

STAC6

Hardware Manual

STAC6-Q-H



920-0109 Rev A
7/12/2016



Sold & Serviced By:

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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, you should follow all applicable local and national codes that regulate the installation and operation of your equipment. These codes vary from area to area and it is your 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.
- 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.

Over-Current Protection

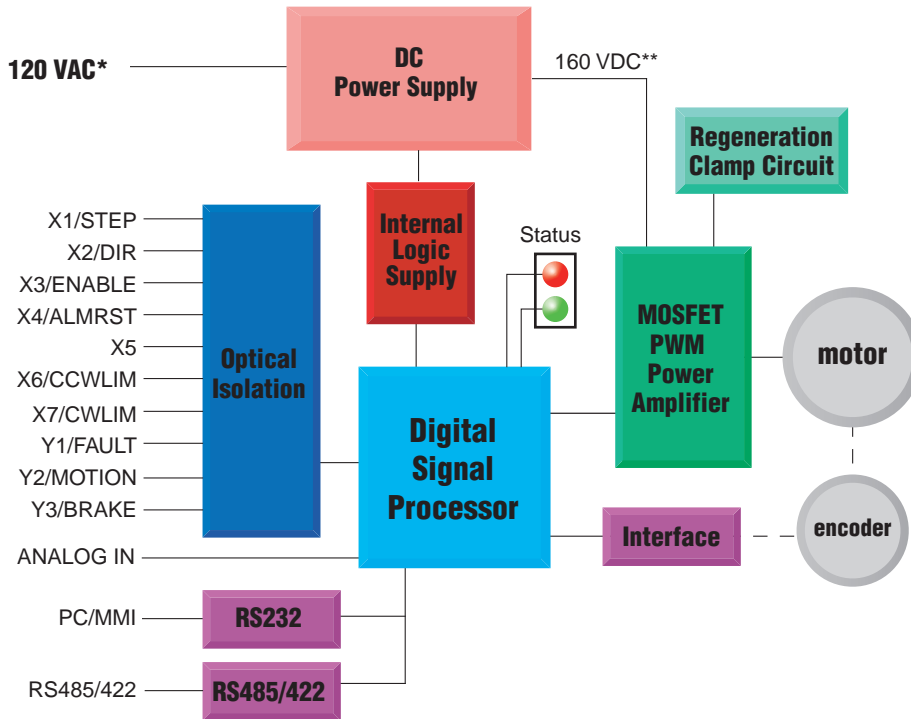
The STAC6 has hardware over-current detection circuits that protect the drive against “phase to ground” and “phase to phase” motor shorts. These circuits directly disable the amplifier in a rapid fashion to prevent damage to the driver circuitry.

Typically, the over-current circuitry will react to an over-current condition in 3 to 5 micro-seconds. For a short occurring in a motor, the motor leads provide enough resistance and inductance to keep the peak current from exceeding the peak rating of the power transistors during this time period. The recommended motors for the STAC6 all include 10 foot cables.

In essence the motor/cable system is a part of the over-current circuitry. If the drive is directly shorted with a very short wire, this condition may cause current conditions that exceed the peak current rating of our power transistors and therefore could weaken or cause failure in the drive power devices.

Repetitive short circuits also risk damage to the drive. If a short circuit fault occurs, please power off the drive and investigate carefully before restoring power.

Block Diagram - STAC6-Q-H



Motion Control Options

STAC6-H Control Options

- Pulse & Direction, A/B Quadrature, CW/CCW Pulse.
- Velocity (Oscillator) Mode.
- Host command execution of SCL commands for control from a host PC or PLC using RS-232 or RS-485 serial communication.
- Built-in Q controller
- Comprehensive single-axis programming language.
- Powerful feature set.
- Complex motion and machine control.
- Math functions.
- Register manipulation.
- Multi-tasking.
- Host interrogation/interface while executing internal programs.

Getting Started

This manual describes the use of STAC6 series of step motor drives. What you need to know and what you must have depends on the drive model. For all models, you'll need the following:

- 120VAC single phase power.
- A compatible Hazardous Location Certified step motor. Consult Factory.
- A small flat blade screwdriver for tightening the connectors (included).
- A personal computer running Microsoft Windows XP or Vista or 7 or 8, 32 or 64 bit.

If you've never used a STAC6 drive before you'll need to get familiar with the drive and the set up software before you try to deploy the system in your application. We strongly recommend the following software applications available at www.applied-motion.com:

1. Install the *ST Configurator™* and *Q Programmer™* software applications.
2. Launch the software by clicking Start...Programs...Applied Motion...
3. Connect the drive to your PC with the programming cable.
4. Connect the drive to the motor.
5. Connect the drive to the AC power.
6. Apply power to the drive.

Connecting to the PC using RS-232

- Locate your computer within 8 feet of the drive.
- Your drive was shipped with a communication cable. Plug the large end into the serial port of your PC and the small end into the PC/MMI jack on your drive. Secure the cable to the PC with the screws on the sides.

CAUTION

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

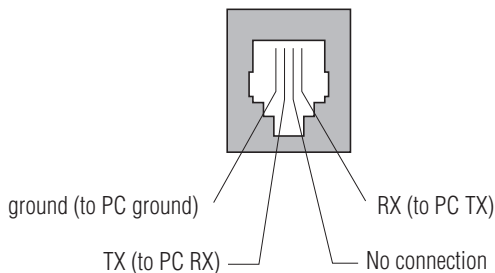
2. Drive ground and PC ground should be at the same potential. Different ground potentials for the drive and PC can result in excessive current through the ground pin of the RS-232 port, resulting in failure of the port.

If your PC does not have a serial port, you should purchase a USB-serial converter to convert one of your PC's USB ports into an RS-232 (COM) port.

For 32-bit Windows operating systems, we have had good results with the Port Authority "USB Serial DB9" Adapter from CablesToGo.com and with the SW1301 from SewellDirect.com. Some laptops also have a PCMCIA slot, in which case the SSP-100 from Sewell Direct is a good choice.

For 64-bit Windows operating systems, namely Windows Vista 64 and Windows 7 64, the Prolific-based adapters listed above do not work. For these PCs we suggest the USB-COMi-M or USB-CBL from Byterunner.com. These adapters also work the 32-bit operating systems.

For USB choices, refer to page 52.

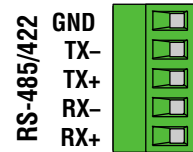


Pin Assignments of the PC/MMI Port (RJ11 connector)

Connecting to the PC using RS-485

RS-485 allows you to connect more than one drive to a single host PC, PLC, HMI or other computer. It also allows the communication cable to be long (more than 1000 feet). But the device to which you connect must have an RS-422 or RS-485 port.

