TXM24 RS232/485

Integrated Step-Servo Motor

Hardware Manual

920-0087

Rev. D

Applied Motion Products

Contents

1 Introduction

Thank you for selecting the Applied Motion Products TXM24 Integrated Motor. The TXM line of integrated step-servo motors combines servo technology with an integrated motor to create a product with exceptional feature and broad capability. We hope our commitment to performance, quality and economy will result in a successful motion control project.

1.1 Features

- Programmable, Digital servo driver and motor in an integrated package
- Operates from a 12 to 70 volt DC power supply
- Control Modes:

  Torque Control
  - * Analog input
  - * SCL commanded

  Velocity Control
  - * Digital input Control Velocity
  - * Analog velocity
  - * SCL Commanded Velocity (Jogging)

  Position Control
  - * Digital Signal type
    - Step & Direction
    - CW & CCW pulse
    - A/B Quadrature (Encoder Following)
  - * Analog Position
  - * Serial Commanded Position

  Q Programming(Q Verision only)
  - * Stand alone operation

- Communications:

  RS-232 , RS-485 or Modbus/RTU
- 5000 line (20,000 counts/rev) encoder feedback
- Available torque:

  TXM24S/Q-3XG: Up to 2.4N•m Continuous (3.0 N•m Boost)

  TXM24S/Q-1XG: Up to 0.82N•m Continuous (1.03 N•m Boost)
- I/O:

  3 optically isolated digital inputs, with adjustable bandwidth digital noise rejection filter, 5 to 24 volts

  1 optically isolated digital output, 30V/100 mA max.

  1 analog input for speed and position control, 0 to 5 volts
- Technological advances:
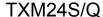
  Full servo control, Closed loop
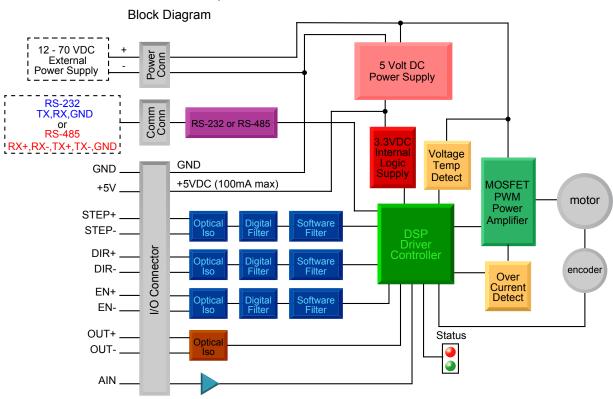
  Efficient, Accurate, Fast, Smooth

  Intelligent, Compact
- IP65 protected with three M12 connectors(RS232 version)
- IP65 protected with four M12 connectors(RS485 version)

1.2 Block Diagram

TXM24S/Q Block Diagram

I/O Configurations

STEP (5 to 24 volts)
Step
CW step
A quadrature (encoder following)
CW limit
CW jog
Start/stop (oscillator mode)
General purpose input

DIR (5 to 24 volts)
Direction
CCW step
B quadrature (encoder following)
CCW limit
CCW jog
Direction (oscillator mode)
General purpose input

EN (5 to 24 volts)
Enable
Alarm/fault reset
Speed 1/speed 2 (oscillator mode)
General purpose input

OUT (30V, 100mA)
Fault
Motion
Tach
In position
Brake
General purpose programmable

Model	Communications		
	RS-232	RS-485	Modbus/RTU
TXM24S-1AG, TXM24S-3AG	✓		
TXM24S-1RG, TXM24S-3RG		✓	
TXM24Q-1AG, TXM24Q-3AG	✓		✓
TXM24Q-1RG, TXM24Q-3AG		✓	✓

1.3 Safety Instructions

Only qualified personnel should transport, assemble, install, operate, or maintain this equipment. Properly qualified personnel are persons who are familiar with the transport, assembly, installation, operation, and maintenance of motors, and who meet the appropriate qualifications for their jobs.

To minimize the risk of potential safety problems, all applicable local and national codes regulating the installation and operation of equipment should be followed. These codes may vary from area to area and it is the responsibility of the operating personnel 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. Applied Motion Products does not guarantee the products described in this publication are suitable for a particular application, nor do they assume any responsibility for product design, installation, or operation.

- Read all available documentation before assembly and operation. Incorrect handling of the products referenced in this manual can result in injury and damage to persons and machinery. All technical information concerning the installation requirements must be strictly adhered to.

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

- This product contains electrostatically sensitive components that can be damaged by incorrect handling. Follow qualified anti-static procedures before touching the product.

- During operation keep all covers and cabinet doors shut to avoid any hazards that could possibly cause severe damage to the product or personal health.

- During operation, the product may have components that are live or have hot surfaces.

- Never plug in or unplug the Integrated Motor while the system is live. The possibility of electric arcing can cause damage.

Be alert to the potential for personal injury. Follow recommended precautions and safe operating practices emphasized with alert symbols. 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 the possible safety hazards associated with this equipment and the precautions necessary to reduce the risk of personal injury and damage to equipment. Failure to observe these precautions could result in serious bodily injury, damage to the equipment, or operational difficulty.

