Tolomatic
EXCELLENCE IN MOTION®

Applied Motion Products

STAC6 Drives and Microstepping Motors

User Manual

3600-4645_00

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Technical Specifications

POWER AMPLIFIER SECTION: D S [STAC6-S], S I [STAC6-Si]

Amplifier Type	MOSFET, Dual H-Bridge, 4 Quadrant
Current Control	4 state PWM at 20 Khz
Output Current	0.5 — 6.0 in 0.01 amp increments
Power Supply	Line Operated Nominal 120 VAC, 50/60 Hz
DC Bus Voltage	Nominal 165 VDC
AC Input Voltage	94—135VAC, 50/60Hz
Protection	Over-Voltage, Under voltage, Over-Temp, External Output Shorts (Phase to-Phase, Phase-to-Ground), Inter Amplifier Shorts
Idle Current Reduction	Reduction to any integer percent of full-current after delay selectable in milliseconds

POWER AMPLIFIER SECTION: D S [STAC6-S-220], S I [STAC6-Si-220]

Amplifier Type	MOSFET , Dual H-Bridge, 4 Quadrant
Current Control	4 state PWM at 20 Khz
Output Current	0.5 — 3.0 in 0.01 amp increments
Power Supply	Line Operated Nominal 120-240 VAC, 50/60 Hz
DC Bus Voltage	Nominal 330 VDC (at 240 VAC line input)
AC Input Voltage	94—265VAC, 50/60Hz
Protection	Over-Voltage, Under voltage, Over-Temp, External Output Shorts (Phase to-Phase, Phase-to-Ground), Inter Amplifier Shorts

Idle Current Reduction	Reduction to any integer percent of full-current after delay selectable in milliseconds.

CONTROLLER SECTION

Non-Volatile Storage	Configurations are saved in FLASH memory aboard the DSP.
Mode of Operation	Step & Direction, CW/CCW, Encoder Following, Joystick:
Step & Direction Inputs	Optically Isolated: 5-12 Volt. Minimum pulse width = 200 ns. Maximum pulse frequency = 2 MHz
Speed Range	Depends upon selected resolution. Amplifier is suitable for speeds up to 50 rps
Analog Input Range	Software selectable: 0-5V, ±5V, 0-10V, ±10V
Analog Input Resolution	12 bits (with ±10V signal range) 11 bits (with 0-10V or ±5V signal range) 10 bits (with 0-5V signal range)
Microstep Resolution	Software selectable from 200 to 50800 steps/rev in increments of 200 steps/rev
Anti-Resonance	Raises the system damping ratio to —0.3-to-0.5. Eliminates midrange instability and allows stable operation to 50 rps.
Waveform	Allows for fine adjustment of phase current waveform harmonic content to reduce low-speed torque ripple in the range 0.25 to 1.5 rps
Auto Setup	Measures motor parameters and configures tuning and observer parameters
Self Test	Identifies the presence of an encoder and determines resolution. Diagnoses miswires and open phases

Microstep Emulation	Performs low resolution stepping by synthesizing coarse steps from fine microsteps.
Dynamic Smoothing	Software configurable filtering (4th order, elliptic) for use in removing spectral components from the command sequence. Reduces jerk and excitation of extraneous system resonances.
Encoder Option	Employs encoder (hi or low resolution) to provide stall detection, stall prevention and perform position verification and maintenance.
Interface	RS-232 and RS-485 Bus
Encoder	Differential line receivers suitable for 200 KHz or greater
Ambient Temperature	0 to 55°C (32 - 158°F)
Humidity	90% non-condensing

Motion Control Options

⚠ DS [STAC6 S]

- Basic drive; analog, digital and host command input.
- Pulse & direction with electronic gearing.
- Encoder following with electronic gearing.
- CW and CCW pulse.
- Multi-axis Si programming if used with a HUB [SiNET™ HUB 444].
- "Host" commands for real time control from a host PC or PLC using RS-232 or RS-485 serial communication.

⚠ SI [STAC6 Si]

- SI [STAC6-Si] can be programmed for stand-alone operation with the easy to use Si Programmer™ Windows software with integrated tuning (software and programming cable included).
- Graphical point and click format combines motion, I/O, and operator interface functionality for simple machine sequencing.
- Easily integrates with other devices on the machine (Sensors, PLCs etc).

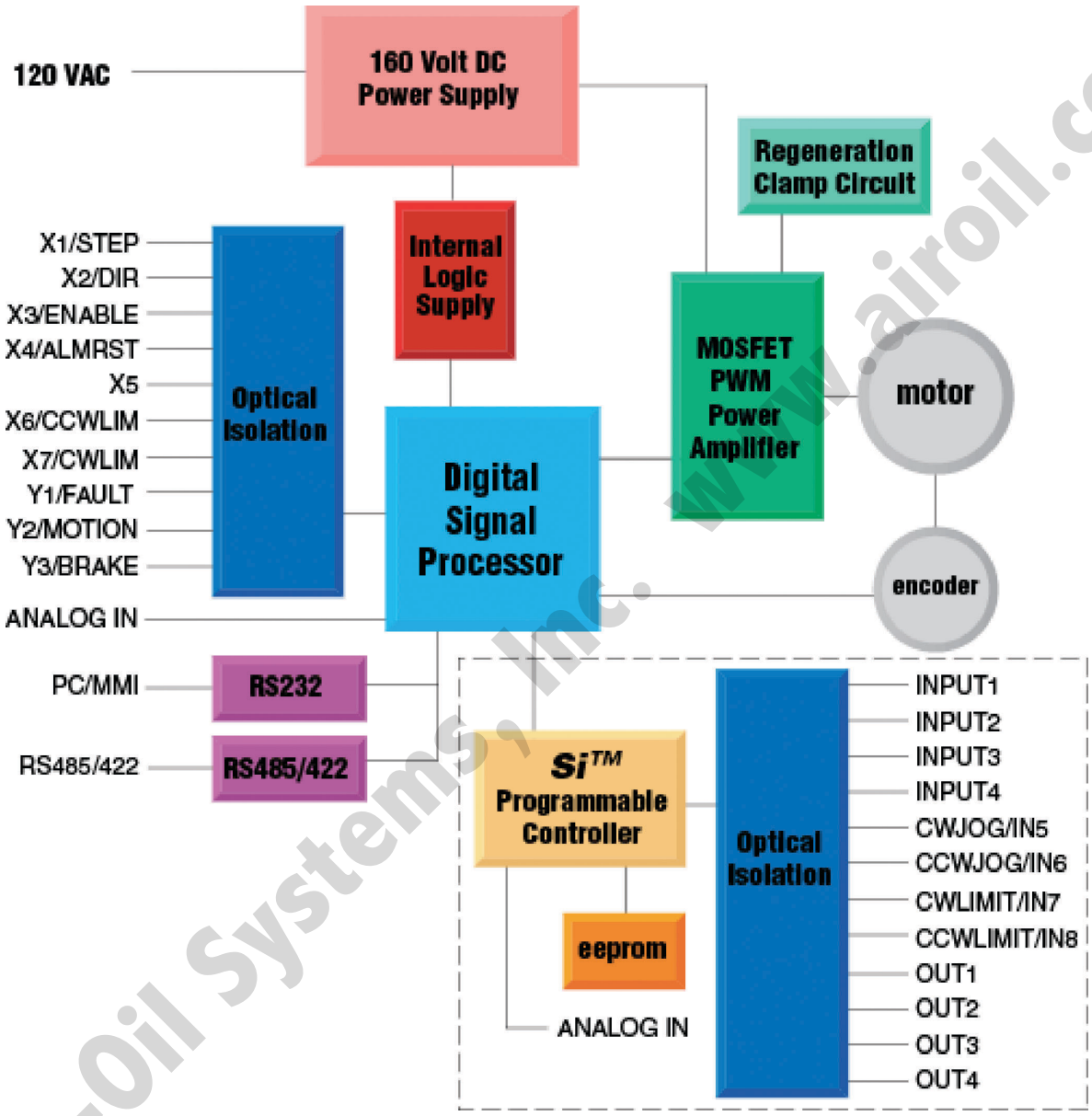

Figure 1: [D][S] [STAC6-S], [S][I] [STAC6-Si] Block Diagram

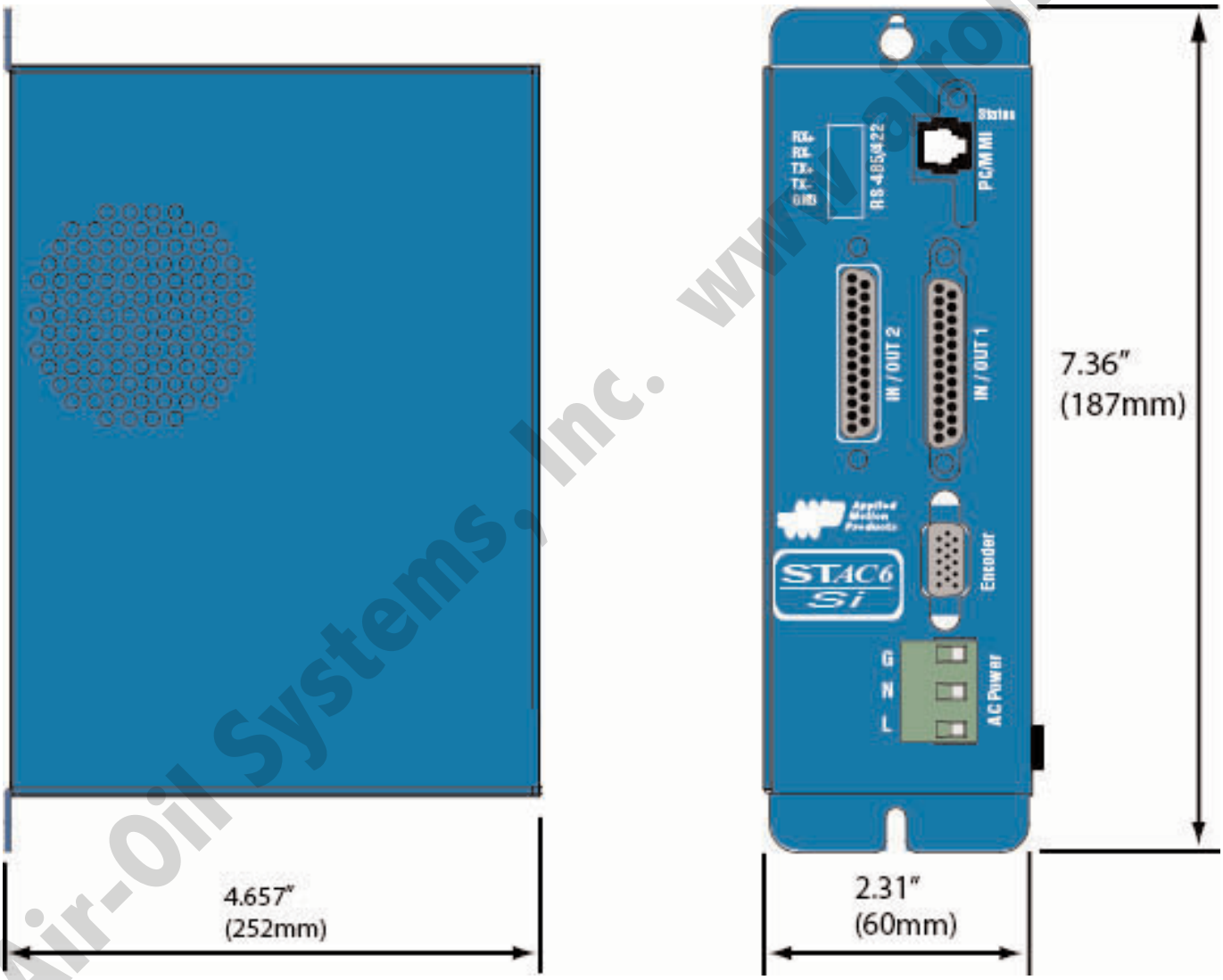

Figure 2: [D][S] [STAC6-S], [S][I] [STAC6-Si] Drive Mounting Dimensions

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Safety Instructions

Only qualified personnel are permitted to transport, assemble, commission, and maintain this equipment. Properly qualified personnel are persons who are familiar with the transport, assembly, installation, commissioning and operation of motors, and who have the appropriate qualifications for their jobs. The qualified personnel must know and observe the following standards and regulations:

IEC 364 resp. CENELEC HD 384 or DIN VDE 0100

IEC report 664 or DIN VDE 0110

National regulations for safety and accident prevention or VBG 4

To minimize the risk of potential safety problems, follow all applicable local and national codes that regulate the installation and operation of your equipment. Since codes vary from area to area it is the users responsibility to determine which codes should be followed, and to verify that the equipment, installation, and operation are in compliance with the latest revision of these codes.

Equipment damage or serious injury to personnel can result from the failure to follow all applicable codes and standards. We do not guarantee the products described in this publication are suitable for your particular application, nor do we assume any responsibility for your product design, installation, or operation.

Read all available documentation before assembly and commissioning. Incorrect handling of products in this manual can result in injury and damage to persons and machinery. Strictly adhere to the technical information on the installation requirements.

It is vital to ensure that all system components are connected to earth ground. Electrical safety is impossible without a low-resistance earth connection.

The STAC6 contains electrostatically sensitive components that can be damaged by incorrect handling. Discharge yourself before touching the product. Avoid contact with high insulating materials (artificial fabrics, plastic film, etc.). Place the product on a conductive surface.

During operation keep all covers and cabinet doors shut. Otherwise, there are deadly hazards that could possibly cause severe bodily damage or damage to the product.

In operation, depending on the degree of enclosure protection, the product can have bare components that are live or have hot surfaces. Control and power cables can carry a high voltage even when the motor is not rotating.

Never pull out or plug in the product while the system is live. There is a danger of electric arcing and danger to persons and contacts.

After powering down the product, wait at least ten minutes before touching live sections of the equipment or undoing connections (e.g., contacts, screwed connections). Capacitors can store dangerous voltages for long periods of time after power has been switched off. To be safe, measure the contact points with a meter before touching.

Be alert to the potential for personal injury. Follow the recommended precautions and safe operating practices. Safety notices in this manual provide important information. Read and be familiar with these instructions before attempting installation, operation, or maintenance. The purpose of this section is to alert users to possible safety hazards associated with this equipment and the precautions that need to be taken to reduce the risk of personal injury and damage to the equipment.

Failure to observe these precautions could result in serious bodily injury, damage to the equipment,or operational difficulty.

Introduction

Figure 1.1: STAC6 Applied Motion Products (Motor Control)

Thank you for selecting an Applied Motion Products motor control from Tolomatic. We are committed to making your motion control project successful.

If there's anything we can do to help you service or troubleshoot your system. Contact our technical support department at (800) 325-2174 or you can reach us by fax at (763) 478-8080. You can also email techsupport@tolomatic.com.

Getting Started

For all STAC6 Drive models, you must have the following:

- A compatible stepper motor
- A small flat blade screwdriver for tightening the connectors (included).
- A personal computer running Microsoft Windows 98, NT, Me, 2000 or XP.
- The "Software, Manuals & More" CD that was included with your STAC6 Stepper drive
- A programming cable (included)

Familiarize yourself with the drive and the software before deploying the system in your application.

Recommended Procedures:

1. Install the Configurator™ software from the CD.
2. Launch the software by clicking Start...Programs...Applied Motion Products...Configurator.
3. Connect the drive to your PC using the programming cable supplied.
4. Connect the drive to the AC power source (may be switched).
5. Connect the drive to the motor.
6. Apply power to the drive.
7. Follow the instructions in the Configurator™ help screens. (On the CD)

Error Codes / Status LED

The STAC6 includes a bi-color (red/green) LED to indicate status. Normal status is indicated by a solid green LED. If the LED changes to red, an error has occurred. The errors are indicated by combinations of red and green "flashes" as follows:

Code	Error
1 red, 1 green	motor stall (optional encoder only)
1 red, 2 green	attempted move while drive disabled
1 red, 3 green	subroutine stack overflow
2 red, 1 green	ccw limit
2 red, 2 green	cw limit
2 red, 3 green	subroutine stack underflow
3 red, 1 green	drive overheating
3 red, 2 green	excess regen
4 red, 1 green	power supply overvoltage
4 red, 2 green	power supply undervoltage
4 red, 3 green	bad instruction in Si program (memory or s/w error)
5 red, 1 green	over current / short circuit
5 red, 2 green	motor resistance out of range
6 red, 1 green	open motor winding
6 red, 2 green	bad encoder signal
7 red, 1 green	serial communication error

Figure 1.2: STAC6 Error Codes

RS 232 Communications

CONNECTING TO THE PC USING RS - 232

Locate your computer within 6 feet of the STAC6 Stepper drive.