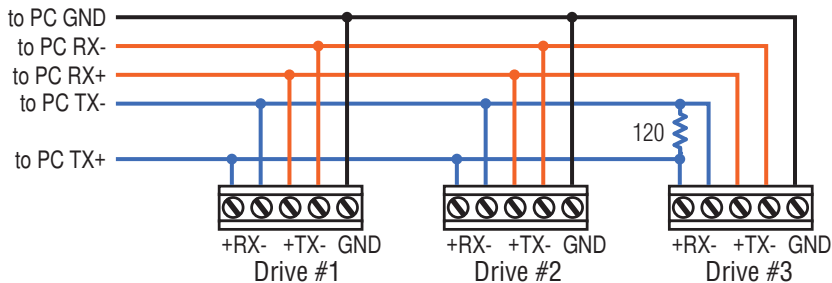
Pin diagram is shown to the right. Wiring diagrams can be found on this and the next page. We recommend the use of Category 5 cable. It is widely used for computer networks, it is inexpensive, easy to get and certified for quality and data integrity.



The STAC6 drives can be used with four wire RS-485 implementations. The connection can be point to point (i.e. one drive and one host) or a multi-drop network (one host and up to 32 drives).

Four wire systems utilize separate transmit and receive wires. One pair of wires must connect the host computer's transmit signals to each drive's RX+ and RX- terminals. Another pair connects the TX+ and TX- drive terminals to the host computer's receive signals. A logic 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 RS-485 network are powered from the same supply it is not necessary to connect the logic grounds. **You should still connect one drive's GND terminal to the host computer ground.**

Four wire systems are better than two wire types because the host can send and receive data at the same time, increasing system throughput. Furthermore, the host never needs to disable its transmitter, which simplifies your software. We recommend that a 120 ohm terminating resistor be connected between RX+ and RX- at the farthest drive from the host.



Converting USB to RS-485

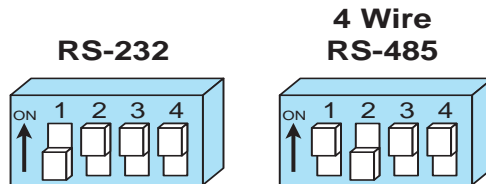
The USB-COMi-M from www.byterunner.com is an excellent choice for USB to RS-485 conversion.

For four wire RS-485, set SW1,3,4 to ON and SW2 to OFF. On the USB-COMi-M screw terminal connector:

USB-COMi-M	STAC6 Drive
pin 1	RX-
pin 2	RX+
pin 3	TX+
pin 4	TX-
pin 6	GND

USB-COMi-M Switch Settings

Note: Prolific-based USB serial adapters do not work with Vista 64 or Windows 7 64 bit operating systems.



Suggested adapters are Byterunner USB-COMi-M or Byterunner USB-COM-CBL.

Assigning Addresses in Multi-axis Systems

Before wiring the entire system, you'll need to connect each drive individually to the host computer so that a unique address can be assigned to each drive. Use the programming cable and the *STAC Configurator™* software that came with your drive for this purpose.

Connect the drive to your PC, then launch *ST Configurator™*. Finally, apply power to your drive. If you have already configured your drive, then you should click the Upload button so that the *ST Configurator™* settings match those of your drive. Click on the Motion button, then select the "SCL" operating mode. If you have a Q drive, you may want to select "Q Programming". Either way, you'll see the RS-485 Address panel appear. Just click on the address character of your choice. You can use the numerals 0..9 or the special characters ! " # \$ % & ' () * + , - . / : ; < = > ? @ . Just make sure that each drive on your network has a unique address. If you are using a 2 wire network, you may need to set the Transmit Delay, too. 10 milliseconds works on the adapters we've tried. Once you've made your choices, click Download to save the settings to your drive.

Connecting AC Power

Using the connector supplied connect to the AC supply per the diagram below. Use solid or stranded copper wire, minimum -50°C to 125°C 250V, 16 AWG - 12 AWG, 1 conductor per terminal, stripping length 7 mm, tightening torque 0.5 Nm - 0.6 Nm.

Care should always be taken when working with high voltages.

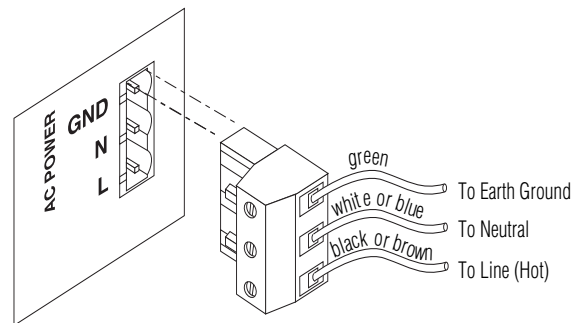
In regions where the single-phase supply is higher, an auto transformer can be used to drop the voltage to the correct level.

Fusing

The STAC6 contains an internal 8A fast acting fuse. If an external fuse is desired, we recommend a 6A fast acting fuse.

Line Filter

For applications requiring CE EMC compliance, a Corcom 6ET1 line filter is required in series with the AC input.



AC Power Plug

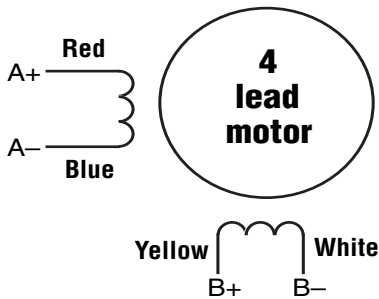
Connecting the Motor

Never connect or disconnect the motor while the power is on.

Note: it is highly recommended that you use a motor with a shielded cable with the STAC6.

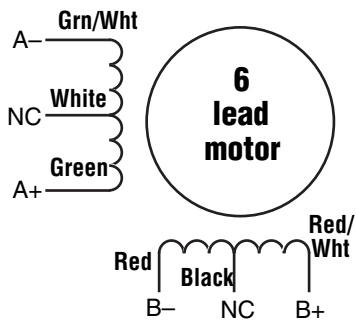
Connection diagrams are shown below for industry standard wire colors. If the wire colors of your motor do not match these diagrams, please consult the factory.

Four lead motors can only be connected one way. Please follow the sketch below.

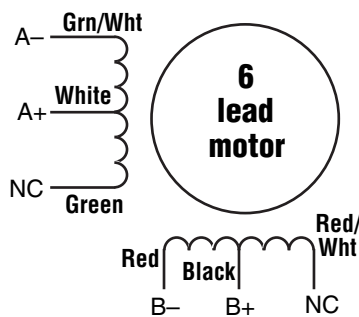


4 Leads

Six lead motors can be connected in series or center tap. In series mode, motors produce more torque at low speeds, but cannot run as fast as in the center tap configuration. In series operation, the motor should be operated at 30% less than the rated current to prevent overheating. Winding diagrams for both connection methods are shown below. NC means not connected.

