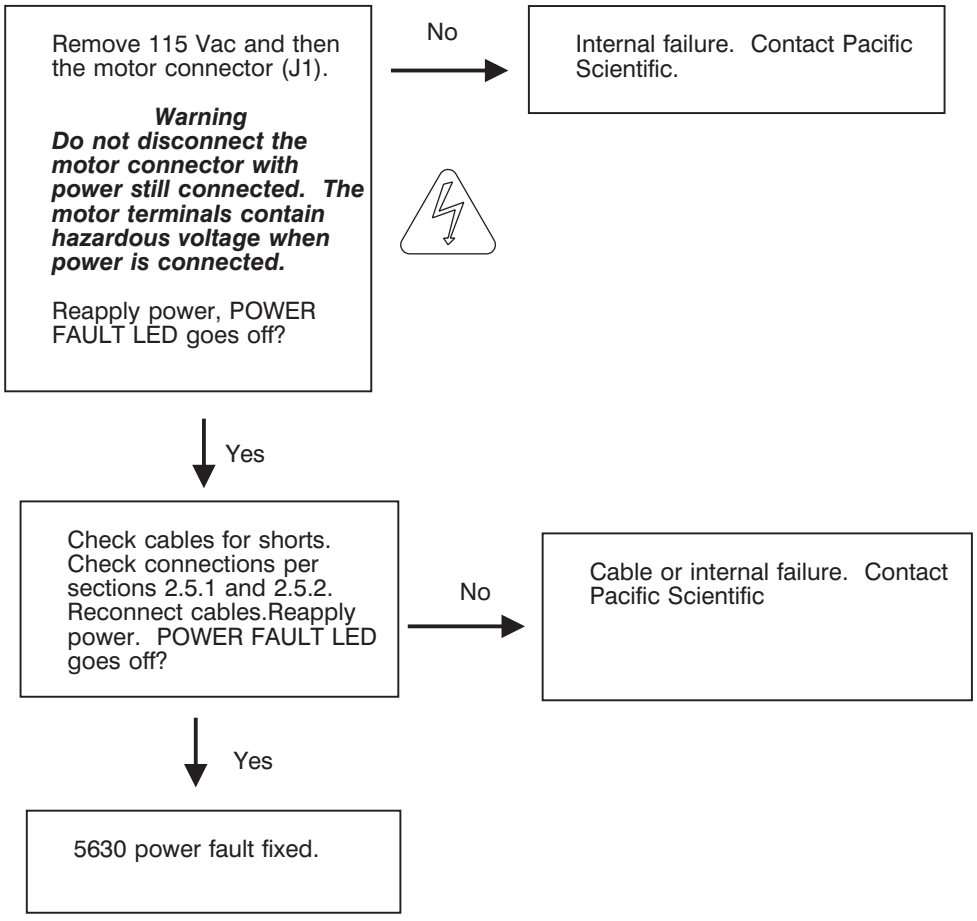
Procedure Follow this procedure if the step motor will not step or the STEP LED will not light when an enable input is applied.



Note: *Be careful not to confuse the holding torque (due to current in the windings and mechanical resistance) with the detent torque (due to mechanical resistance only). To feel the difference between the two, rotate the shaft with power applied (holding torque), then disconnect the motor from power and rotate the motor shaft (detent torque).*

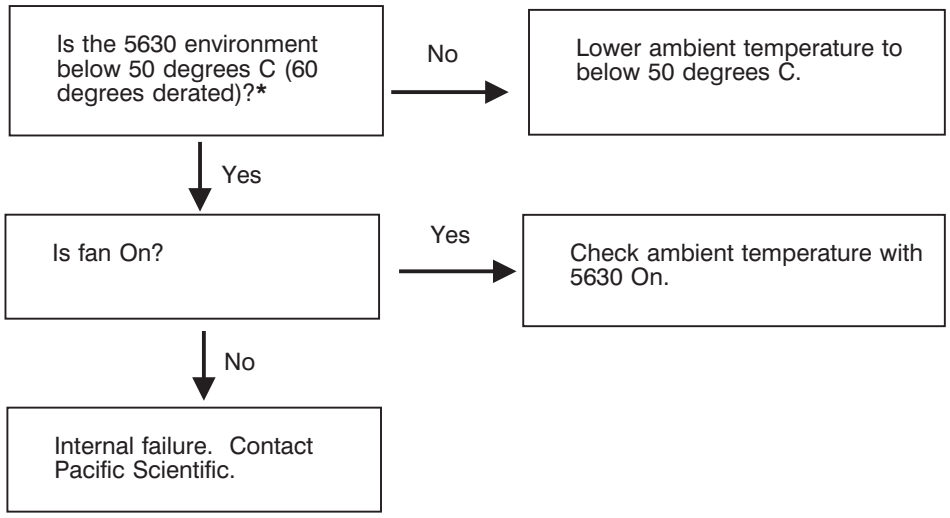
3.2.4 POWER FAULT LED On - 5630 Contains Power Fault