The drive is shipped with a black adapter plug. A telephone style jack is at one end and a larger 9-pin connector at the other. Plug the large end into the COM1 serial port of your PC. Secure the adapter with the screws on the sides. If the COM1 port on your PC is already in use, the COM2 port may be used for the drive. On some PCs, COM2 will have a 25 pin connector that does not fit the black adapter plug. If this is the case, purchase a 25-to-9 pin serial adapter sold at local computer stores.

The drive is also shipped with a 7 foot telephone line cord. Plug one end into the black adapter plug attached to your PC, and the other end into the RS-232 jack on the drive. If the drive needs to be located farther from the PC, replace the 7 foot phone cord with a longer one. Do not use cords in excess of 50 feet.

Never connect a STAC6 drive to a telephone circuit. It uses the same connectors and cords as telephones and modems, but the voltages are not compatible.

RS 485 and RS 422 Communications

CONNECTING TO THE PC USING RS-485

RS-485/422 allows connection of more than one drive to a single host PC, PLC or other computer. It also accommodates a longer cable (more than 1000 feet) for devices that have a RS-485/422 port.

A SHORT TUTORIAL ON RS-485 & RS-422

RS-485 in the strictest definition is a "2-wire" interface that allows multi-node connections limited to "Half-duplex" serial communications. Up to 32 nodes that both transmit and receive can be connected to the network. RS-422 in the strictest definition is a "4-wire" point-to-point connection that allows "Full-duplex" serial communications when connected to a single node. RS-422 has one node that is the driver or transmitter and up to 10 nodes that are receivers. RS-422 was not designed for a true multi-node network.

2- wire interfaces require a network node, master or slave, must be able to tristate its transmitter to allow other nodes to use the network when required. For high speed baud rates this must be done very quickly to avoid communications collisions.

4-wire interfaces can go beyond the simple point-to-point and accommodate multi-node networks if the slave node is capable of tri-stating their transmitters as required in the 2-wire networks. Some RS-485 devices are setup to do this and can be used in a 4-wire configuration.

On the AMP Servo drives, the RS-485 can be implemented with either "2-wire" or "4-wire" interfaces. In both cases, communications are still limited to "Half-duplex" because of the nature of the serial communications protocols used. 4-wire implementations can sometimes be easier due to the greater number of Host RS-232 to RS-485 adapters that support the 4-wire interface. 2-wire implementations may require special Host adapters that support

"Auto enable" of the adapter transmitter. Host adapters are required as PC software typically doesn't support tri-stating the output of the serial adapters.

In both 2-wire and 4-wire systems one extra wire is always required to connect the "Grounds" of all the nodes on the network. Even though 2-wire and 4-wire systems send differentially, a command ground connection is absolutely required.

In addition, proper cable shielding is a must. High voltage, high frequency, high current signals that are present on servo motor cables can emit a significant amount of electrical interference. Without proper shielding these signals can disrupt even "noise tolerant" differential line drivers.

4-Wire RS-485-422 Network

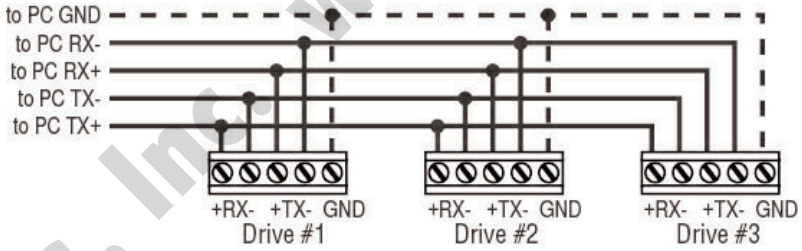
The RS485 implementation is a 4-wire multi-drop network with separate transmit and receive wires. One pair of wires connects from the host computer's TX+ and TX- signals to each of the drive's RX+ and RX- terminals. Another pair connects the TX+ and TX- drive terminals to the host computer's RX+ and RX- signals. A common ground terminal is provided on each drive and can be used to keep all drives at the same ground potential. This terminal connects internally to the DC power supply return (V-), so if all the drives on the RS485 network are powered from the same supply, it is not necessary to connect the logic grounds. Connection of one drive's GND terminal to the host computer ground is still required. Before wiring the entire system, connect each drive individually to the host computer so a unique address can be assigned to each drive. Proceed as follows: (Also see figure below)

1. Connect the drive TX+ to the PC's RX+ terminal.
2. Connect the drive TX- to PC RX-.
3. Connect RX+ to TX+.
4. Connect RX- to TX-.
5. Connect GND to GND.

Getting and Connecting a RS485 4-wire adapter to your PC

A 25-pin serial port is recommended. The Jameco Electronics (800-831-4242) Model 1117701 is a good choice. If a 9-pin serial port is on your PC, a Jameco cable Model 31721 is also required.
Connect as follows:

adapter	drive
1	RX+
2	RX-
3	TX-
4	TX+



Set the switches for DCE and TxON,RxON. Plug in the DC power adapter that comes with the unit.

Figure 1.3: RS - 422 Wiring

The drive can also be connected to the Host computer using only a 2-wire interface. In this case, first connect the TX+ to the RX+ and the TX- to the RX- on the servo drives before connecting to the Host adapter. Usually RS-485 2-wire interfaces are labeled "A" & "B".

Getting and Connecting a RS485 2-wire adapter to your PC

The RS485 2-wire adapter (Model 485-25E) from Integrity Instruments (800-450-2001) is recommended.

adapter	drive
B	TX+/RX+
A	TX-/RX-

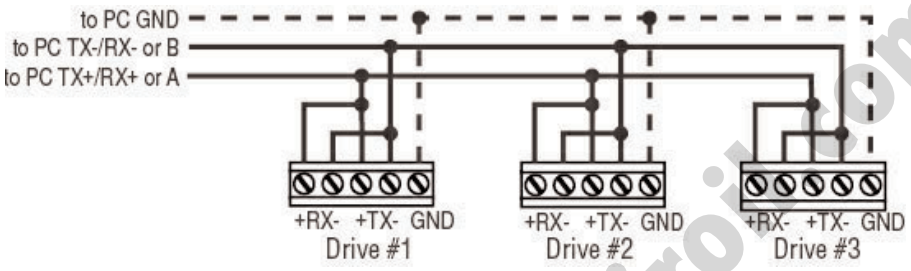


Figure 1.4: RS - 485 Wiring

Before connecting the stepper drive to your system

With the RS-232 cable connected between the PC and the Servo drive, start the SiNet™ Setup software. Select the proper comm port (1,2,3 or 4) then apply power to the drive. Press the Caps Lock key as the drives will only accept commands in uppercase. Type RV then press ENTER. If the drive has power and is properly wired, it will respond with "RV=x". Where "x" is the firmware version of your drive. If the drive responds, the RS485 network is functioning.

Next, choose an address for the drive. Any of the "low ASCII" characters (many of which appear above the number keys on a PC keyboard) are acceptable:

! " # $ % & ‘ ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < > ? @

To find out what address is currently in the drive, type DA then press enter. The drive will respond with DA=x, where "x" is the address that was last stored. (For example, the response might be DA=@ or DA=!). To change the address, type DAy, where "y" is the new address character, then press ENTER.

To test the new address, type yRV, then press ENTER. For example: Set the address to %. To test, type %RV. The drive should respond just as it does to RV, the global revision level request.

Once all the drives have been assigned unique addresses, you can proceed to wire the whole system.

Wiring Your Drive

CONNECTING AC POWER

The STAC6 accepts an AC supply voltage from 94 to 135VAC , 50/60Hz. The [S][I] [STAC6-Si-220] is a special version designed to operate from 94 to 265 VAC. Using the connector supplied and AWG 16 wire, connect to the AC supply as per the diagram below. Care should always be taken when working with high voltages. In regions where the Single phase supply is higher, an auto transformer can be used to drop the voltage to the correct level.

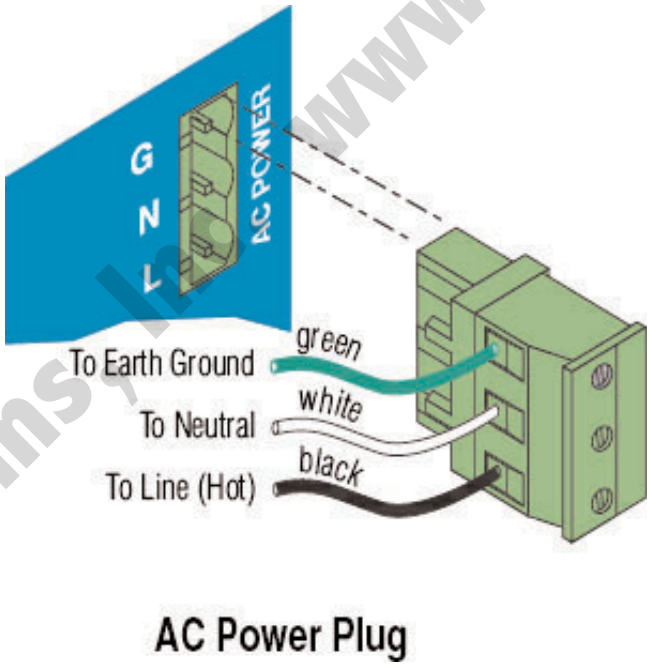


Figure 1.5: AC Connection

FUSING

The STAC6 contains an internal 8 amp fast acting fuse (4 amps for the 220V version). If an external fuse is desired, a time lag (slo blo) fuse is recommended. Use an 8 amp fuse (Littlefuse 313008) for the standard STAC6 and a 4 amp fuse for the 220V version.

Motor Wiring

APPLIED MOTION PRODUCTS MOTORS

All recommended Applied Motion motors for the STAC6 include shielded cables. These motors should be connected in "series." Parallel connections are not suitable for the STAC6 because of the high motor bus voltage.

In most cases, the motor includes a pre-assembled connector for the STAC6. If your motor does not already have a connector attached or the length of the cable needs to be changed, please refer to the illustration below. Be sure to connect the cable shield for safety and minimize electrical interference.

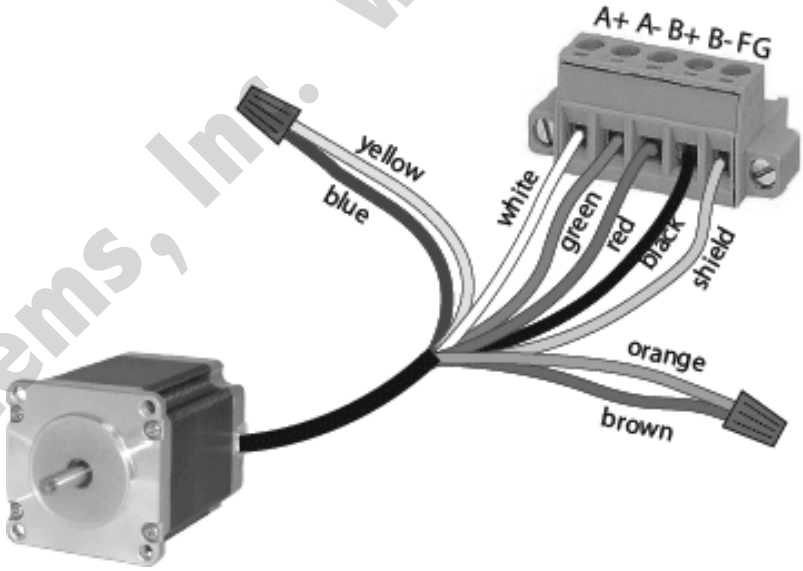


Figure 1.6: Motor Cable Wiring

Connecting an Encoder

RECOMMENDED ENCODERS

An optional encoder connects to the STAC6 using an HD15 male connector. Add this connector referencing the diagram below. It is not essential to connect the Z (index) channel.

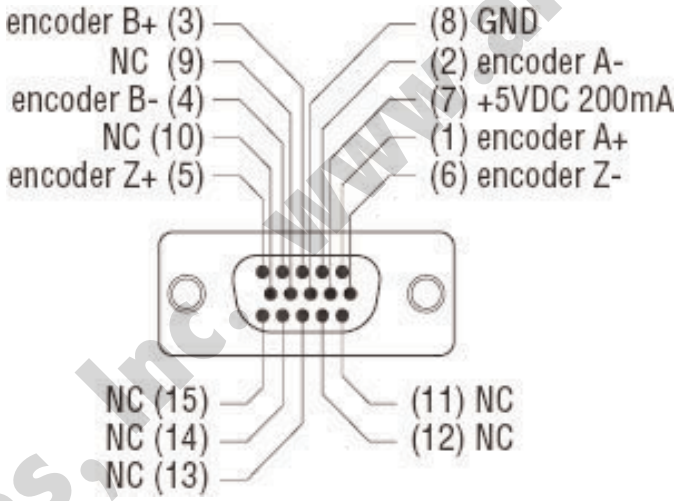


Figure 1.7: HD 15 Pinouts

Differential encoders are highly recommended over single-ended types. They are far less sensitive to electrical interference and provide problem free performance. Use of differential encoders with the STAC6 enables the drive to detect a broken wire or bad signal and display an alert.

If using single-ended encoders, connect to the A+ and B+ terminals only. These terminals are internally biased to the proper voltage and will provide the best performance results. Also, select the "single-ended" box in the encoder dialog. Failure to do so will make the drive function as if a broken wire has been encountered.

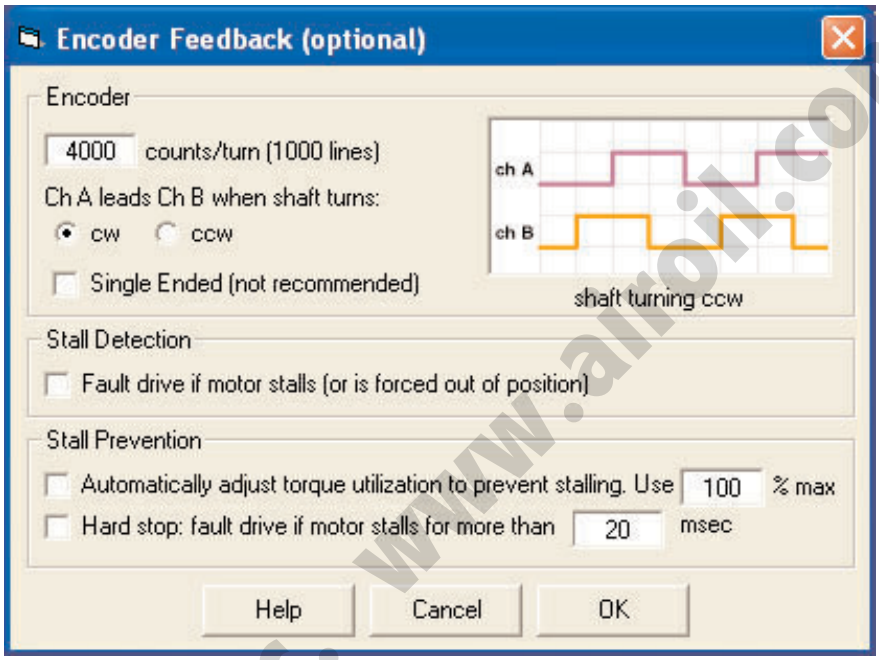


Figure 1.8: Encoder Dialog

ENCODER FEEDBACK OPTIONS

Stall Detection continuously compares the actual motor position, as reported by the encoder, against the theoretical motor position. If the motor strays so far out of position that it can produce no torque, a position fault occurs. This includes a motor at rest being driven out of position by an external force. Check the box below "Stall Detection" if the drive is desired to fault when the motor stalls. This fault can be reported by the Fault output and cleared by the Alarm Reset input (see I/O Dialog).