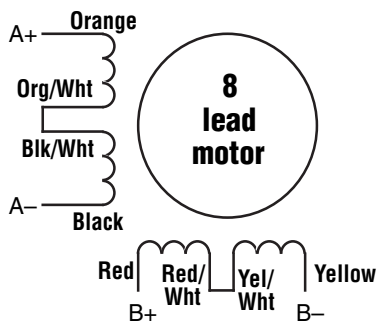


6 Leads Series Connected

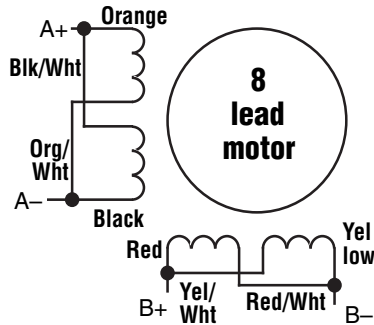


6 Leads Center Tap Connected

Eight lead motors can also be connected in two ways: series and parallel. As with six lead motors, series operation gives you less torque at high speeds, but may result in lower motor losses and less heating. In series operation, the motor should be operated at 30% less than the unipolar rated current. The wiring diagrams for eight lead motors are shown below.



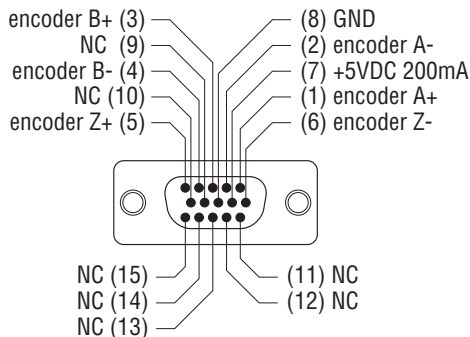
8 Leads Series Connected



8 Leads Parallel Connected

Connecting an Encoder

The motors recommended for use with STAC6 drives are available with rear-shaft mounted encoders. Note: remember to always order a double-shaft motor if you need an encoder option. The mating cables available for these encoders come with an HD-15 connector on one end that connects directly to the Encoder connector on the STAC6, and a mating connector on the other end that connects directly to the encoder. Simply connect the cable between the encoder and the drive and you're done. For applications where you might use your own encoder, you'll need to connect to the STAC6 drive's encoder connector using the pin assignments below.



If you are using an encoder with single ended outputs, shame on you. Differential connections are far less sensitive to electrical interference and life is too short to waste time deciphering the bizarre problems that can occur with a poor quality encoder. That said, single ended encoders should be connected to the A+ and B+ terminals. Leave A- and B- unconnected. They are internally biased to the proper voltage for best results. You'll also need to select the "single ended" box in the Encoder button of *ST Configurator™* or the drive will think you have a broken encoder wire. That's another good reason to use a differential encoder, the STAC6 can detect a broken wire or bad signal and alert you to the problem.

Encoder Feedback Options

The following encoder feedback options are configured and enabled using the *ST Configurator™* software.

Stall Detection continuously compares the actual motor position, as reported by the encoder, against the theoretical motor position. If the motor lag reaches 7.2 mechanical degrees behind the target position, a position fault occurs. This includes a motor at rest being driven out of position by an external force.

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 in the *ST Configurator™* software and enter the maximum torque utilization you want to allow.

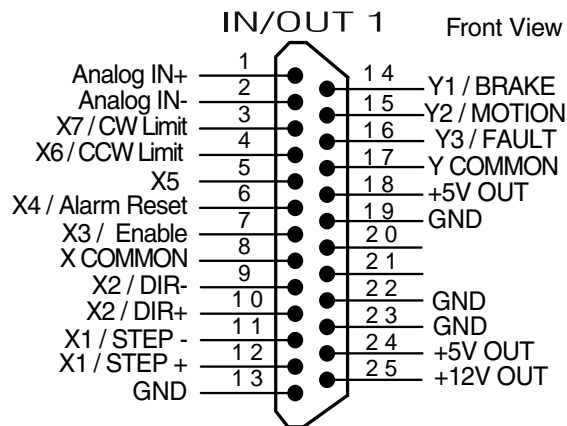
In the event that the motor cannot move at all, such as hitting a hard stop, you may want to fault the drive after a given amount of time by checking the Hard Stop box and entering a time limit.

Wiring Inputs and Outputs

The STAC6 drives come with a number of inputs and outputs for interfacing to external control hardware:

- High speed digital inputs for step & direction commands or encoder following, 5V logic. These inputs, X1/STEP and X2/DIR, are available on all models. They can also be used to connect sensors and other types of devices. Connections to these inputs can be sourcing, sinking or differential.
- Lower speed digital inputs for other signals, 12 - 24 volt logic, accepting sourcing, sinking or differential signals. All STAC6 models have 5 of these inputs on the IN/OUT1 connector.
- Analog inputs for analog speed and positioning modes, included on all drives. Can be configured for 0-10V, 0-5V, $\pm 10V$ or $\pm 5V$, with or without offset.
- Digital Outputs rated at 30V, 100mA. There are three outputs on IN/OUT1, which is present on all models.

Connector Pin Diagram



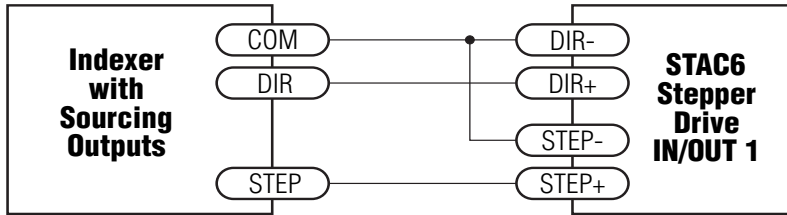
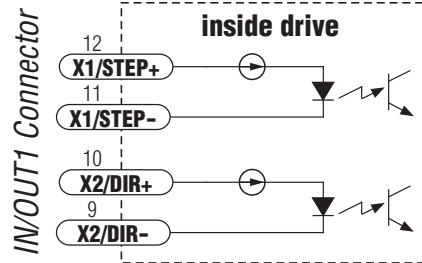
IN/OUT1 connector, this connector is present on all models

Connecting Digital Inputs on the IN/OUT1 connector

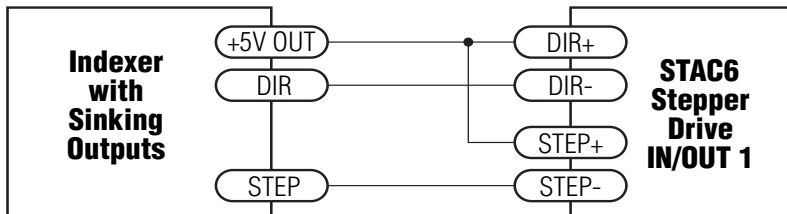
High Speed Digital Inputs

All STAC6 drives include two high speed inputs called STEP and DIR. They accept 5 volt single-ended or differential signals, up to 2 MHz. Normally these inputs connect to an external controller that provides step & direction command signals. You can also connect a master encoder to the high speed inputs for following applications. Or you can use these inputs with *Wait Input*, *If Input*, *Feed to Sensor*, *Seek Home* and other such commands.