Procedure Follow this procedure if the 5630 POWER FAULT LED lights during operation.



3.2.5 OVER TEMP LED On - 5630 Senses Excessive Temperature

Procedure Follow this procedure if the 5630 OVER TEMP lights during operation:



Note: *Power dissipated by the drive will heat a sealed enclosure. Measure drive temperature under operational conditions.*

3.3 Repairing or Replacing the 5630

Introduction

This section contains information on how to return a faulty drive for repair or replacement.

Return procedure

1. Call Pacific Scientific at (815) 226-3100 from 8:00 am to 5:00 pm Eastern Standard Time to get a Returned Materials Authorization Number (RMA#).

   Note: *Do not attempt to return the drive or any other equipment without a valid RMA#. Returns received without a valid RMA# are not accepted and are returned to the sender.*

2. Pack the drive in its original shipping carton. Pacific Scientific is not responsible or liable for damage resulting from improper packaging or shipment.

   Ship the 5630 to:

   Pacific Scientific
   110 Fordham Road
   Wilmington, MA 01887
   Attn: Repair Department, RMA# _____

   Note: *Do not ship Pacific Scientific motors to the above address. The correct address for motor returns is:*

   Pacific Scientific
   4301 Kishwaukee Street
   Rockford, IL 61105
   Attn: Stepper Repair Department, RMA# _____

   Shipment of your 5630 or motor to Pacific Scientific constitutes authorization to repair the unit. Refer to Pacific Scientific's repair policy for standard repair charges. Your unit will be repaired and returned shipped UPS Ground delivery. If another means of shipping is desired, please specify this at the time of receiving an RMA#.

Appendix A - Specifications

Electrical

Input voltage	115 volt ac (± 15%)
Input current	13 A RMS maximum
Fuse	Buss MDA 20 on 115 volt ac hot line Buss MDL 1/2 on logic supply
Drive circuit	Two-phase bipolar, chopper current regulated
Bus voltage	160 volt dc nominal at 115 volt ac input
Rated current	Switch selectable: 8.0 A RMS (11.3 A peak microstepping) nominal 7.5 A RMS (10.6 A peak microstepping) nominal 6.0 A RMS (8.5 A peak microstepping) nominal 5.0 A RMS (7.1 A peak microstepping) nominal

Step size

Switch selectable	Steps/motor (1.8° stepper motor)
Full	200
1/2	400
1/5	1,000
1/25	5,000
1/125	25,000

Step input-output lag

1. With mid-range instability control **enabled** and with step frequencies less than 500 full steps per second, input-to-output lag is **less than 500 microseconds**.

   At step frequencies greater than 500 full steps per second, input-to-output lag is **less than 270 degrees** of the input step pulse period.

2. With mid-range instability control **disabled**, input-to-output lag is **less than 10 microseconds** for all step frequencies.

Chopper frequency

20 kHz, nominal

Maximum pulse rate

Switch selectable	Pulses/second
full step	40,000 pulses/second
1/2 step	80,000 pulses/second
1/5	100,000 pulses/second
1/25	500,000 pulses/second
1/125	500,000 pulses/second

Minimum ramp time

1. With mid-range instability control enabled - **50 milliseconds to 20,000 full steps/sec.**
2. With mid-range instability control disabled - **no minimum**.