Stall Prevention can prevent many stalls before they occur. The STAC6 achieves this by using the encoder to monitor the lead angle of the motor, a measure of torque utilization. If the motion profile begins to demand more torque than the motor can produce, the

velocity is automatically reduced before the motor stalls. To engage stall prevention, simply check the Stall Prevention box and enter the maximum allowable torque utilization.

In the event that the motor cannot move at all, such as hitting a hard stop, fault the drive after a given amount of time by checking the "Hard Stop" box and entering a time limit.

Connecting Digital Inputs on the IN/OUT 1 Connector

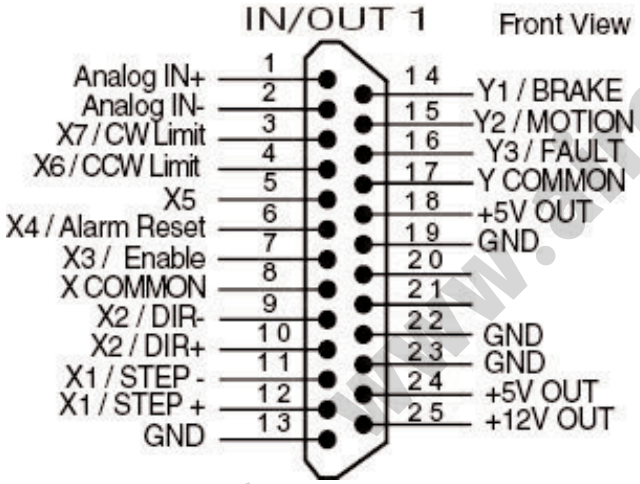


Figure 1.9: Connections In/Out 1

HIGH SPEED DIGITAL INPUTS

The STAC6 drives include two high speed inputs called STEP and DIR. They accept 5 volt single-ended or differential signals, up to 2 MHz. These are configured using the STAC6 Configurator software. Normally these inputs connect to an external controller that provides step & direction command signals. Connection of a master encoder to the high speed inputs can also be made for Encoder Following applications.

CONNECTIONS

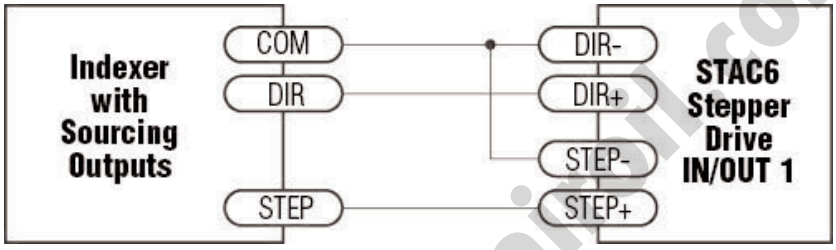


Figure 1.10: Step Source – Connecting to indexer with Sourcing Outputs

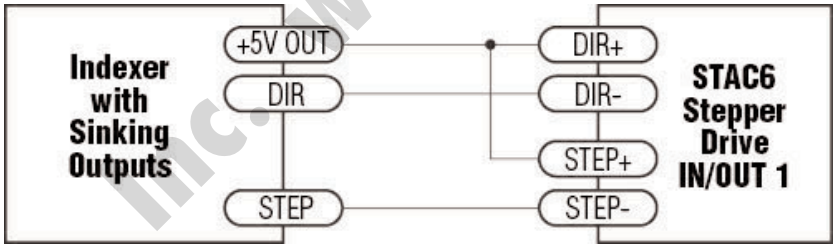


Figure 1.11: Step Sink – Connecting to indexer with Sinking Outputs
(includes Applied Motion Si-1 Indexer)

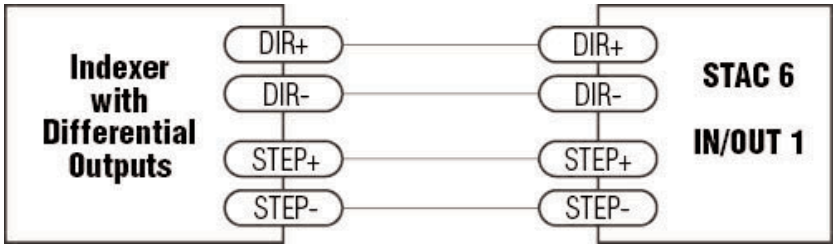


Figure 1.12: Step Differential – Connecting to indexer with Differential Outputs

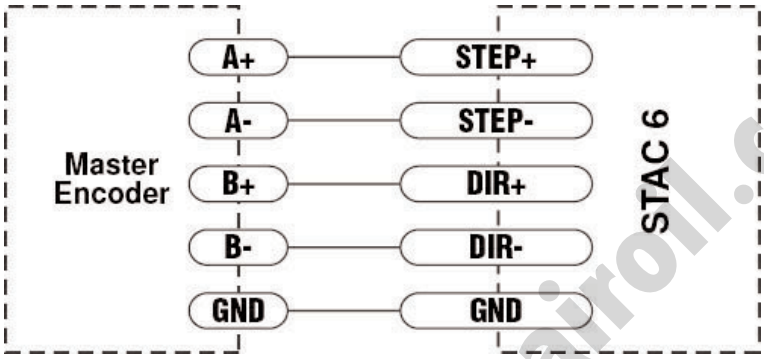


Figure 1.13: Connecting the Master Encoder

USING HIGH SPEED INPUTS WITH 12-24 VOLT SIGNALS

Most PLCs don't use 5 volt logic. Signal levels as high as 24 volts can be connected to the STEP and DIR inputs if external dropping resistors are added, as shown below.

- For 12 volt logic, add 820 ohm, 1/4 watt resistors
- For 24 volt logic, use 2200 ohm, 1/4 watt resistors

WARNING: The maximum voltage that can be applied directly to a high speed input terminal is 5 volts. Never apply high voltage AC to an input terminal.

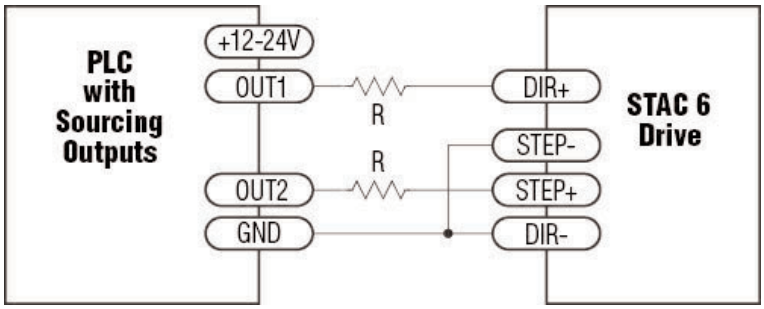


Figure 1.14: Connecting to PLC with Sourcing (PNP) Outputs
(most PLC's use 24 volt logic)

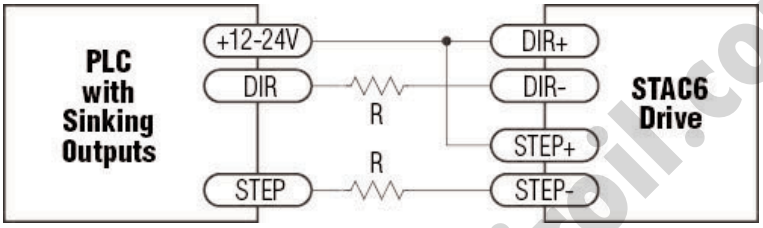


Figure 1.15: Connecting to PLC with Sinking (NPN) Outputs
(most PLC's use 24 volt logic)

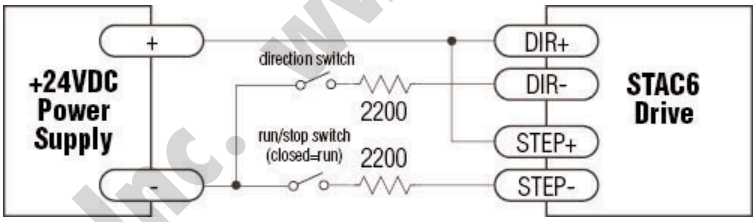


Figure 1.16 Using Mechanical Switches at 24 volts

STANDARD DIGITAL INPUTS

As we previously stated, the high speed STEP and DIR inputs are configured for five volt logic. All other digital inputs are designed for operation between 12 and 24 volts DC. This includes five inputs on the IN/OUT 1 connector and the eight digital inputs on the expanded I/O board (IN/OUT2).

SINGLE ENDED INPUTS

The [S][I] [STAC6-Si] includes single ended, optically isolated input circuits that can be used with sourcing or sinking signals, 12 to 24 volts. This allows connection to PLCs, sensors, relays and mechanical switches. Because the input circuits are isolated, they require a source of power. When connecting to a PLC, the PLC should be able to supply the power. When using relays or

mechanical switches, a 12-24 V power supply will be required. This also applies when connecting the inputs to the programmable outputs of another Si product from Applied Motion.

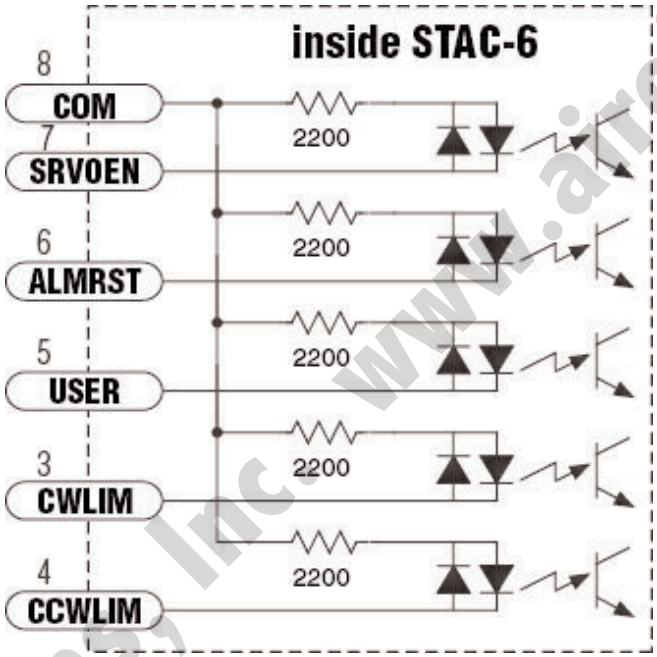


Figure 1.17: Inside Inputs

What is COM?
"Common" is an electronics term for an electrical connection to a common voltage. Sometimes "common" means the same thing as "ground", but not always. In the case of the STAC 6, when using sourcing (PNP) input signals, connect COM to ground (power supply -). When using sinking (NPN) signals, COM must connect to power supply +.

Note: If current is flowing into or out of an input, the logic state of that input is low or closed. If no current is flowing, or the input is not connected, the logic state is high or open.

DIGITAL INPUT CONNECTION EXAMPLES

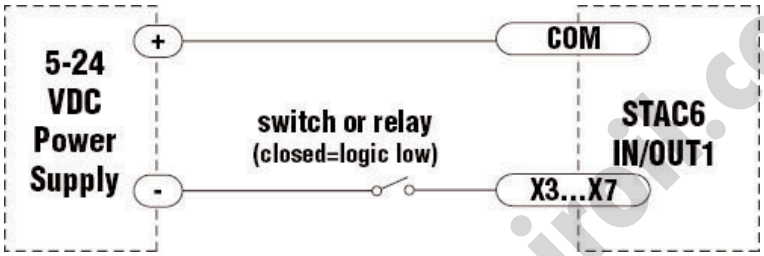


Figure 1.18: INP Relay

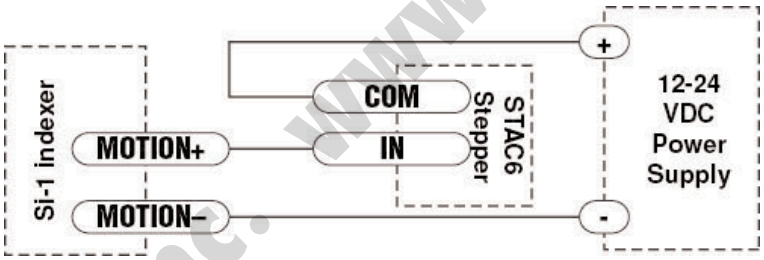


Figure 1.19: Si1

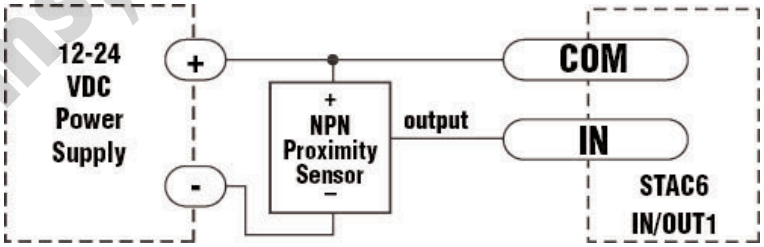


Figure 1.20: INP NPN In/Out 1

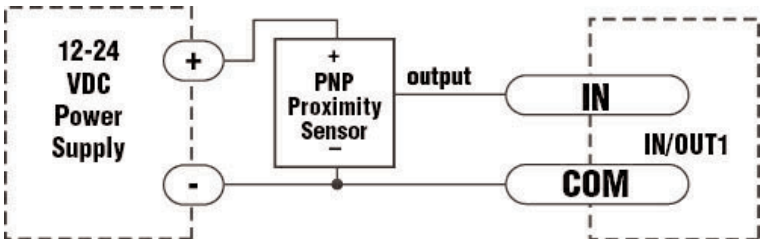


Figure 1.21: INP PNP 1

CONNECTING LIMIT SWITCHES TO THE STAC6 DRIVE

The CWLIM and CCWLIM inputs are used for connecting end-of-travel sensors. These inputs are differential, which allows use of signals that are sinking (NPN), sourcing (PNP) or differential (line driver). By connecting switches or sensors that are triggered by the motion of the motor or load, the motor can be forced to operate within certain limits. This is useful to prevent a program or operator error causing damage to a system by traveling too far.

Limit inputs are optically isolated. This allows selection of the voltage for limit circuits of 12 to 24 volts DC. Longer wires on limit sensors can also be accommodated, creating greater distance from the drive, resulting in less noise reduction to the drive electronics. The schematic diagram of the limit switch input circuit is shown below.

STAC-6 LIMIT INPUT DIAGRAM

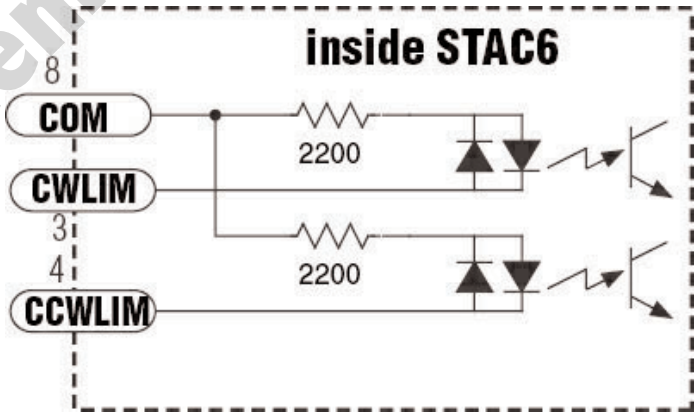


Figure 1.22: STAC6 Limit Input Diagram

WIRING A MECHANICAL LIMIT SWITCH

Both normally open or normally closed limit switches can be used and wired as shown below.