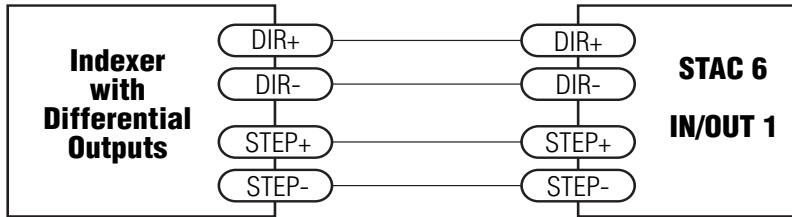
Connection diagrams follow.



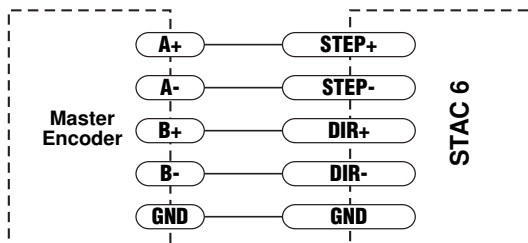
Connecting to indexer with Sourcing Outputs



Connecting to Indexer with Sinking Outputs



*Connecting to Indexer with Differential Outputs
(Many high speed indexers have differential outputs)*



*Wiring for Encoder Following
(Encoder power can be supplied from the +5V OUT terminal on IN/OUT 1 if the encoder requires no more than 100mA)*

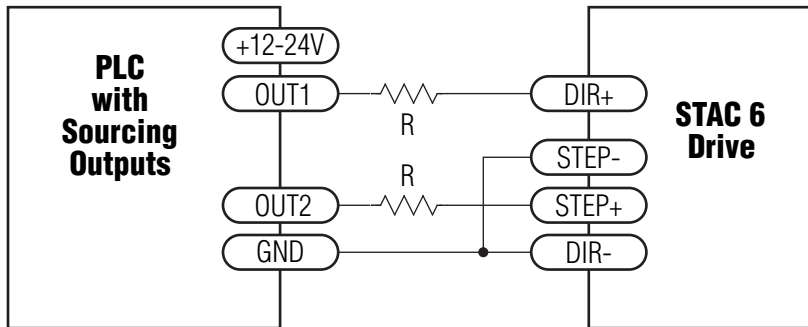
Using High Speed Inputs with 12-24 Volt Signals

Most PLCs don't use 5 volt logic. You can connect signal levels as high as 24 volts to the STEP and DIR inputs if you add external dropping resistors, as shown below.

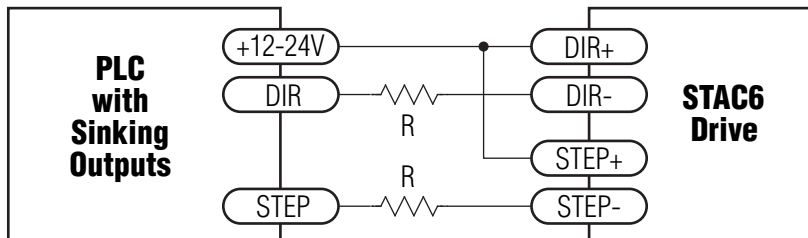
For 12 volt logic, add 820 ohm, 1/4 watt resistors

For 24 volt logic, use 2200 ohm, 1/4 watt resistors

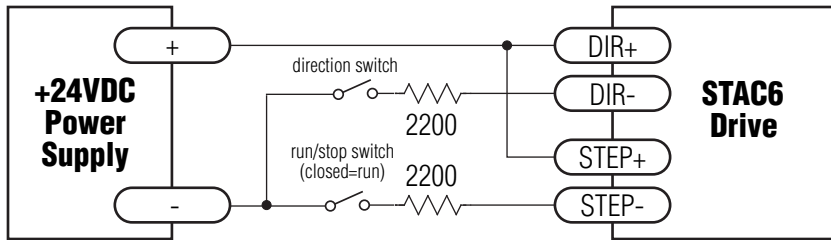
WARNING: The maximum voltage that can be applied directly to a high speed input terminal is 24 volts. Never apply high voltage AC to an input terminal.



Connecting to PLC with Sourcing (PNP) Outputs (Most PLC's use 24 volt logic)



Connecting to PLC with Sinking (NPN) Outputs (Most PLC's use 24 volt logic)



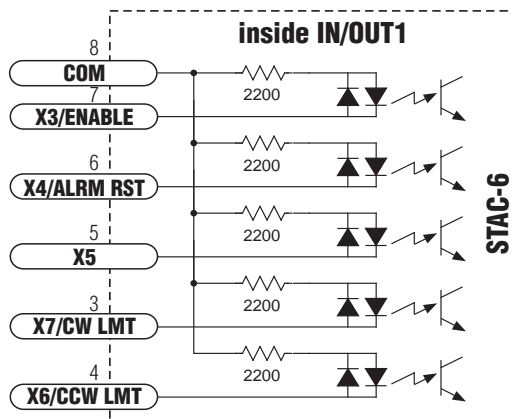
Using Mechanical Switches at 24 Volts.

Standard Digital Inputs

As we mentioned above, 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 of all drives (X3-X7) and the eight digital inputs on the IN/OUT 2 connector of -Si and -QE drives only (inputs IN1-IN8).

Single Ended Inputs

The STAC6 drives include single ended, optically isolated input circuits that can be used with sourcing or sinking signals, 12 to 24 volts. This includes inputs X3-X7 on the IN/OUT 1 connector and inputs IN1 - IN6 on the IN/OUT 2 connector. This allows connection to PLCs, sensors, relays and mechanical switches. Because the input circuits are isolated, they require a source of power. If you are connecting to a PLC, you should be able to get power from the PLC power supply. If you are using relays or mechanical switches, you will need a 12-24 V power supply. This also applies if you are connecting the inputs to the programmable outputs of another Si product from Applied Motion.

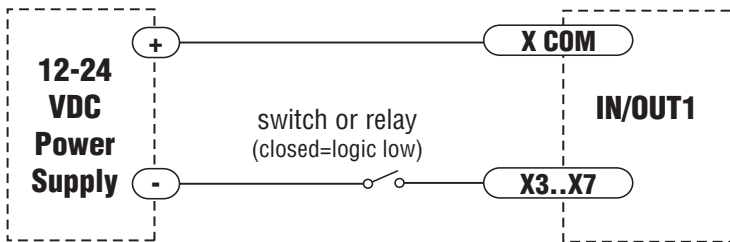


What is COM?

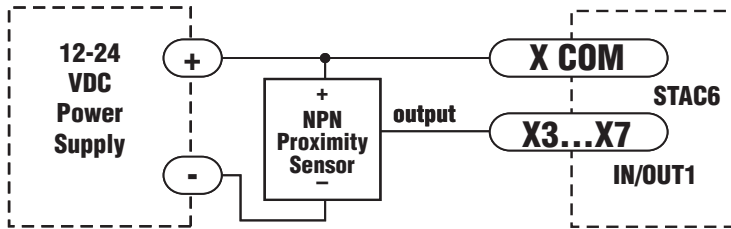
“Common” is an electronics term for an electrical connection to a common voltage. Sometimes “common” means the same thing as “ground”, but not always. In the case of the STAC6, if you are using sourcing (PNP) input signals, then you will want to connect COM to ground (power supply -). If you are using sinking (NPN) signals, then 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.