Environmental

Operating temperature

0 to 50 degrees C at full rated current

0 to 60 degrees C at 5.0 or 6.0 Amp RMS with idle current reduction enabled

Storage temperature

-25 degrees to 85 degrees C

Humidity

0 to 95%, noncondensing

Altitude

5,000 feet (1500 meters)

Mechanical

Power dissipation

For an estimate of the power dissipation for use in cabinet cooling requirements, use the values shown:

For an RMS current of (amps):	Use a value of (watts):
8.0	90
7.5	80
6.0	50
5.0	35

Dimensions

Refer to section 2.4

Weight

9 pounds (4 kg)

Appendix B - Order Number and Ordering Information

Background This appendix lists the 5630 part numbers and gives information on ordering.

5630 part number table

Part	Pacific Scientific Order Number	Comment
Stepper Motor Drive	5630	
Connector Kit	106-563000-01	PCD 3- and 5- pin connectors for power and motor connection and 25-pin D connector with housing.
Installation and Hardware Reference Manual	903-563040-01	Revision E
Motor Cable	SPC-xxx-5630	xxx represents length in feet; for example, SPC-005-5630 is a cable 5 feet long. For lengths over 50 feet, contact Pacific Scientific. The connectors are MS on the motor end and PCD on the drive end to connect to Pacific Scientific motors.

How to order Contact Pacific Scientific to order these parts:

Call 815-226-3100 from 8 am to 5 pm Eastern Standard Time.

Write Pacific Scientific
4301 Kishwaukee Street
Rockford, IL 61105

Fax (815) 226-3148

Appendix C - Connections Summary

Introduction

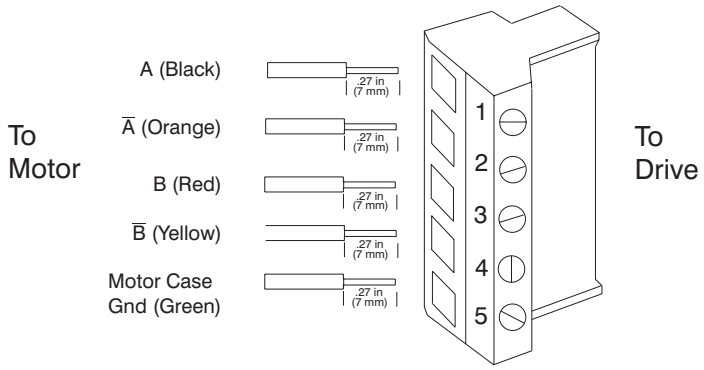
This appendix summarizes the J1, J2 and J3 connections that are covered in-depth in Section 2.5.

J1 - Motor Connector

The J1 motor connector is connected in one of three ways, determined by the lead wiring from the motor.

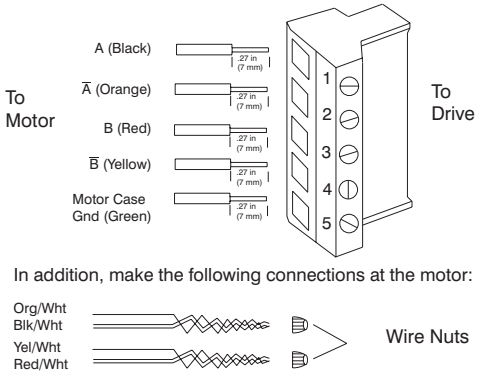
4-lead

For four lead wiring to the 5-pin connector wire as follows:



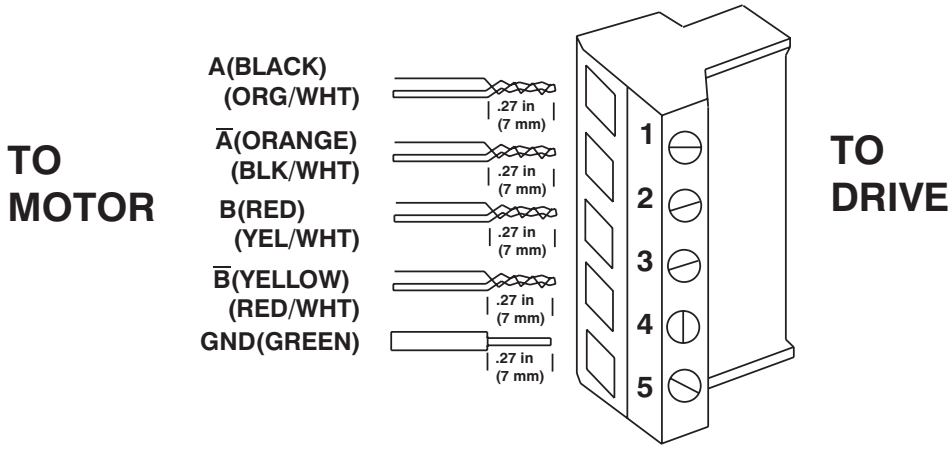
8-lead series

For eight lead series winding to the 5-pin connector, wire as follows:



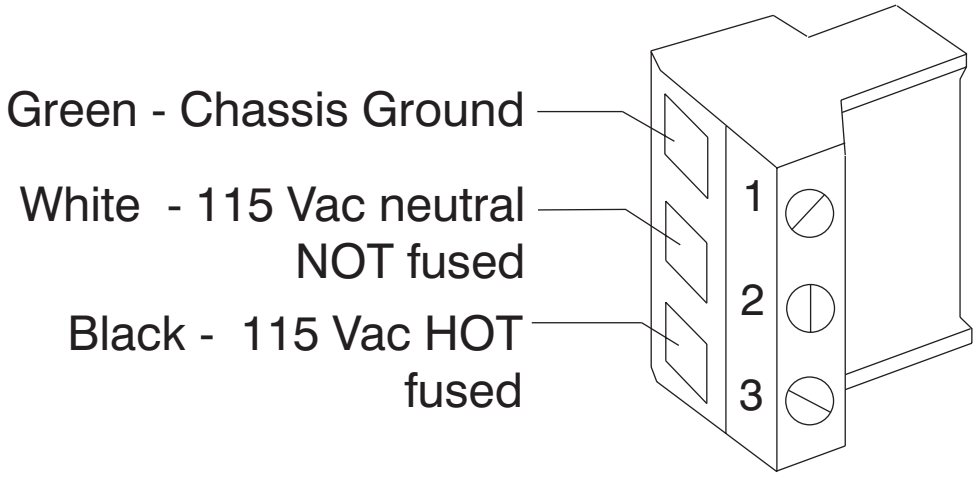
8-lead parallel

For eight-lead parallel wiring to the 5-pin connector, wire as follows:



J2-115 Vac Power Connector

Wire the three leads to the 3-pin connector as follows:



J3-Drive Signal Interface

Wire the 10 leads to the 25-pin connector as follows:

Connect lead ...	To pin ...
Step +	1
Step -	14
Direction +	2
Direction -	15
Fault out +	9
Fault out -	21
Enable +	13
Enable -	25

Appendix D - Switch Summary

Introduction

This appendix summarizes the DIP switch settings for step size, mid-range instability control, idle current reduction, and current setting. These settings are covered in-depth in Section 2.6.

Note: *The arrow signifiy up or down as oriented from the numbering on the switch. The character X signifies that the switch setting does not need to be specified (can be in either position).*

Step Set Up

For step size ...	Move switch settings to ...							
	1	2	3	4	5	6	7	8
full	↓	↓	↓	X	X	X	X	X
1/2	↑	↓	↑	X	X	X	X	X
1/5	↑	↓	↓	X	X	X	X	X
1/25	↓	↑	↓	X	X	X	X	X
1/125	↓	↓	↑	X	X	X	X	X

Mid-range Instability Control Set Up

Mid-range Instability Control Set up	Move switch settings to ...							
	1	2	3	4	5	6	7	8
Enable	X	X	X	↑	X	X	X	X
Disable	X	X	X	↓	X	X	X	X

Idle Current Redution Set Up

Idle Current Reduction Set up	Move switch settings to ...							
	1	2	3	4	5	6	7	8
Enable	X	X	X	X	↑	X	X	X
Disable	X	X	X	X	↓	X	X	X

Current Set Up

For RMS current (amps) ...	Move switch settings to ...							
	1	2	3	4	5	6	7	8
5.0	X	X	X	X	X	↑	↑	↑
6.0	X	X	X	X	X	↓	↑	↑
7.5	X	X	X	X	X	X	↓	↑
8.0	X	X	X	X	X	X	X	↓

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