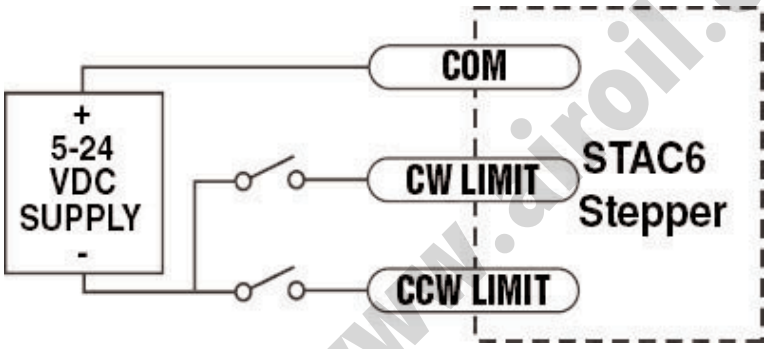


Figure 1.23: Mechanical Limit Switch

WIRING A LIMIT SENSOR

Some systems use active limit sensors that produce a voltage output rather than a switch or relay closure. These devices must be wired differently than switches. If an open collector output or a sinking output sensor is used, wire as shown below.

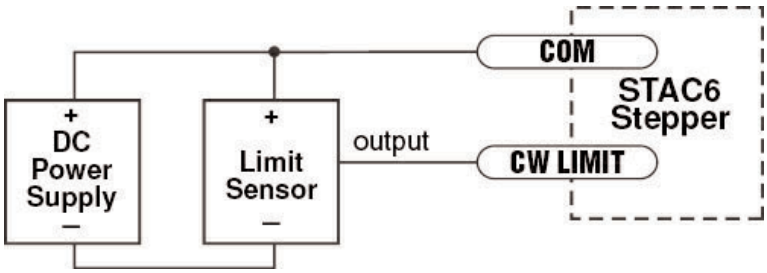


Figure 1.24: NPN Limit Sensor

If the sensor output goes low at the limit, select the option "closed" (in the software). If the output is open, or high voltage, choose "open."

Other sensors have sourcing outputs causing current to flow out of the sensor output, but not into it. Sensors with sourcing outputs should be wired as shown below.

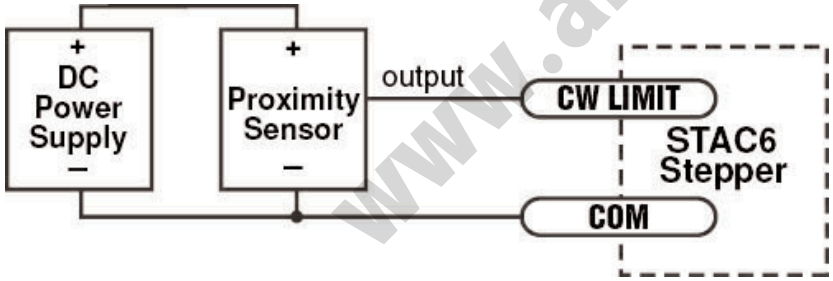


Figure 1.25: PNP Limit Sensor

Connecting Digital Outputs on the IN/OUT 1 Connector

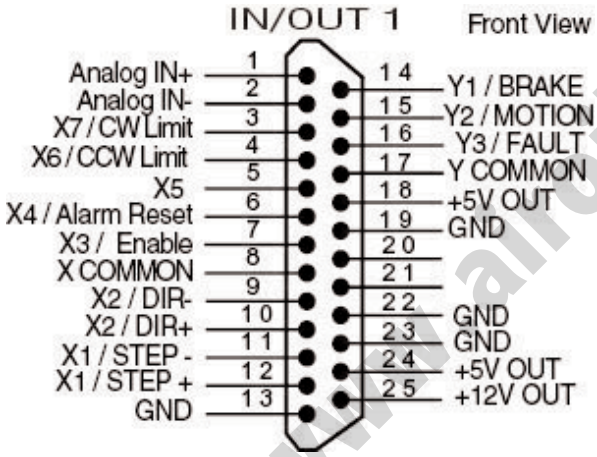


Figure 1.26 Connections In/Out 1

The [S][I] [STAC6-Si] drives feature three digital outputs:

Brake: Controls an electric brake relay, automatically releasing and engaging as the drive requires.

Alarm: Closes when a drive fault or alarm condition occurs. The red and green LEDs will flash an error code.

Motion: Indicates that the drive has achieved a desired goal, such as a target position.

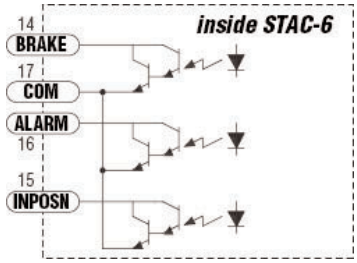


Figure 1.27: STAC6 Outputs

The optional I/O expansion board adds four additional

programmable outputs. The outputs can be used to drive LEDs, relays and the inputs of other electronic devices like PLCs and counters. The BRAKE, ALARM and MOTION outputs can only sink current.

The COM terminal must be tied to power supply (-).

Diagrams for each type of connection follow.

Do not connect the outputs to more than 30VDC. The current through each output terminal must not exceed 100 mA.

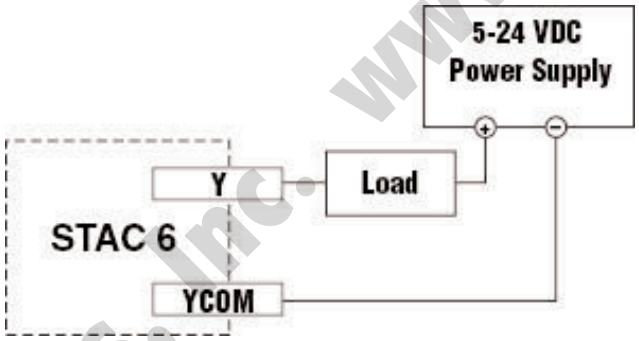


Figure 1.28: STAC6 Outsinking

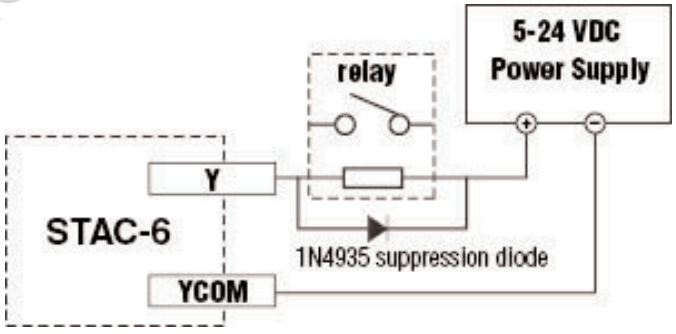


Figure 1.29: STAC6 Relay

Connecting Analog Inputs on the IN/OUT 1 Connector

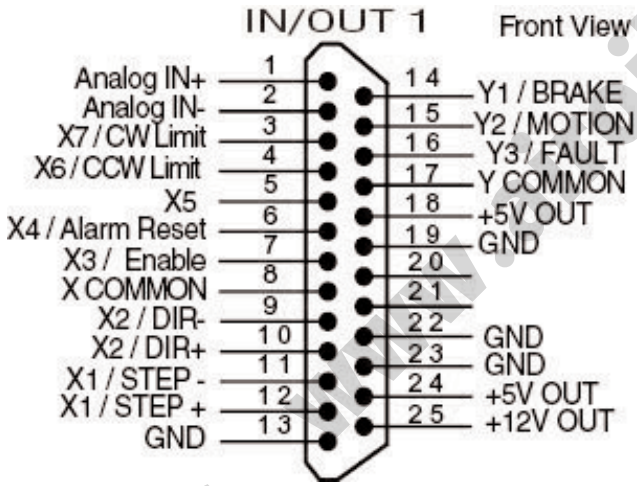


Figure 1.30: Connections In/Out

The STAC6 has a ±10 Volt analog input that can be used by the drive for a number of dedicated purposes for controlling the motor. It can also be used for general purpose analog input signals.

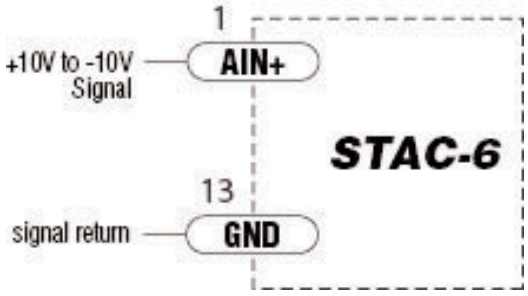


Figure 1.31: Analog Single Ended Signal

THREE DEDICATED MODES

- Analog Torque Mode
- Analog Velocity Mode
- Analog Positioning Mode

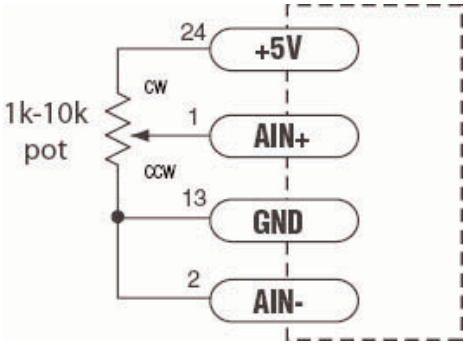
Each of these three modes uses the analog input for "Commanding" the stepper drive. Other uses include using an analog signal to stop a move when using any of the "Feed to Sensor" type moves and waiting on a analog signal using the "Wait on Input".

BASIC SPECIFICATIONS

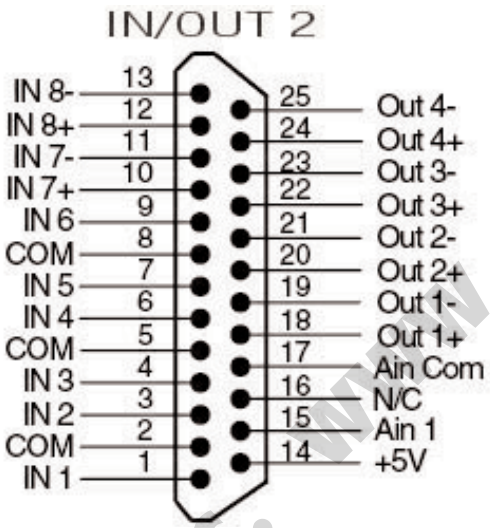
- The analog input can accept ±10 Volts.
- The input has an impedance of 20K ohms.
- Because of the nature of the design, the input will exhibit a 1.4V offset when not driven by an analog source.
- Low source impedance is important for minimizing analog errors, 100 ohms or lower is recommended.

WARNING - Analog input must be used with care. It is not optically isolated and may operate improperly or could be damaged when system grounds are not compatible.

Connecting an Analog Input to a Potentiometer or Joystick



Connecting Digital Inputs on the IN/OUT 2 Connector



Note - this connector is standard on [S][I] [STAC6-Si] version and only on [D][S] [STAC6-S] versions with expanded I/O.

Figure 1.33: In/Out 2 Connections

Digital Inputs

SINGLE ENDED INPUTS

The [S][I] [STAC6-Si] includes single ended, optically isolated input circuits that can be used with sourcing or sinking signals, 12 to 24 volts. This allows connection to PLCs, sensors, relays and mechanical switches. Because input circuits are isolated, they require a source of power. When connecting to a PLC, the PLC should be able to supply the power. If you are using relays or mechanical switches, a 12-24 V power supply will be required. This also applies when connecting the inputs to the programmable outputs of another [S][I] [STAC6-Si] Drive.

What is COM?
"Common" is an electronics term for an electrical connection to a common voltage. Sometimes "common" means the same thing as "ground", but not always. In the case of the STAC 6, when using sourcing (PNP) input signals, connect COM to ground (power supply -). When using sinking (NPN) signals, then COM must connect to power supply +.

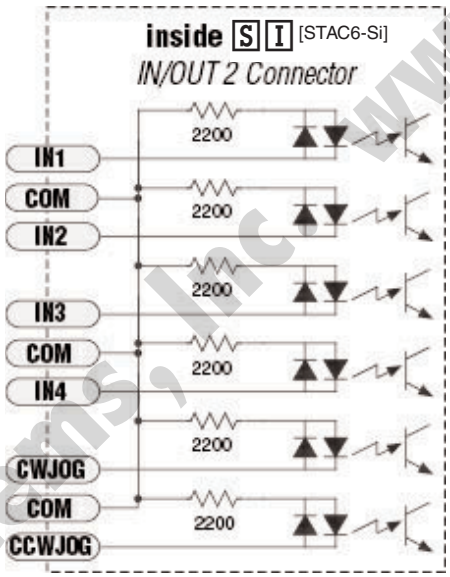


Figure 1.34: Inputs S I [STAC6-Si]

CONNECTING AN INPUT TO A SWITCH OR RELAY

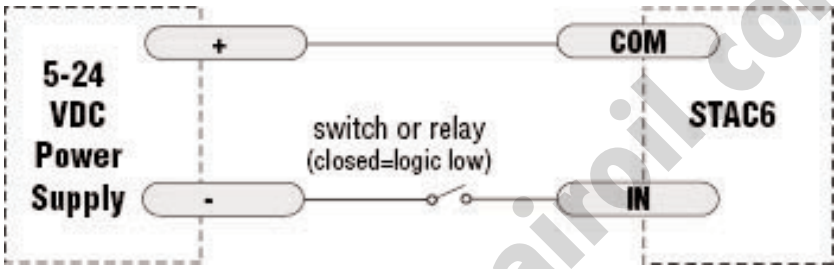


Figure 1.35: Switch In/Out 2

Use a normally open momentary switch to trigger the drive using the "Wait Input" instruction.

Use a single throw switch for parameter selection using the "If Input" instruction.

Use a normally open momentary switch for jogging.

CONNECTING ANOTHER Si DRIVE

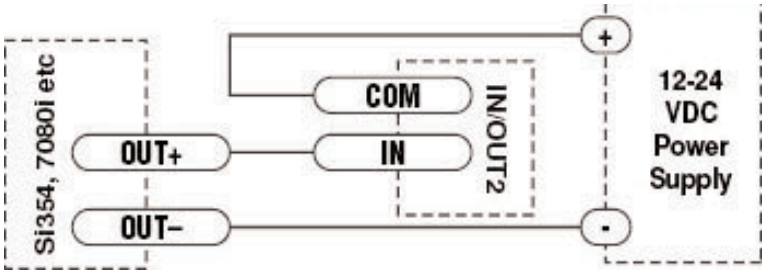


Figure 1.36: Output In/Out 2 – When output closes, drive input goes low.

CONNECT NPN TYPE PROXIMITY SENSOR TO AN INPUT

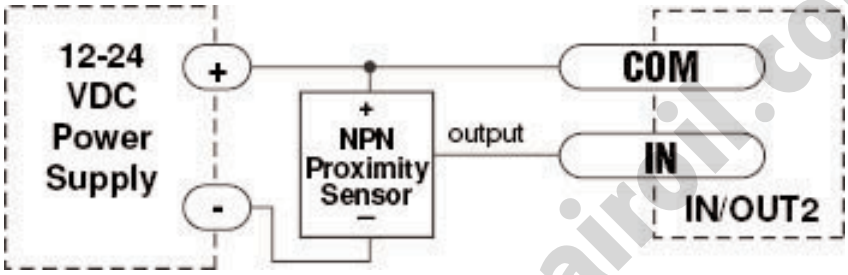


Figure 1.37: NPN Proximity In/Out 2 – When prox. sensor activates, drive input goes low.

CONNECT PNP TYPE PROXIMITY SENSOR TO AN INPUT

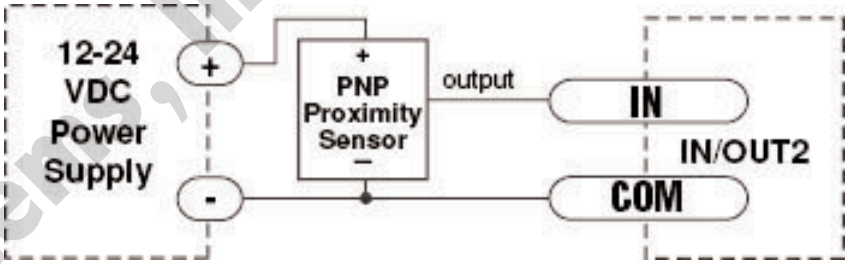
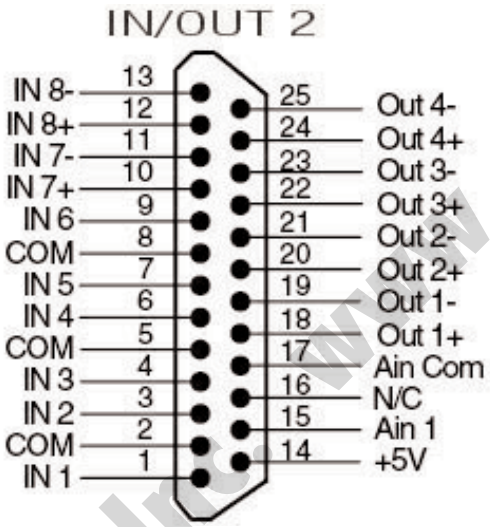


Figure 1.38: PNP Proximity In/Out 2 – When prox. sensor activates, drive input goes low.