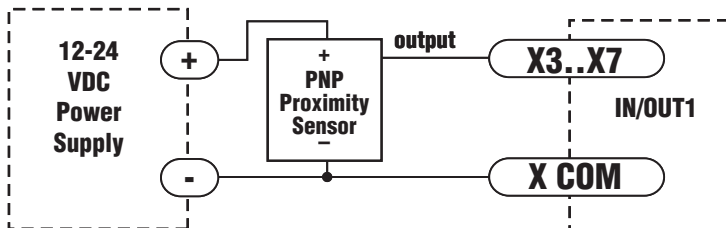
Digital Input Connection Examples



Connecting an Input to a Switch or Relay



*Connecting an NPN Type Proximity Sensor to an input
(When prox sensor activates, input goes low).*

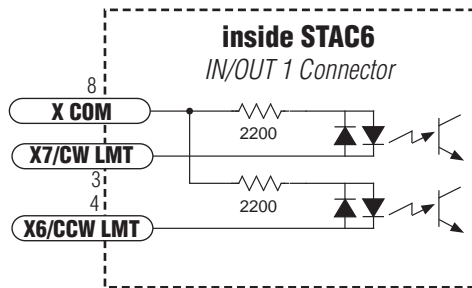


Connecting a PNP Type Proximity Sensor to an input

Connecting Limit switches to the STAC6 Drive

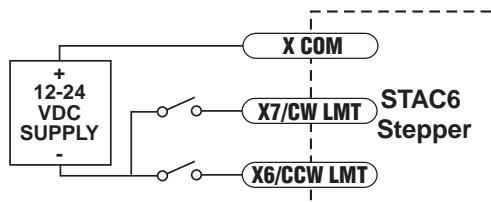
The X7/CW LIMIT and X6/CCW LIMIT inputs are used for connecting end of travel sensors. These inputs are differential, which allows you to use signals that are sinking (NPN), sourcing (PNP) or differential (line driver). By connecting switches or sensors that are triggered by the motion of the motor or load, you can force the motor to operate within certain limits. This is useful if a program or operator error could cause damage to your system by traveling too far.

The limit inputs are optically isolated. This allows you to choose a voltage for your limit circuits of 12 to 24 volts DC. This also allows you to have long wires on limit sensors that may be far from the drive with less risk of introducing noise to the drive electronics. The schematic diagram of the limit switch input circuit is shown below.



Wiring a Mechanical Limit Switch

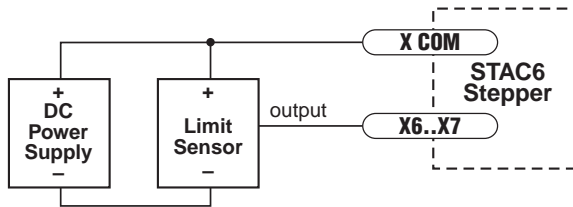
You can use normally open or normally closed limit switches. Either way, wire them as shown here.



Wiring a Limit Sensor

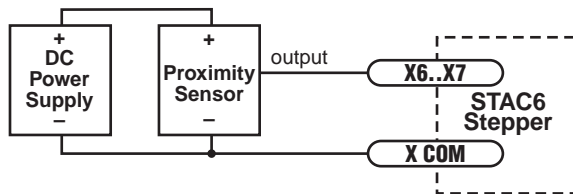
Some systems use active limit sensors that produce a voltage output rather than a switch or relay closure. These devices must be wired differently than switches.

If your sensor has an open collector output or a sinking output, wire it like this:

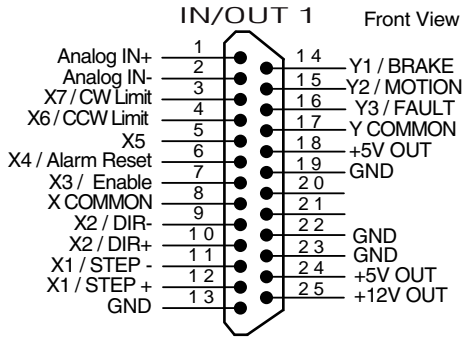


If the sensor output goes low at the limit, select the option “closed” (in the software). If the output is open, or high voltage, choose “open”.

Other sensors have sourcing outputs. That means that current can flow out of the sensor output, but not into it. In that case, wire the sensor this way:



Connecting Digital Outputs on the IN/OUT1 connector

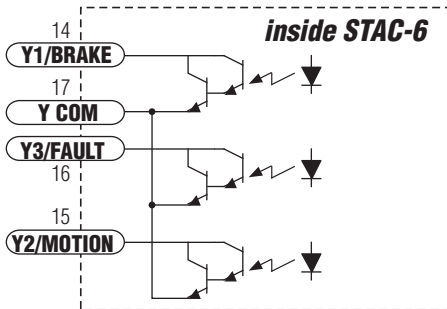


All STAC6 drives feature three digital outputs on the IN/OUT 1 connector:

Y1/Brake: controls an electric brake relay, automatically releasing and engaging as the drive requires

Y2/Motion: indicates that the drive has achieved a desired goal, such as a target position

Y3/Fault: closes when a drive fault occurs. The red and green LEDs will flash an error code.



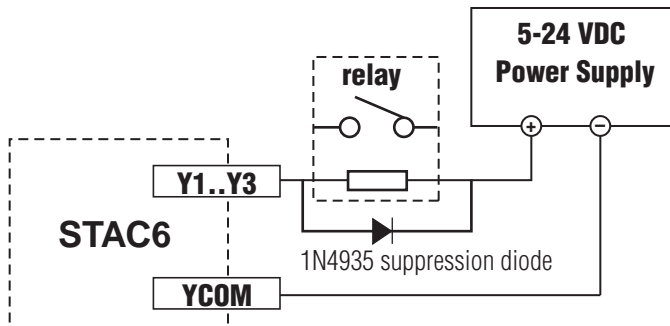
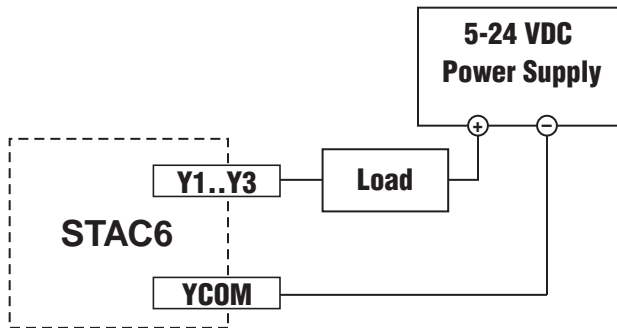
These outputs can be used to drive LEDs, relays and the inputs of other electronic devices like PLCs and counters. These outputs can only sink current.

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

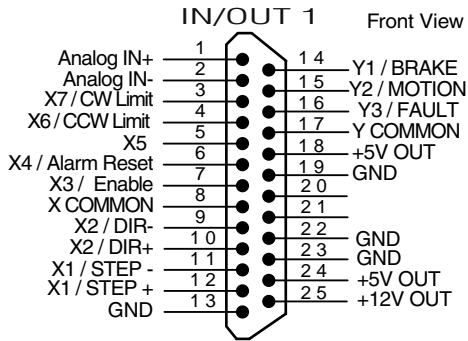
Diagrams of different connections follow.

Do not connect the outputs to more than 30VDC.

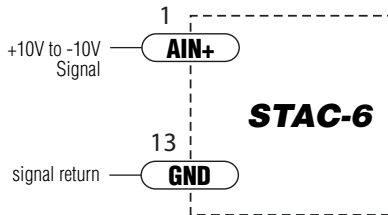
The current through each output terminal must not exceed 100 mA.



Connecting Analog Inputs on the IN/OUT1 connector



All STAC6 drives have two analog input pins that can be used separately as two, single-ended analog inputs or together as one, differential analog input. Whether separate or together, the maximum range that can be applied to these pins is +/- 10V. The analog input(s) can be used by the drive for a number of dedicated purposes for controlling the motor or can be used for general purpose analog input signals.



The analog input can be used for:

- Analog Velocity Mode
- Analog Positioning Mode.

Both of these modes use the analog input for commanding the stepper drive.

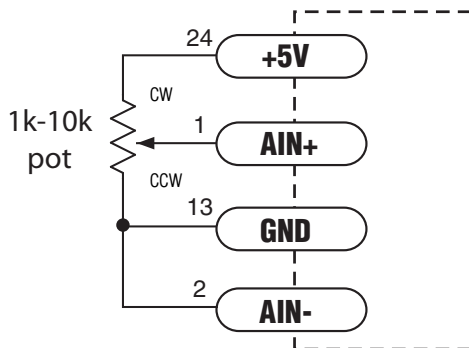
Other uses include using an analog signal to stop a move when using any of the “Feed to Sensor” type moves and waiting on an analog signal using the “Wait on Input”.

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.

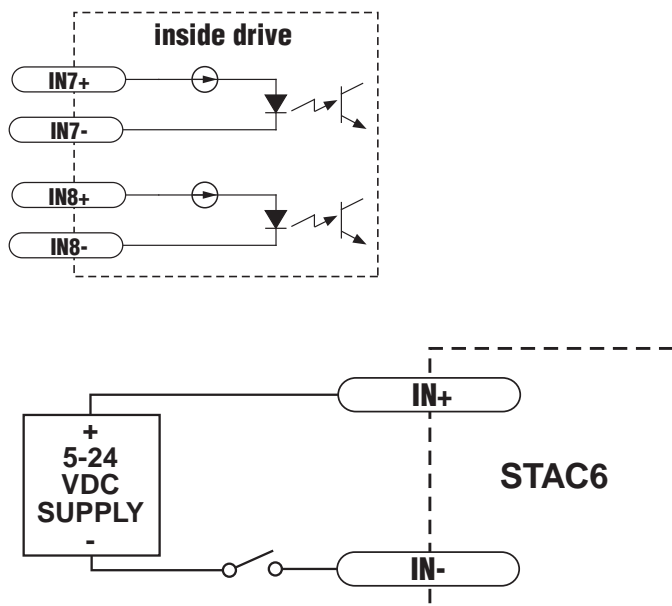
WARNING - The analog input must be used with care. It is not optically isolated and may operate improperly or could be damaged when system grounds are not compatible.

Connecting an Analog Input to a Potentiometer or Joystick

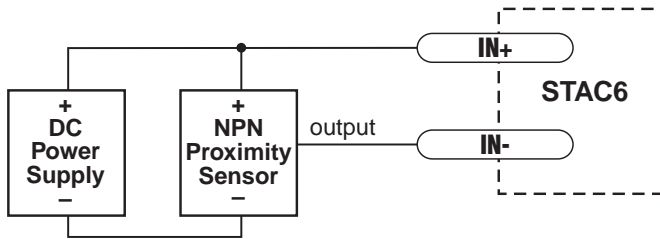


Differential Inputs

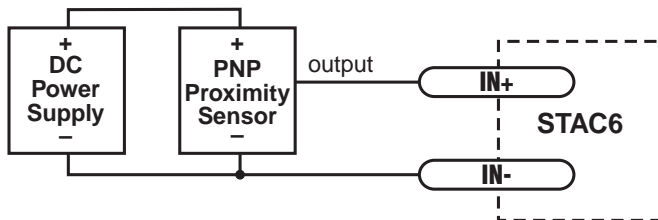
The IN/OUT2 connector also includes two differential, optically isolated input circuits that can be used with sourcing or sinking signals, 12 to 24 volts. They are labeled IN7 and IN8. These inputs allow connection to PLCs, sensors, relays and mechanical switches. Because the input circuits are isolated, they require a source of power. If you are connecting to a PLC, you should be able to get power from the PLC power supply. If you are using relays or mechanical switches, you will need a 12-24 V power supply. This also applies if you are connecting the inputs to the programmable outputs of another Si product from Applied Motion.



Connecting a Mechanical Switch to a Differential Input



Connecting an NPN Proximity Sensor to a Differential Input



Connecting a PNP Proximity Sensor to a Differential Input

Mounting the Drive

You can mount your drive on the wide or the narrow side of the chassis using #6 screws. If possible, the drive should be securely fastened to a smooth, flat metal surface that will help conduct heat away from the chassis. If this is not possible, then forced airflow from a fan may be required to prevent the drive from overheating.

Installation orientation: The STAC6-Q-H drive is ONLY to be installed standing vertical with motor connections on top).

- **Never use your drive in a space where there is no air flow or where other devices cause the surrounding air to be more than 55°C.**
- **Never put the drive where it can get wet or where metal or other electrically conductive particles can get on the circuitry.**
- **Always provide air flow around the drive. When mounting multiple STAC6 drives near each other, maintain at least one half inch of space between drives.**

Schedule of Limitations:

- **Suitability of the use of these drives with ANY stepper motor shall be determined in the end product evaluation.**
- **This drive does not provide motor overload protection. The maximum current available to the stepper motor is 4.24 A rms (6 Amps peak). Any consideration for stepper motor over-load protection should be evaluated in the end product.**
- **The equipment shall be installed in an enclosure that provides a degree of protection not less than IP54 in accordance with IEC/EN 60079-15 which is accessible only with use of a tool.**
- **These components have been judged on the basis of the creepages and clearances required in clause 6.4 of IEC/EN 60079-15 4th Edition.**
- **The sealed device tests were conducted on mechanical sealed relay based on the relay service temperature of 101.4°C.**
- **The relay service temperature of 101.4°C was determined during the temperature test on the Model STAC6-Q-H Stepper Drive at ambient temperature of 55°C.**

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 possibility cause severe damage to health or the product.