Connecting Digital Inputs on the IN/OUT 2 Connector



Note - this connector is standard on [S][I] [STAC6-Si] version and only on [D][S] [STAC6-S] versions with expanded I/O.

Figure 1.39: In/Out 2 Connections

DIGITAL OUTPUTS

The expanded I/O board adds four additional programmable outputs. The outputs can be used to drive LEDs, relays and the inputs of other electronic devices like PLCs and counters. On the IN/OUT 2 connector outputs, both the "+" (collector) and "-" (emitter) terminals of each transistor are available on the connector pins. This allows configuration of each output for current sourcing or sinking.

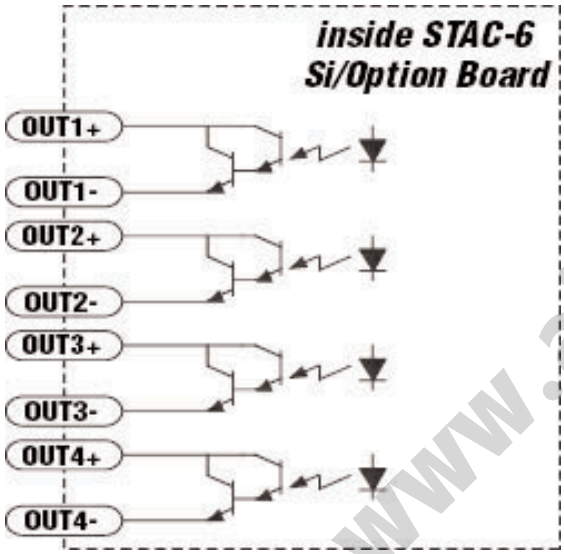


Figure 1.40: Outputs S I [STAC6-Si]

Diagrams of each type of In/Out connection follow.

Do not connect the outputs to more than 30VDC. The current through each output terminal must not exceed 100 mA.

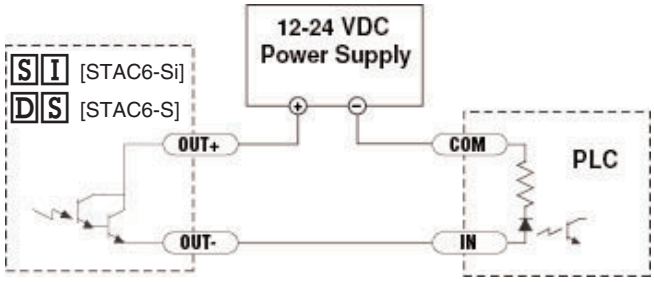


Figure 1.41: Sourcing Out

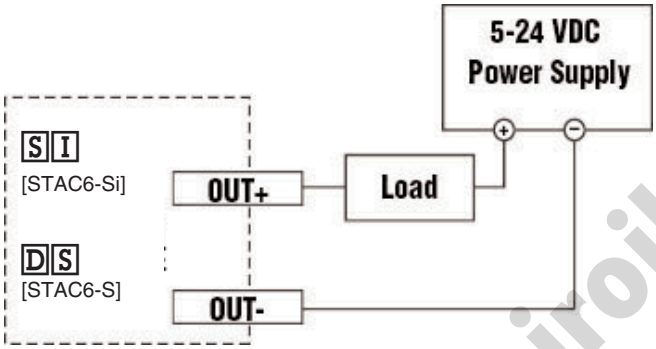


Figure 1.42 SI [STAC6-Si] ***Out Sinking***

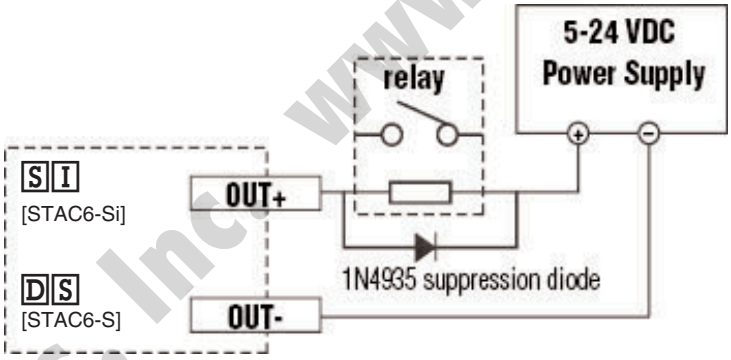
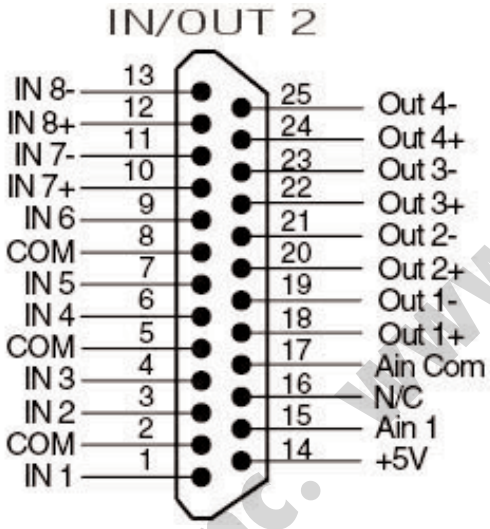


Figure 1.43: SI [STAC6-Si] ***Relay***

Connecting Analog Inputs on the IN/OUT 2 Connector



Note - this connector is standard on [S][I] [STAC6-Si] version and only on [D][S] [STAC6-S] versions with expanded I/O.

Figure 1.44: In/Out 2 Connections

CONNECTING TO THE AUX ANALOG INPUT

The auxiliary analog input on the STAC6 IN/OUT 2 connector can be used by "Feed to Sensor" commands and other input functions when operating the drive in "Host" mode. The analog input can also be read back to the "Host" using the "IA" immediate type and "RA" buffered type Host commands. Readings are in Volts.

+5 volt DC is provided for powering potentiometers. A 1000 to 10000 ohm potentiometer is recommended and should be connected as shown below.

A 0 to 5 volt analog signal may also be used. Usually this signal comes from a PLC, a PC with data acquisition card or a motion controller. Connections are shown below.

The +5V terminal is an output. Do not connect it to a power supply.

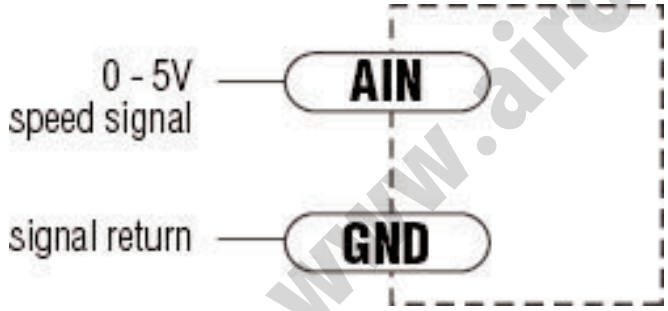


Figure 1.45: Connecting an Analog Input to an Active Signal

Regeneration Clamp

The STAC6 includes a regeneration clamp circuit and internal power dump resistor. Only the circuit is designed to handle any power level that the drive is able to out put.

The internal power resistor is rated for a continuous 50 watts. This may not be adequate in cases where the load has a high inertia content and very little frictional content. For these cases, an external power resistor may be connected to the drive. When using an external power resistor, the regeneration parameters must be changed in the Regen dialog box.

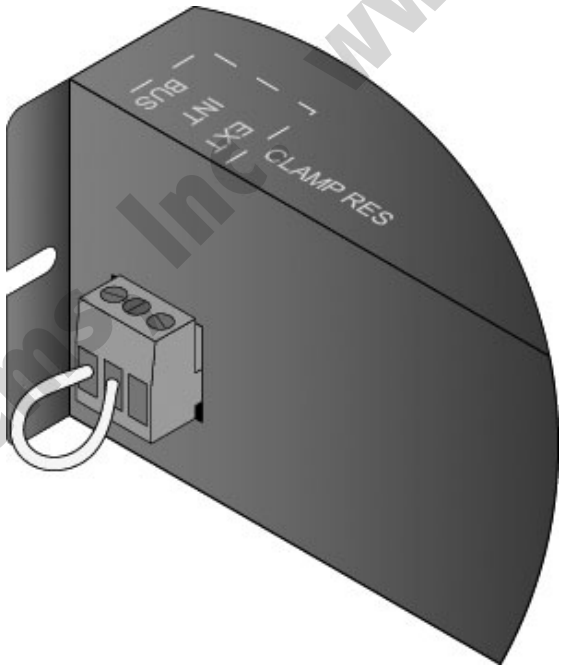


Figure 1.46: STAC6 Internal Regen

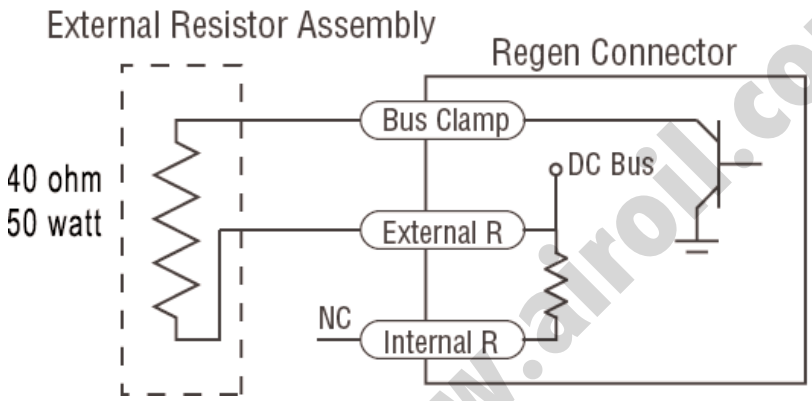


Figure 1.47: Regen Resistor Connection

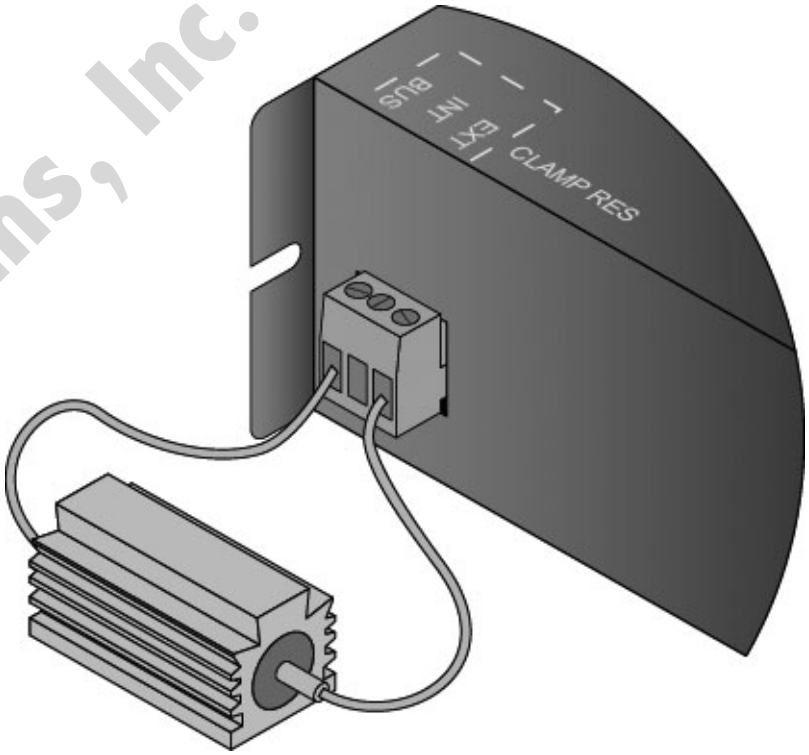


Figure 1.48: STAC6 External Regen

BLANK

Applied Motion motors are suited for the use with the STAC6. These motors have been tested and approved by Applied Motion Products and Tolomatic.

GENERAL MOTOR DATA

Spec	
Steps per rev	200
Step Angle	1.8°
Insulation class	B
Bearings	ABEC3 Double Shielded
Temp Rise	80° C Max
Opperating temp Range	-20 to +50°C
Storage temp Range	-40 to +70°C

Figure 2.1: General Motor Data Table

SIZE 23 MOTORS

Spec	Holding Torque (Series)		STAC 6 Current Setting	Resistance	Inductance	Rotor Inertia	Dimensions
Model	oz-in	kg-cm	A	Ohms	mH	g-cm^2	
HT23-548	60	4.3	1.5	3.4	6	120	HT23-548
HT23-549	118	8.5	1.4	4.2	12.8	300	HT23-549
HT23-550	187	13.5	2.9	5.1	15.2	480	HT23-550

Figure 2.2: Size 23 Motors

Rating are with motor connected in series

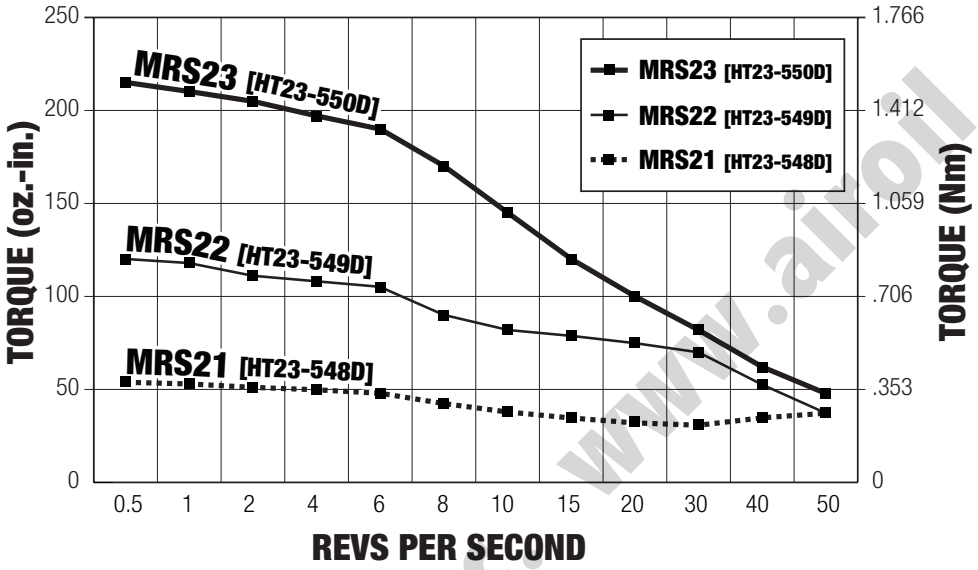


Figure 2.3: HT 23 Torque Curves

SIZE 34 MOTORS

Spec	Holding Torque (Series)		STAC 6 Current Setting	Resistance	Inductance	Rotor Inertia	Dimensions
Model	oz-in	kg-cm	A	Ohms	mH	g-cm^2	
HT34-488	650	46.8	6.0	1.4	5.2	1400	HT34-488
HT34-489	1200	86.4	5.7	1.7	1.08	2680	HT34-489
HT34-490	1845	133	6.0	1.7	1.08	4000	HT34-490