Electrical Ratings:

Input Power: 120Vac, 1 Phase, 1.67A (rms)

Output Power: 120Vdc, 1 Phase, 4.24A (rms), Continuous Duty Rating

Input/Output Signal Connections: 5/12Vdc, 10/100mA, electrically isolated

Markings:

Applied Motion Products, Inc.

404 Westridge Dr

Watsonville, CA 95076

IECEX Cert Number: IECEX UL 15.0067U

Ex nA nC IIB Gc

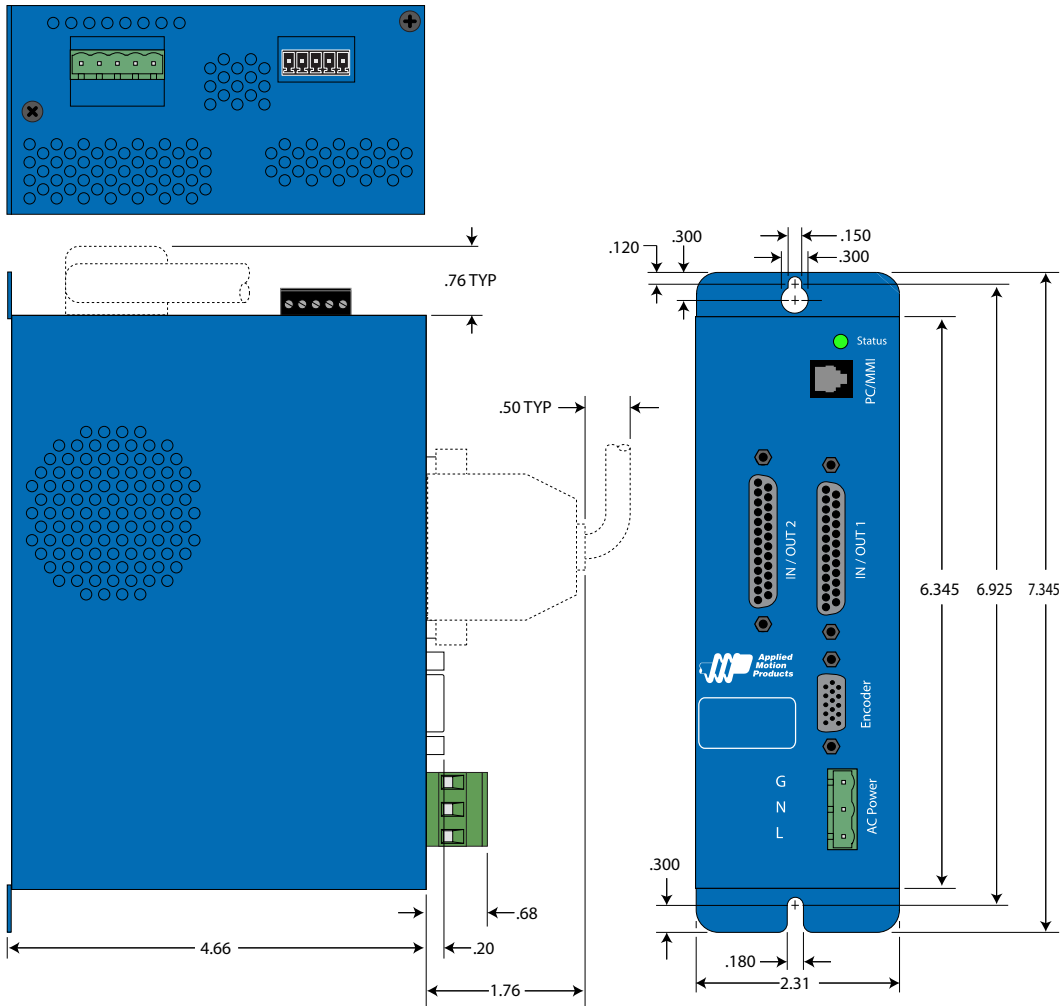
-40°C < Ta < +55°C

ATEX Cert Number: DEMKO 15 ATEX 1505U  II 3 G

USA: Class 1, Zone 2, AEx nA nC IIB; Class 1, Division 2, Groups C & D

Canada: Class 1, Zone 2, Ex nA nC IIB Gc "U"; Class 1, Division 2, Groups C & D

Mechanical Outline



Technical Specifications

POWER AMPLIFIER SECTION	
AMPLIFIER TYPE	MOSFET , Dual H-Bridge, 4 Quadrant
CURRENT CONTROL	4 state PWM at 20 Khz
OUTPUT CURRENT	STAC6 0.5– 6.0 amps in 0.01 amp increments (6A peak of sine)
POWER SUPPLY	STAC6 Line Operated Nominal 120 VAC, 50/60 Hz
AC INPUT VOLTAGE	STAC6 94–135VAC, 50/60Hz
PROTECTION	Over-voltage, under-voltage, over-temp, external output shorts (phase to-phase, phase-to-ground), internal amplifier shorts
IDLE CURRENT REDUCTION	Reduction to any integer percent of full-current after delay selectable in milliseconds.
MOTOR REGENERATION	Built in regeneration circuit - 25watts max.
INPUT POWER	120Vac, 1 Phase, 1.67A (rms)
OUTPUT POWER	120Vdc, 1 Phase, 4.24A (rms), Continuous Duty Rating
INPUT / OUTPUT SIGNAL CONNECTIONS	5/12Vdc, 10/100mA, electrically isolated

CONTROLLER SECTION	
NON-VOLATILE STORAGE	Configurations are saved in FLASH memory on board the DSP.
STEP AND DIRECTION INPUTS	Optically Isolated: 5 Volt. Minimum pulse width = 200 ns. Maximum pulse frequency = 2 MHz
RESOLUTION	Software selectable from 200 to 51200 steps/rev in increments of 2 steps/rev
ANTI RESONANCE (Electronic Damping)	Raises the system damping ratio to eliminate midrange instability and allow stable operation throughout the speed range and improves settling time.
TORQUE RIPPLE SMOOTHING	Allows for fine adjustment of phase current waveform harmonic content to reduce low-speed torque ripple in the range 0.25 – 1.5 rps.
SELF TEST AND AUTO SETUP	Checks internal & external power supply voltages, diagnoses open motor phases. Measures motor parameters and configures motor current control and anti-resonance gain settings.
MICROSTEP EMULATION	Performs low resolution stepping by synthesizing fine microsteps from coarse steps.
COMMAND SIGNAL SMOOTHING	Software configurable filtering reduces jerk and excitation of extraneous system resonances (step & direction mode only)
ENCODER OPTION	Employs encoder (hi or low resolution) to provide failsafe stall detect and perform stall prevention and position maintenance. Differential line receivers suitable for 500 kHz or greater. Minimum encoder resolution is 1000 lines.
INTERFACE	RS-232 and RS-485
AMBIENT TEMPERATURE	-40 to +55 °C (-40 to +131 °F)
HUMIDITY	90% non-condensing
COT	K1 Relay COT (Continuous Operating Temperature) is 115 °C

INPUTS AND OUTPUTS	
IN / OUT 1 connector - All Drives	
7 Inputs	
X1, X2	Optically Isolated, Differential, 5 Volt. Minimum pulse width = 250ns. Maximum pulse, frequency = 2 MHz Function: Step & Direction, Encoder Following, Sensor, Home or Branch Select
X3	Optically isolated, 12 - 24V, sourcing or sinking. Function: Motor Enable, Sensor, Home or Branch Select. X3 - X7 have shared common.
X4	Optically isolated, 12 - 24V, sourcing or sinking. Function: Alarm Reset, Sensor, Home or Branch Select. X3 - X7 have shared common.
X5	Optically isolated, 12 - 24V. Function: Function; general Purpose Input. X3 - X7 have shared common.
X6,X7	Optically isolated, 12 - 24V. Function: CW & CCW Limits, Sensor, Home or Branch Select. X3 - X7 have shared common.
3 Outputs	
Y1	Optical darlington, 30V, 100mA max, NPN/sinking, shared common with Y2 & Y3. Function: Brake or general purpose programmable
Y2	Optical darlington, 30V, 100mA max, NPN/sinking, shared common with Y1 & Y3. Function: Motion, tach or general purpose programmable
Y3	Optical darlington, 30V, 100mA max, NPN/sinking, shared common with Y1 & Y2. Function: Fault or general purpose programmable
Analog Inputs	
Software selectable:	0-5V, $\pm 5V$, 0-10V, $\pm 10V$,
RESOLUTION	12 bits (with $\pm 10V$ signal range) 11 bits (with 0-10V or $\pm 5V$ signal range) 10 bits (with 0-5V signal range)

The subject products have been certified for use in Hazardous Locations per the applicable requirements in the Standards listed in the table below:

IEC 60079-0 6th Edition, Explosive Atmospheres - Part 0: Equipment - General requirements
IEC 60079-15 4th Edition, Explosive Atmospheres - Part 15: Equipment protection by type of protection "n"
CENELEC EN 60079-0:2012+A11:2013, Explosive Atmospheres - Part 0: Equipment - General Requirements
CENELEC EN 60079-15:2010, Explosive Atmospheres - Part 15: Equipment protection by type of protection "n"
UL 60079-0 6th Edition, Explosive Atmospheres - Part 0: Equipment - General requirements
UL 60079-15 4th Edition, Explosive Atmospheres - Part 15: Equipment Protection by Type of Protection "n"
CAN/CSA C22.2 No. 60079-0:11, Explosive atmospheres - Part 0: Equipment - General Requirements
CAN/CSA C22.2 No. 60079-15:12, Electrical apparatus for explosive gas atmospheres - Part 15: Construction, test and marking of type of protection "n" electrical apparatus
ISA 12.12.01-2013, Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations
CAN/CSA C22.2 No. 213-M1987, Nonincendive Electrical Equipment for Use in Class I, Division 2 Hazardous Locations

Mating Connectors and Accessories

Mating Connector (Type)	Manufacturer and P/N	Required Wiring
Motor (5-position, screw terminal)	Phoenix Contact 1757048 (included)	solid or stranded CU, minimum -50 °C to 125 °C 250V wire, 14 AWG -12 AWG, 1 conductor per terminal, stripping length 7 mm, tightening torque 0.5 Nm - 0.6 Nm.
AC Power (3-position, screw terminal)	Phoenix Contact 1767012 (included)	solid or stranded CU, minimum -50 °C to 125 °C 250V wire, 16 AWG - 12 AWG, 1 conductor per terminal, stripping length 7 mm, tightening torque 0.5 Nm - 0.6 Nm.
RS485 Logic (3-position, screw terminal)	Phoenix Contact 1827622 (included)	solid or stranded CU, minimum -50 °C to 125 °C 250V wire, 20 AWG - 16 AWG, 1 conductor per terminal, stripping length 7 mm, tightening torque 0.2 Nm - 0.25 Nm.
IN/OUT1 (DB-25 male)	Norcomp 171-025-103L001 connector, Mouser 40-9725HS shell kit	-
IN/OUT2 (DB-25 female)	Norcomp 171-025-203L011 connector, Mouser 40-9725HS shell kit	-
Encoder (HD-15 male)	Norcomp 180-015-102-001 connector, AMP 5-748678-1 shell kit	-

Accessories

Breakout Box for DB-25 Connectors

BOB-1, includes cable, connects to IN/OUT 1

Screw Terminal Connectors that mate directly to the DB-25 connector on the front panel of the drive:

Phoenix Contact P/N [2761622](#)

This connector is not available from Applied Motion. You must purchase it from a [Phoenix distributor](#).

Mating Cable for IN/OUT2 connector with “flying leads”

Black Box P/N: BC00702

This cable is not available from Applied Motion. You must purchase it from [Black Box](#).

Useful for custom wired applications. This shielded cable has a DB-25 connector on each end. You can cut off the female end to create a 6 foot “DB-25 to flying lead cable”.

It'll be easier to wire if you get the [cable color chart from Black Box's web site](#).

Suggested adapters are Byterunner USB-COMi-M or Byterunner USB-COM-CBL or USB-COMi. (USB) Serial Adapters:

For 32-bit Windows operating systems:

Port Authority “USB Serial DB9” Adapter from [CablesToGo.com](#) (USB).

SW1301 from [SewellDirect.com](#) (USB).

[SSP-100](#) from Sewell Direct (PCMCIA)

For 64-bit and 32-bit Windows operating systems:

Byterunner USB-COM-CBL or USB-COMi. (USB)

Alarm Codes

In the event of an error, the green LED on the main board will flash one or two times, followed by a series of red flashes. The pattern repeats until the alarm is cleared.

Code	Error
● solid green	no alarm, motor disabled
●● flashing green	no alarm, motor enabled
●● 1 red, 1 green	motor stall (optional encoder only)
●●● 1 red, 2 green	move attempted while drive disabled
●●● 2 red, 1 green	ccw limit
●●●● 2 red, 2 green	cw limit
●●●●● 3 red, 1 green	drive overheating
●●●●●● 3 red, 2 green	internal voltage out of range
●●●●●●● 3 red, 3 green	blank Q segment
●●●●●●●● 4 red, 1 green	power supply overvoltage
●●●●●●●●● 4 red, 2 green	power supply undervoltage
●●●●●●●●●● 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 (optional encoder only)
●●●●●●●●●●●●●● 7 red, 1 green	serial communication error
●●●●●●●●●●●●●●● 7 red, 2 green	flash memory error
●●●●●●●●●●●●●●●● 8 red, 1 green	internal voltage out of range

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