Figure 2.4: Size 34 Motors

Ratings are with motor connected in series

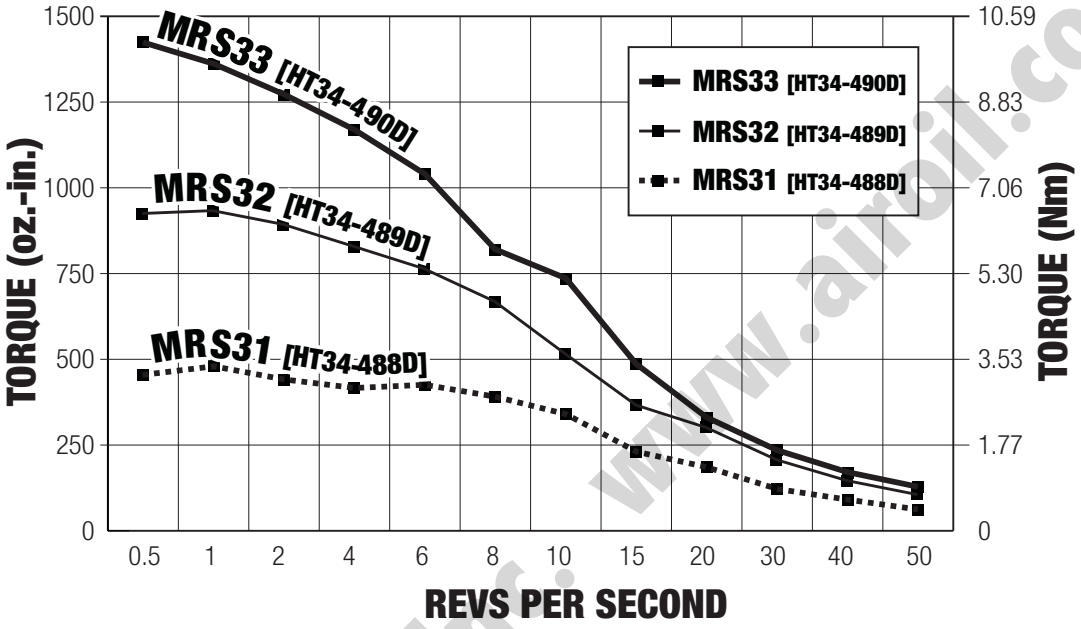


Figure 2.5: HT 34 Torque Curves

Dimensions

(See also - Connecting the Motor)

HT23 STEP MOTORS

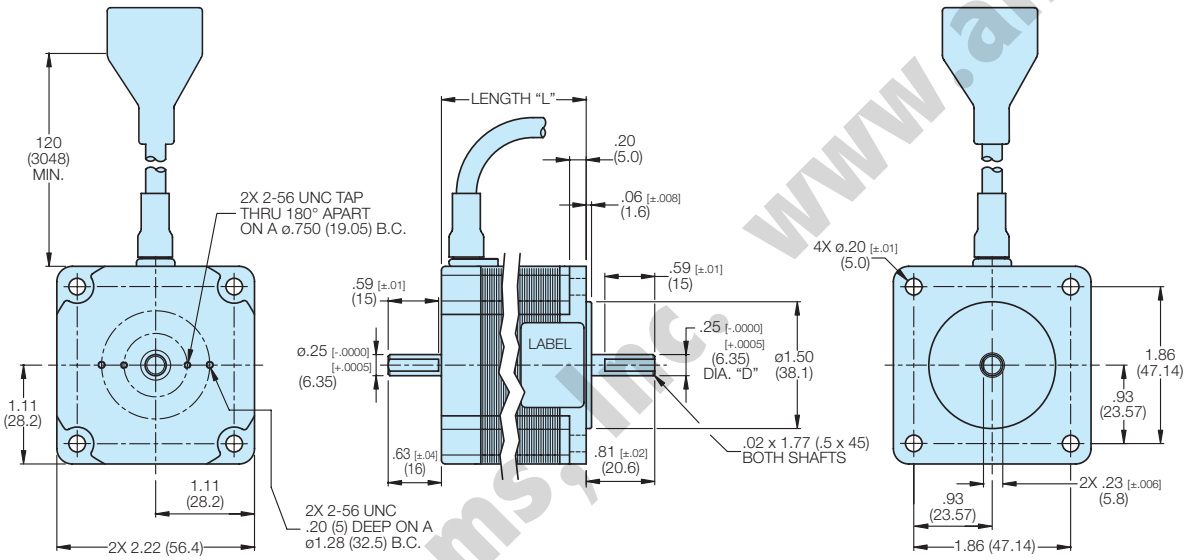


Figure 2.6: HT23 Step Motors

	LENGTH "L"		DIA."D"	
MODEL	***in.***	***mm***	***in.***	***mm***
HT23 - 548	1.7	43.8	.25	6.35
HT23 - 549	2.16	54.8	.25	6.35
HT23 - 550	3.05	77.5	.25	6.35

Ratings are with motor connected in series

HT34 STEP MOTORS

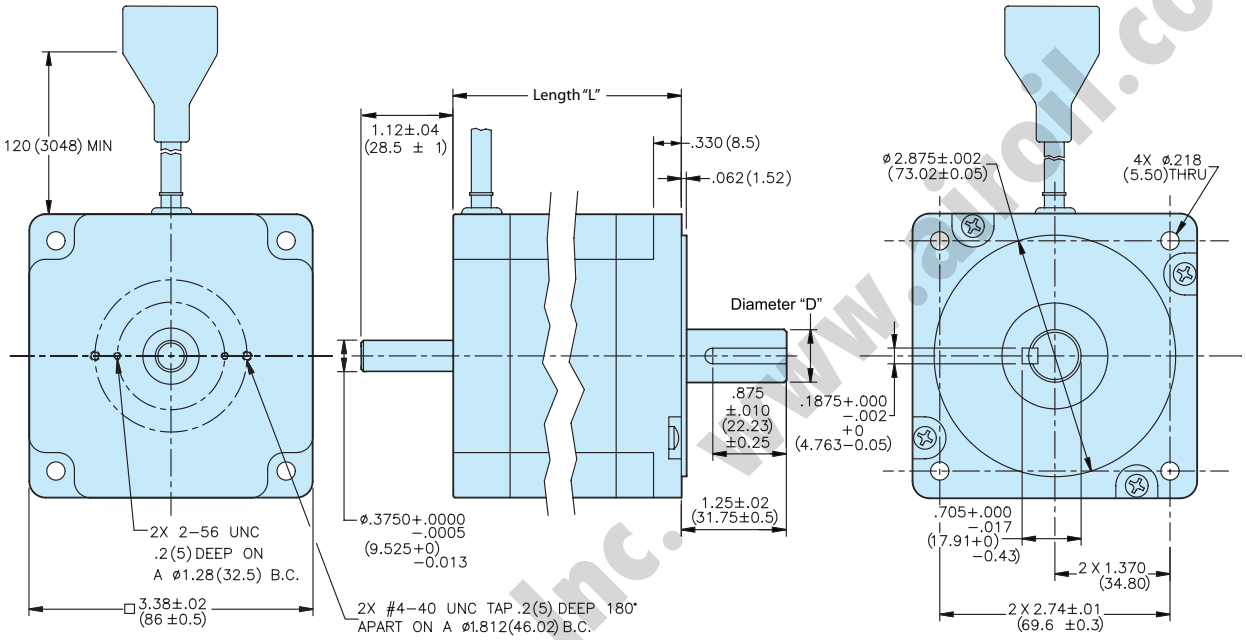


Figure 2.7: HT34 Step Motors

	LENGTH "L"		DIA."D"	
MODEL	***in.***	***mm***	***in.***	***mm***
HT34 - 488	3.11	79	.5	12.7
HT34 - 489	4.63	117.6	.5	12.7
HT34 - 490	6.14	155.9	.625	15.875

Ratings are with motor connected in series

BLANK

STAC6 Configurator Software

The Configurator is used to configure a STAC6 drive for your application. The drive set up is divided into six sections, each focusing on one area of configuration. Drop down menus provide additional functionality.

Figure 3.1: STAC6 Configurator

DRIVE

First, select the appropriate STAC6 model from the configurator drop down list in the upper right corner of the screen. The -S can be used for three types of applications.

1. Applications where another device controls the STAC6 by sending electrical signals over wires. The signals can be digital positioning pulses (pulse & direction or quadrature encoder following modes) or a velocity mode where the motor speed is selected by digital and/or analog signals.

2. Applications where a host PC or PLC sends high level commands over a serial port (RS-232 or RS-485) using the Serial Command Language (SCL)

3. Multi-axis applications where a control program is stored in a HUB [SiNet™ Hub444] and one or more STAC6 drives are connected to it.

   The HUB [SiNet™ Hub444] is used with our Si™ Programmer software where motion and machine control programs can be quickly and easily created in a user friendly, graphical environment. The Configurator is not required to set up or program a SI [STAC6-Si] drive, as that function can be performed in the Si Programmer. However, the configurator can be used for set-up and programming when a Si™ drive is operated in one of the DS [STAC6-S] mode.

   Both drives work with the HUB [SiNet™ Hub444].

MOTOR

The motor dialog allows you to choose a motor from a database of specially matched motors, or enter the parameters for a specified motor. For more details, see Configuring the Motor.

MOTION

Click on the Motion button to bring up the Motion Menu. Select one of the operating modes: Digital Positioning, Velocity (Oscillator) Mode, SCL, Hub, or Si™ program.

I/O

The STAC6 includes several inputs and outputs that can be assigned for special purposes, such as end of travel limits or signaling a drive fault. The I/O Dialog allows you to choose all the options.

REGEN CLAMP

A fast moving load can possess considerable kinetic energy especially if it has high rotating mass (inertia). If the STAC6 decelerates that load quickly, much of that kinetic energy is transferred back into the drive electronics. This is called "regeneration." To handle the incoming energy, the STAC6 includes a circuit called a "regeneration clamp." In most cases, the internal regen clamp can handle the incoming energy of most loads and motor speeds. If the drive experiences a "regen fault", a large external resistor must be used to dissipate the energy. The Regen Dialog gives you a place to enter the electrical parameters of the resistor and can help you learn how to wire it.

ENCODER

If using encoder feedback with your STAC6, click on Encoder and enter the encoder parameters and description. For more details, see Configuring an Encoder.

BLANK

Configuring the Motor

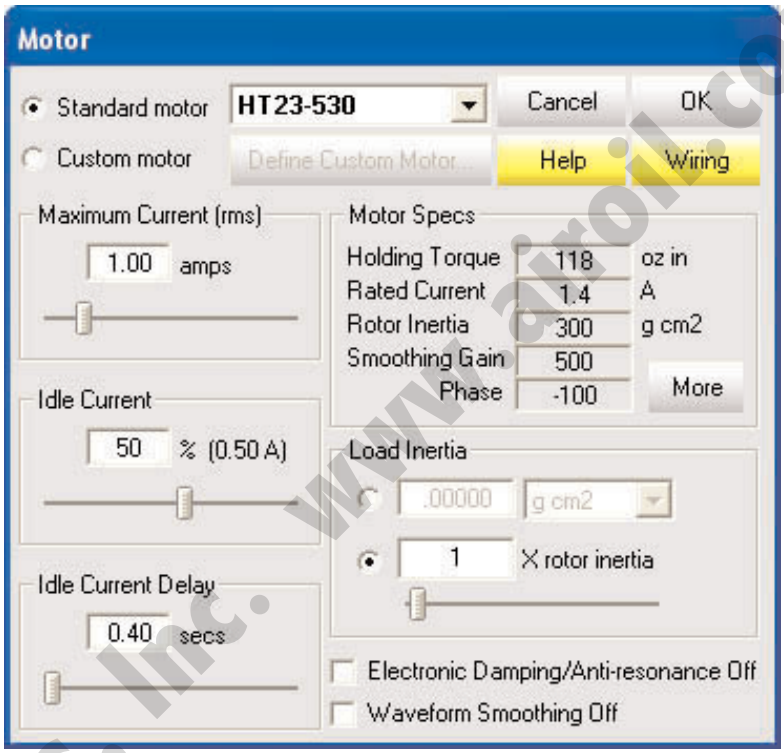


Figure 3.2: Motor Dialog

The STAC6 works best with the specially matched motors in the Recommended List. To configure the drive for one of these motors, click on the motor icon, select a motor from the drop down list, and set the current. The rated current for the motor chosen appears in the "Motor Specs" and that value is normally used. If your application is particularly heat sensitive, and more torque than needed is displayed, reduce motor heating by lowering the current. For short duty cycles, where the motor has time to cool down between moves, the current can be set higher than the motor rating to increase the torque.

Note: Motors operated above their rated current will not operate as smoothly and if used continuously will likely overheat.

Idle current reduction automatically reduces motor heating by lowering the current when the motor is at rest. In most cases, the default value of 50% works well. Reduce motor heating further by lowering the idle current percentage.

The idle current delay can also be adjusted. This determines the delay between the instant the motor stops moving and the actual reduction of the current. Allow time for the motor to settle out after a move before going into idle reduction.

LOAD INERTIA

The anti-resonance feature of the STAC6 is most effective when the load inertia is precisely set. If this value is known, click on the first option button, enter the inertia in the box and select the units (oz-in-sec2, g-cm2, etc) from the list. If the exact inertia value of the load is not known, choose the second option button and enter a load to motor inertia ratio in the box.

DEFINING A MOTOR NOT IN A RECOMMENDED LIST

Tolomatic highly recommends selecting an Applied Motion Products Motor from the standard motor dropdown matched listing in the configuration software. These are high quality motors whose torque, rotor inertia, and harmonic waveform content are precisely known. The motors also include shielded cables to reduce electrical emissions and enhance safety. They come with prewired mating connectors further reducing the risk of error.

If a motor not on the list is to be used, detailed information from the manufacturer, including electrical specification (holding torque, rated current and rotor inertia) plus a wiring diagram will be required. It is important the motor be constructed from high quality magnetic materials that are suitable for operation with a 160 volt bus such as that of the STAC6.

Referencing the motor manufacturer specifications, choose the "custom motor" option and click on the Define Custom Motor button. Enter the current, torque and inertia values into the Add New Motor dialog. Enter the harmonic distortion gain and phase to create the smoothest motion. Experiment by running the motor at a slow speed (typically 1 rev/sec) with different gain and phase values to see what works best. When in doubt, set the gain and phase at 0.

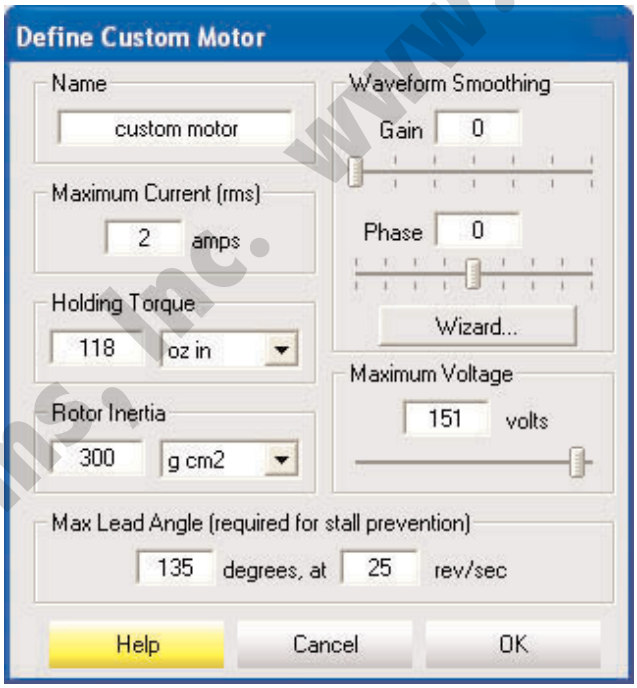


Figure 3.3: Add New Motor Dialog

If using the Encoder Stall Prevention feature (see the Encoder Dialog), enter the maximum lead angle and the speed at which the "timing advance" peaks so the STAC6 knows when it is producing maximum torque. A typical motor produces maximum torque at low speeds with a 90° lead angle. To produce maximum torque at higher speeds, the lead angle must be increased because of inductance and back emf. Above a certain speed, further increases in lead angle produce no benefit, and the STAC6 must be told when to stop advancing the timing. In the example below, the lead angle is

increased steadily from 90° at low speeds to 135° at 40 rev/sec, so the entered value is "135 degrees at 40 rev/sec", as shown. If Stall Prevention is not being used, these values are not needed by the STAC6.

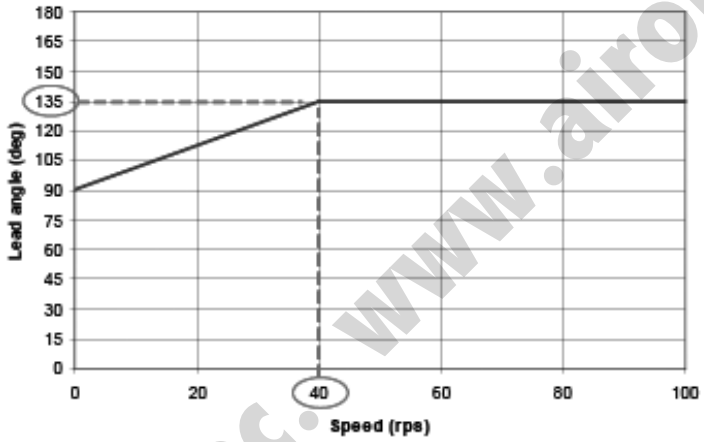


Figure 3.4: Lead Angle Graph

Inputs and Outputs

FAULT OUTPUT

The drive features a Fault Output that will be triggered if there is a fault condition. This may be a fault within the drive or it may indicate a system fault. Not all faults will disable the drive. If running the STAC6 Configurator while an alarm condition develops, a dialog box will display providing details of the fault. Alarms and faults are also displayed by a pattern of red and green flashes on the drive's front panel LED.

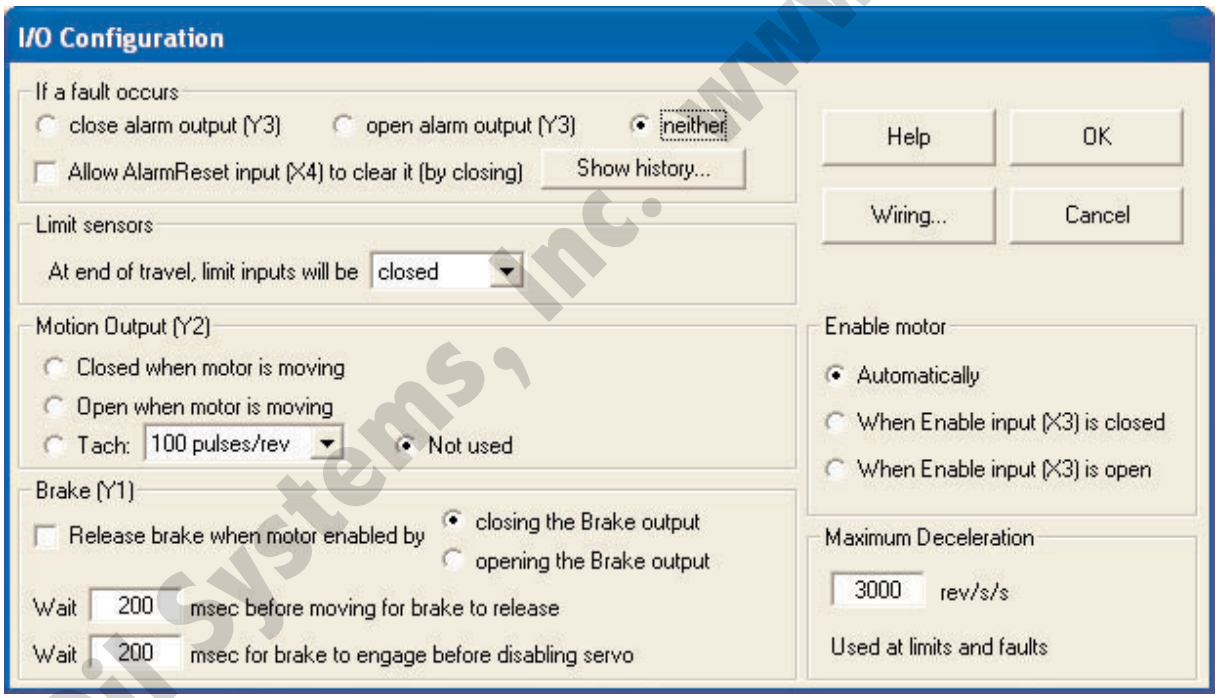


Figure 3.5: I/O Dialog

ALARM RESET INPUT

The Alarm Reset input is used to clear the alarm. This will clear the Fault Output but will not reset the drive unless the other box in the Alarm dialog box is checked. If this box is not checked, reset the

drive by cycling the power. This is important as an alarm condition may indicate a fault on the drive or it may indicate a error on your machine or system. Resetting the drive at this point will make the drive able to respond to any command signal present and could result in damage to your machine or possibly injury.

BRAKE OUTPUT

A brake output is used when a motor is fitted with a fail safe holding brake. These brakes are normally used to hold the load in position when the motor is turned off, and are especially useful when the motor must hold a load against gravity. Most brakes are fail safe, requiring a voltage to hold the brake in the "released" position, allowing the motor to move.

The brake output can be configured to open or closed on motor enable. Care should be made when selecting this option to prevent damage to your system.

The Brake Output has two time delay settings. The "release delay" is the time delay between the brake being released and the drive being available for moves. If a move is attempted immediately after the drive is enabled this could create a time lag in the system as the motor will not respond until after the brake release period.

The "brake engage" delay controls the time period between the brake engaging and the drive disabling. This will ensure that the brake is fully engaged before the load is no longer being held in position by the motor.

LIMIT SWITCH INPUTS

The STAC6 has two inputs that can be configured as end of travel limit switches. These are useful for linear applications such as actuators.

The Limit Sensors dialog box is used to tell the drive whether input switches or sensors are Open or Closed when activated. Select the "Not Used" option when limit sensors are not present. SCL users can configure these limit sensors to be used as programmable inputs.

What happens when a limit switch is activated will depend on the programming mode and the commands being used. Please refer to the programming manual for details of Limit Switch Input errors.

MOTION OUTPUT

Motion Output Y2 is used to tell another piece of electronics what the drive is doing in velocity mode. Signalling motor motion can be done in one of two ways: Y2 can be closed when the motor is moving and open when it is stopped, or Y2 can be open when moving and closed when stopped. For tachometer output (a signal proportional to the motor speed), Y2 can emit pulses as the motor turns. The default setting provides 100 square wave pulses per revolution, assuming a 1.8° motor is used. Otherwise, factor 2 times the motor electrical frequency.

Additional settings or 200, 400, 800 and 1600 pulses/rev are available for drives with DSP firmware version 1.02 or later. However, the signal may not be accurate at higher speeds. Refer to the table below for details.

tach ppr	accurate at speeds
100	0 - 50 rev/sec
200	0 - 25
400	0 - 12.5
800	0 - 6.25
1600	0 - 3.125

Note: Signal integrity is best with an 80 mA load (use 300 ohms at 24V, 150 ohms at 12V or 62 ohms at 5V.)

MOTOR ENABLE INPUT

The Motor Enable Input is used to turn the power stage of the drive on and off. This means the drive can be powered on, but the motor will not be active.

Status Monitor

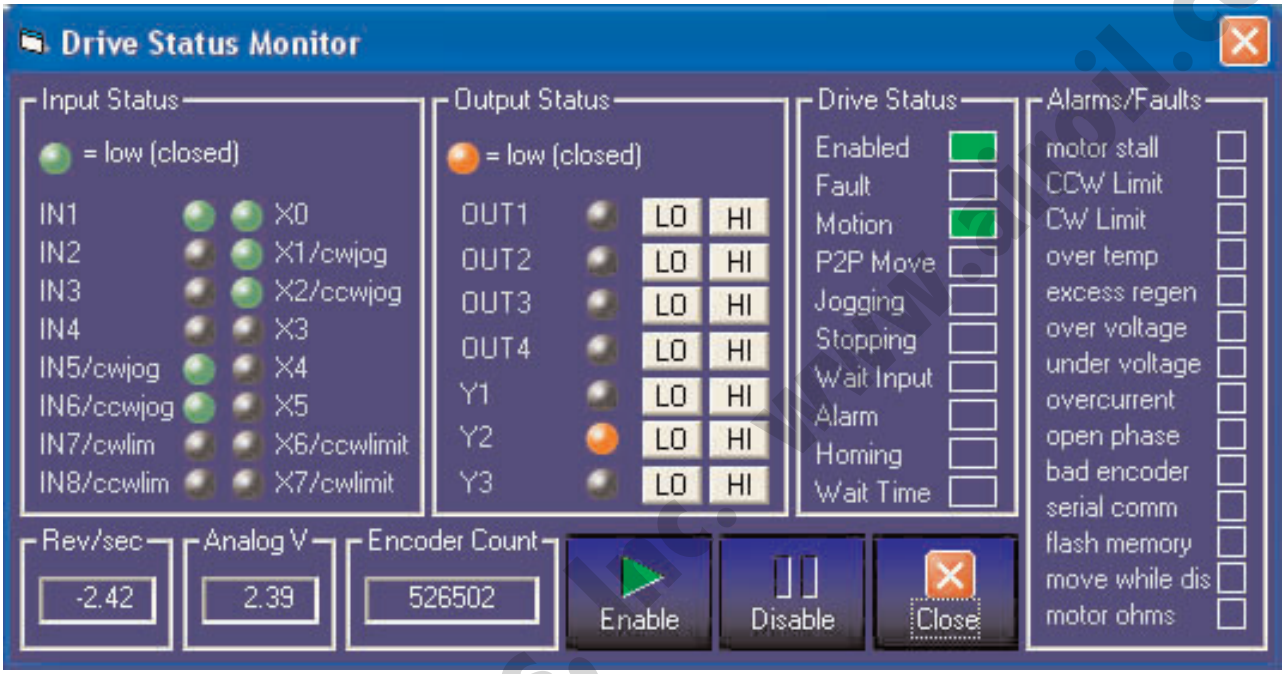


Figure 3.6: Status Monitor

The status monitor, accessed from the Drive menu, displays real time drive status including:

- State (open or closed) of all inputs
- State of outputs (click the HI/LO buttons to force an output)
- Motor speed
- Voltage at the analog input
- Encoder count (if you're using the optional encoder)
- Alarms or faults
- Status flags (enabled, motion, jogging, etc.)

The motor can be enabled or disabled from the Status Monitor by clicking the buttons at the bottom of the display.

STANDARD ACCESSORIES & OPTIONS 4

Standard Accessories

BREAKOUT BOX FOR IN/OUT CONNECTORS

- Breakout Board-1, for IN/OUT 1, includes male cable with D S [STAC6-S] and S I [STAC6-Si]
- Breakout Board-2, for IN/OUT 2, includes female cable with S I [STAC6-Si] only.

Available Options from Other Manufacturers

CONNECTORS

- **Screw Terminal Connectors** mate directly to the IN/OUT connectors on the front panel of the drive:

  Phoenix Contact P/N 2761619 (for IN/OUT 2) and 2761622 (for IN/OUT 1). This connector is not available from Tolomatic. You must purchase it from a Phoenix distributor.

CABLES AND SURGE PROTECTORS

- **Mating Cable for IN/OUT connectors** with "flying leads"

  Black Box P/N: BC00702. This cable is not available from Tolomatic. You must purchase it from Black Box. Useful for custom wired applications, this shielded cable has a DB-25 connector on each end. Cut it in half it will provide a 3 foot "DB-25 to flying lead cables" for both IN/OUT 1 and IN/OUT 2. Reference the cable color chart from Black Box's web site for easy wiring.

- **Surge Protector with Line Filter:**

  Leviton 51010-WM

HUB [SiNET™ HUB 444] Multi-Axis Motion Hub with I/O

Figure 4.1: HUB [SiNET™ HUB 444]

FEATURES

- Can be programmed to control an entire multi-axis motion control system using SiNet Hub Programmer™ software (included).
- Acts as a router, allowing a host computer or PLC to control one to four drives and the on-board I/O using Si™ Command Language (SCL).
- Four built-in programmable inputs, optically isolated, 5-24 VDC.
- Four built-in programmable outputs, optically isolated, 24V 100mA max load.
- HUB [SiNET™ HUB 444] programs and host computers also have access to the I/O in each drive, typically 8 inputs and 3 outputs per drive.
- Screw terminal connectors for easy I/O wiring.
- RJ11 "telephone-style" drive and PC for easy, reliable connections.
- HUB [SiNET™ HUB 444] is powered by drive #1. No external power supply required.
- Controls and powers optional MMI (operator terminal).
- Optional DIN rail mounting kit for easy installation.

COMPATIBLE INDEXER & DRIVES

- All units have 8 or more programmable inputs and 3 or more programmable outputs or more.
- Si5580: runs on 120/240VAC, 80V bus, 5.5A/phase, 2000 - 50800 steps/rev.
- Si3540: runs on 120/240VAC, 40V bus, 3.5A/phase, 2000 - 50800 steps/rev.
- 7080i: runs on 24 - 80 VDC, 7A/phase, 2000 - 50800 steps/rev.
- 3540i: runs on 12 - 42 VDC, 3.5A/phase, 2000 - 50800 steps/rev.
- 1240i: runs on 12 - 42 VDC, 1.2A/phase, 2000 - 50800 steps/rev.
- Si-100: indexer only, runs on 120/240VAC, provides industry standard step and direction signals to a wide range of step motor and servo motor drives.

GETTING STARTED

The SiNet Hub Programmer™ can be used two different ways.

Stored Program Mode
Install the SiNet Hub Programmer™ software on your PC, and easily point and click to complete a program. Once the program has been prepared and tested, it stays inside the hub and runs without the PC. The program not only controls up to 4 motion control axes, it can also interact with an operator using our Man Machine Interface (MMI). The MMI lets the operator make decisions, choose operations from a menu, enter part counts, move distances, speeds, and visually positions the load.

The SiNet Hub Programmer™ software saves time because it's easy to learn and use. It also eliminates common problems associated with the set up and programming of a system.

Using the SiNet Hub Programmer™ software is recommended before considering Router Mode.

To use your HUB [SiNET™ HUB 444] in Stored Program Mode, you will need:

1.) At least one Si™ step motor or servo motor drive.
2.) A motor for each drive.
3.) A small flat blade screwdriver for tightening the connectors - a screwdriver suitable for this purpose is included with your drive.
4.) A 5-24 volt DC power supply may be required to use the isolated I/O.
5.) A Pentium or better PC running Windows 95, 98, 2000, ME, XP or NT with an unused 9 pin serial port. The SiNet Hub Programmer™ software does not run with Windows 3.1.
6.) A PC serial interface cable (included with the Si™ indexer/drive).
7.) A modular telephone line cord for each indexer/drive (the hub comes with one 7 foot cable, and each drive includes a 7 foot cord. Longer cords can be obtained anywhere telephone cords are sold, such as your local supermarket, discount store or Radio Shack).

Router Mode

Router Mode is for systems where your own software will be used to control multiple indexer-drives. The Hub routes commands to individual drives based on address characters that your software sends along with the commands. It also routes messages from the drives back to the host PC or PLC. In Router Mode, the indexer-drives are commanded and queried using SiNet Command Language (SCL). Router Mode is the most versatile way to use the hub, but also the most difficult because a highly skilled programmer must write your host software.

To use the HUB [SiNET™ HUB 444] in Router Mode, you will need:

1.) At least one Si™ step motor or servo motor drive.
2.) A motor for each drive.
3.) A small flat blade screwdriver for tightening the connectors - a screwdriver suitable for this purpose is included with your drive.
4.) A 5-24 volt DC power supply may be required to use the isolated I/O.
5.) A PC running Windows 95, 98, 2000, ME, NT or XP with an unused 9 pin serial port.
6.) A PC serial interface cable (it comes with your Si™ indexer/drive).
7.) A modular telephone line cord for each indexer/drive (the hub comes with one 7 foot cable, and each drive includes a 7 foot cord. Longer cords can be obtained anywhere telephone cords are sold, such as your local supermarket, discount store or Radio Shack.
8.) Customized software to command and query the indexer/drives using Si™ Command Language (SCL). A highly skilled computer programmer working with a language system like C, Visual Basic or Labview is required.

The sketch below identifies some of the features of the HUB [SiNET™ HUB 444] .

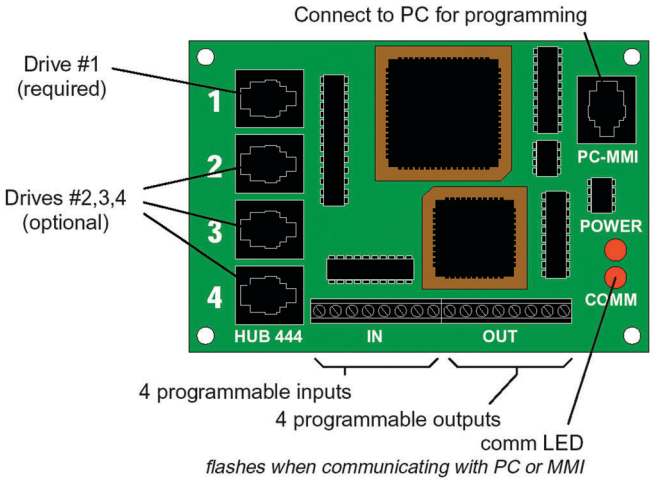


Figure 4.2: HUB [SiNET™ HUB 444] Features

CONNECTING THE HUB [SiNET™ HUB 444]

All connections between the PC, the hub and the Si™ drives are made using four wire cables with RJ11 connectors. These are the same cords used to connect a telephone or modem to the wall jack. A small black "modular adapter" that allows the RJ11 cable to connect to the serial port on your PC is also required. A modular adapter is included with each Si™ drive.

Longer cables can be used but do not exceed 50 feet.

Note: never connect the HUB [SiNET™ HUB 444] to a telephone outlet or to the modem port of your PC.

Note: if making your own cables, make sure that the ends are terminated just like a telephone cord, as shown below. Not following this procedure can seriously damage the hub, the drives, or your PC. If in doubt, purchased cables are highly recommended.

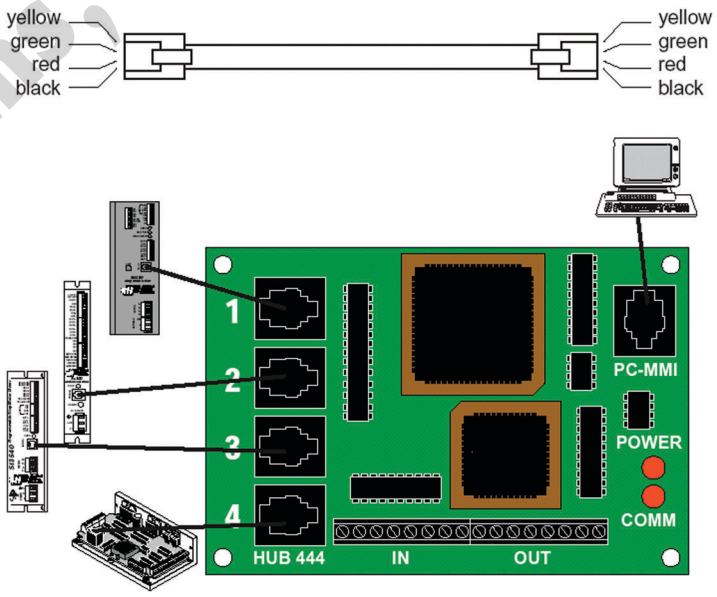


Figure 4.3: Connecting the HUB [SiNET™ HUB 444]

PROGRAMMING - ROUTER MODE

When operated in router mode, the HUB [SiNET™ HUB 444] is a motion control network router. It transfers commands from your PC's serial port to individual Si™ drives (up to 4), and processes responses from the drives.

In router mode, the drives are commanded using Si™ Command Language (SCL).

The Si™ Command Language is explained in the latest copy of the SCL Manual, located on the CD shipped with the drive. Use one of the cables that comes with the drives to connect the Hub to your PC. Ordinary telephone cables are used to connect the hub to the drives. The hub operates at 9600 baud, 8 data bits, one stop bit, no parity. There is no hardware handshaking.

The HUB [SiNET™ HUB 444] requires no power supply. It gets the power it needs from drive #1, so **make sure a drive is connected to port #1**. Power can be applied to all the drives at the same time. However, drives can also be powered up "sequentially" to balance the load on your power circuit. **If all the drives are not powered up together, make sure power is applied to drive #1 first. The remaining drives must receive power within 1/2 second**.

The Hub has two status LEDs marked COMM and POWER. If a powered drive is connected to port #1, then the POWER LED on the Hub should light up. The COMM LED will flash each time a command is sent from the PC to the Hub. The SCL Setup Utility (shipped with the hub) can be used to test the Hub, and get familiar with the SCL commands. **To use the hub in router mode, set the "power up mode" to "router only."** The SCL Setup Utility allows you to control the power up mode. Simply connect the hub to the PC, open the SCL Setup Utility, and apply power to the hub. A "Hub Power Up Mode..." button will appear. Click on it.

The addressing scheme is simple. To send a "Feed to Length" command to the drive connected to port #1, send the hub the ASCII string "1FL" followed by a carriage return (ASCII 13). If you omit the

address character, the command is “global” and will be sent to all drives. That is useful is when sending the same parameter (accel rate, for example) to all the drives.

When asking a drive for status information, the hub will append an address character to the drive’s response. For example, sending “4RS” to the hub will result in the hub sending the host “4R” (assuming the drive is “ready.” If it’s moving, a “4M” response will display. This is helpful when sending a global status request, since all drives will respond at the same time.

PROGRAMMING - STORED PROGRAM MODE

In this mode, a multi-axis motion control program is stored inside the hub, and the hub then operates without the PC. The PC is used to develop and test programs with the aid of the SiNet Hub Programmer™ software.

Please refer to the SiNet Hub Programmer™ Software Manual when installing the software and developing programs.

ABOUT THE PIT

When creating a system where machine operators can interact with a display and keypad, the MMI can be used in conjunction with HUB Programmer software.

The PIT connects to the same port as the PC used to develop and test programs. A "MMI Emulator" is included in the Hub Programmer software to eliminate cable swapping between the PC and interface when testing. When running a program from the PC a PIT related instruction executes and a "virtual MMI"will appear on the computer screen demonstrating all the features.

CABLE ROUTING

The HUB [SiNET™ HUB 444] makes it easy to create multi-axis distributed systems which require both sensitive network communication cables and high power cables for each remote axis. These two classes of cables should not be run together in a common conduit or raceway.

PROGRAMMABLE INPUTS

The HUB [SiNET™ HUB 444] provides four digital inputs for external equipment such as sensors, switches and other electronics. These inputs are optically isolated, and allow a wide range of input voltages to be used. Each input provides the option of using sinking or sourcing signals.

A schematic diagram of the input circuit is shown below.

LEDs on the input side of the optoisolators require a current of 5-24 volts DC. Most CMOS and open collector TTL devices are directly compatible with this drive, as are typical PLC and proximity sensor outputs.

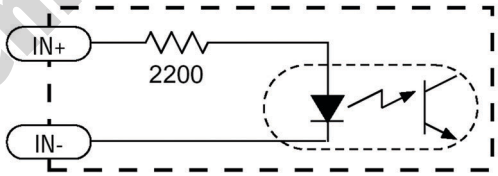


Figure 4.4: Programmable Input Circuit Schematic Diagram

SINKING CIRCUITS (NPN)

If the output devices prefer to sink current, then connect the "+" terminals to the positive power supply, and the "-" terminals to the signals. When using a TTL circuit to drive the hub inputs, connect the "+" terminals to the 5 volt bus. No ground connection is needed. If a PLC or proximity sensor is used, a power supply is required.

SOURCING CIRCUITS (PNP)

If the output devices can only source current (some PLC outputs are this way), connect the "-" terminals to the ground of the DC power supply that powers the output circuits. Then connect the signals to the "+" terminals.

Note: We refer to an input as being ON or CLOSED when current is flowing through the input. A signal is OFF or OPEN when no current is flowing. An input is OPEN when the "+" and "-" input terminals are at the same voltage, or when the input is left unconnected.

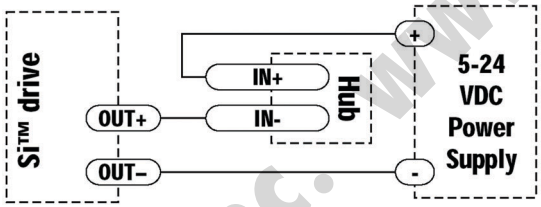


Figure 4.5: Connecting an Si Drive

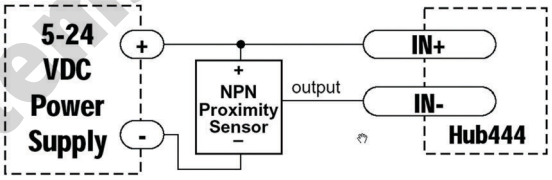


Figure 4.6: Connecting an NPN Type Prox. Sensor

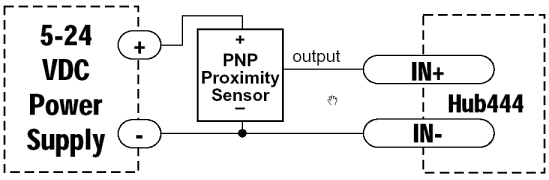


Figure 4.7: Connecting a PNP Type Prox. Sensor

PROGRAMMABLE OUTPUTS

The HUB [SiNET™ HUB 444] provides four programmable outputs that can be used to drive LEDs, relays and the inputs of other electronic devices like PLCs and counters. The "+" (collector) and "-" (emitter) terminals of each transistor are available at the connector. This allows configuration of each output for current sourcing or sinking. Diagrams of each type of connection are shown below.

Do not connect the outputs to more than 30VDC. The current through each output terminal must not exceed 100 mA.

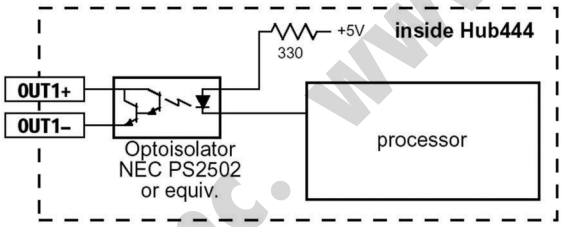


Figure 4.8: Output Circuit Schematic Diagram

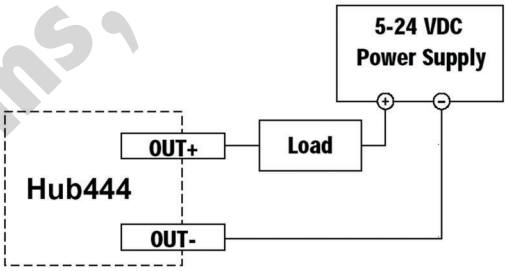


Figure 4.9: Sinking Output

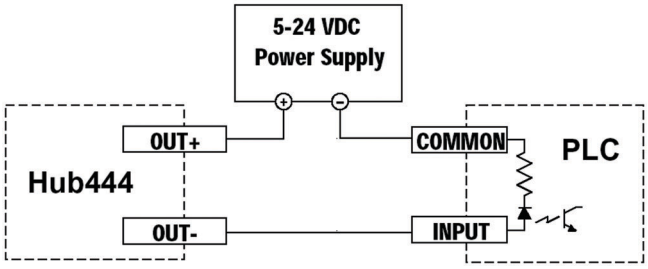


Figure 4.10: Sourcing Output

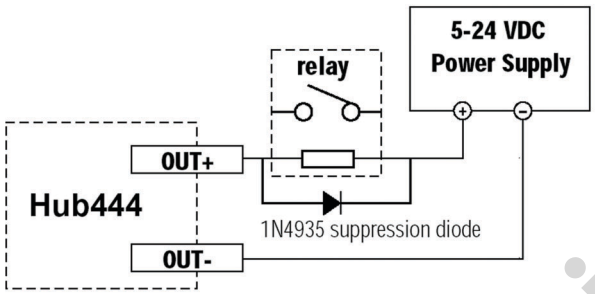


Figure 4.11: Driving a Relay

MECHANICAL OUTLINE

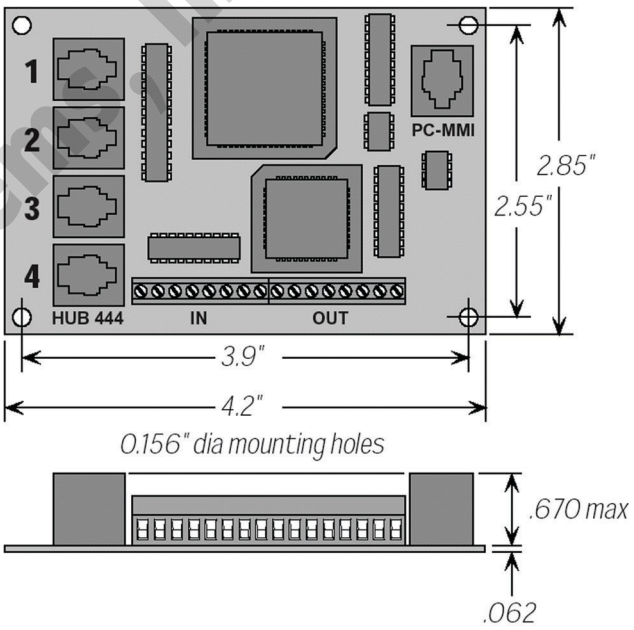


Figure 4.12: Mechanical Outline

TECHNICAL SPECIFICATIONS

Power Runs on 5 VDC, 60 mA.
Power is provided by Si™ indexer-drive on Port 1.
Also provides up to 40 mA for MMI via PC/MMI port.

Communication Ports 1 - 4, MMI, PC in router mode:
RS232, 9600 bps, 8 data bits, one stop bit, no parity

PC when running SiNet Hub Programmer software:
19200 bps

Max cable length, any port: 50 feet

Connectors I/O: European style screw terminal blocks
Wire size: AWG 12 - 28
Drives & PC/MMI: RJ11

Physical Printed Circuit Board: 4.2 x 2.85 inches (107 x 72 mm)
Weights: 2.7 ounces (75 grams).
LED Displays: Two Red Displays
Operating Temp Range: 0 - 70° C
Options: DIN rail mounting kit (DMK-1)

Inputs Optically isolated, differential 5-24V logic.
2200 ohms internal resistance.
1.5 mA minimum “on” current.

Outputs Optically isolated, darlington photo transistors:
30V, 100 mA max

PIN ASSIGNMENTS

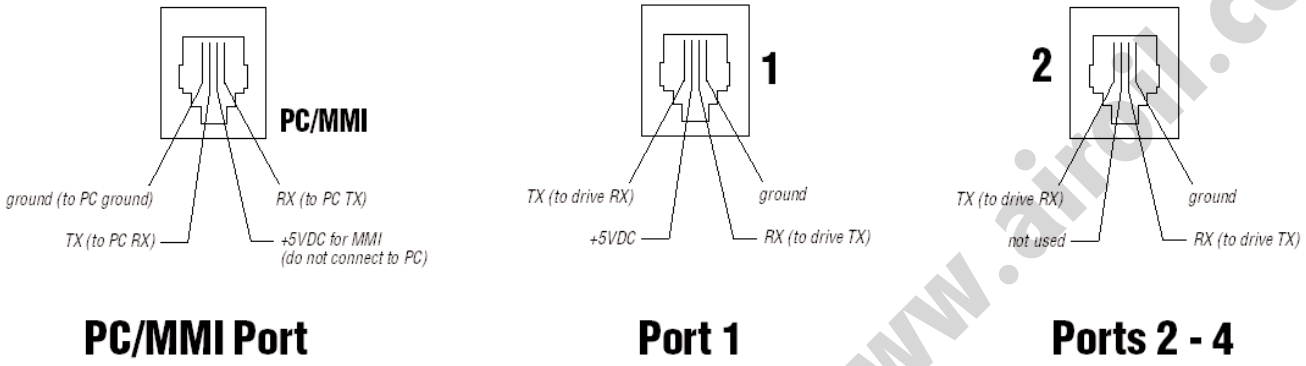


Figure 4.13: Pin Assignments

Contacting Tolomatic

5

Our technical support staff is ready to help you with any questions you may have regarding Tolomatic products.

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P: 763-478-8000
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1/07 LC

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