2 Getting Started

The following items are needed:

- a 12 - 70 volt DC power supply, see the section below entitled "Choosing a Power Supply" for help in choosing the right one
- a PC running Microsoft Windows XP, Vista, or Windows 7 or 8

2.1 Installing Software

Before utilizing the TXM24 Integrated Step-Servo Motor and Step-Servo Quick Tuner Software in an application, the following steps are necessary:

- Download and install the Step-Servo Quick Tuner software from Applied Motion Products website.
- Connect the drive to the PC using the programming cable. When using RS-485, it must be setup in a 4-Wire configuration (see "Connecting to a host using RS-485" below.)
- Connect the drive to the power supply. See instructions below.
- Launch the software by clicking Start...Programs...Applied Motion Products...Step-Servo Quick Tuner
- Apply power to the drive.
- The software will recognize the drive and display the model and firmware version. At this point, it is ready for use.

2.2 Mounting the Hardware

As with any step motor, the TXM24 must be mounted so as to provide maximum heat sinking and airflow. Keep enough space around the Integrated Motor to allow for airflow.

- Never use the drive where there is no airflow or where other devices cause the surrounding air to be more than 40°C (104°F)

2.3 Choosing a Power Supply

The main considerations when choosing a power supply are the voltage and current requirements for the application.
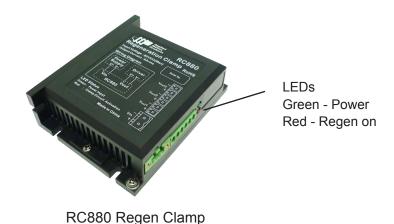
2.3.1 Voltage

The TXM24 is designed to give optimum performance between 24 and 48 Volts DC. Choosing the voltage depends on the performance needed and motor/drive heating that is acceptable and/or does not cause a drive over-temperature. Higher voltages will give higher speed performance but will cause the TXM24 to produce higher temperatures. Using power supplies with voltage outputs that are near the drive maximum may significantly reduce the operational duty-cycle.

The extended range of operation can be as low as 10 VDC minimum to as high as 75 VDC maximum. When operating below 18 VDC, the power supply input may require larger capacitance to prevent under-voltage and internal-supply alarms. Current spikes may make supply readings erratic. The supply input cannot go below 10 VDC for reliable operation. Absolute minimum power supply input is 10 VDC. If the Input supply drops below 10 VDC the low voltage alarm will be triggered. This will not fault the drive.

Absolute maximum power supply input is 75 VDC at which point an over-voltage alarm and fault will occur. When using a power supply that is regulated and is near the drive maximum voltage of 75 VDC, a voltage clamp may be required to prevent over-voltage when regeneration occurs. When using an unregulated power supply, make sure the no-load voltage of the supply does not exceed the drive's maximum input voltage of 75 VDC.

2.3.2 Regeneration Clamp

If a regulated power supply is being used, there may be a problem with regeneration. When a load decelerates rapidly from a high speed, some of the kinetic energy of the load is transferred back to the power supply, possibly tripping the over-voltage protection of a regulated power supply, causing it to shut down. This problem can be solved with the use of an Applied Motion Products RC880 Regeneration Clamp. It is recommended that an RC880 initially be installed in an application. If the "regen" LED on the RC880 never flashes, the clamp is not necessary.
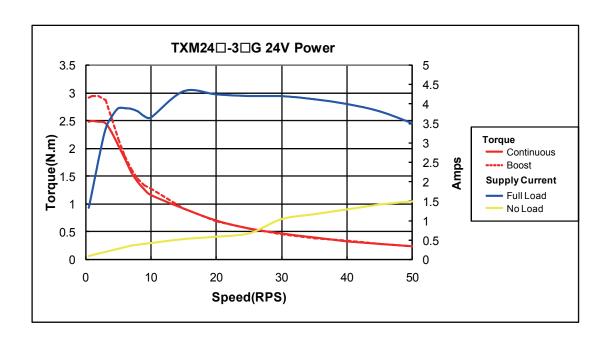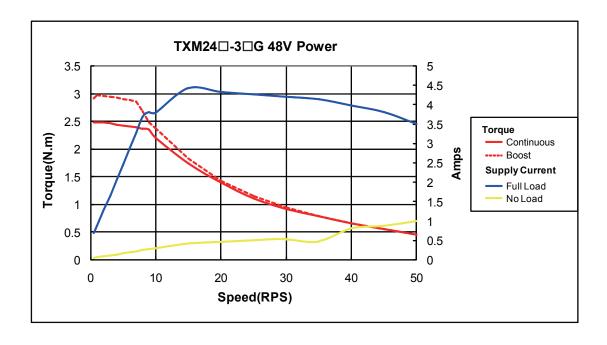

LEDs
Green - Power
Red - Regen on

RC880 Regen Clamp

Rev. D
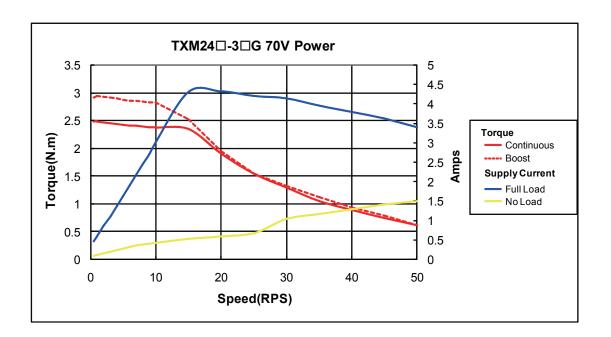920-0087

2.3.3 Current

The maximum supply currents required by the TXM24 are shown in the charts below at different power supply voltage inputs. The TXM24 power supply current is lower than the winding currents because it uses switching amplifiers to convert a high voltage and low current into lower voltage and higher current. The more the power supply voltage exceeds the motor voltage, the less current will be required from the power supply.

It is important to note that the current draw is significantly different at higher speeds depending on the torque load to the motor. Estimating how much current is necessary may require a good analysis of the load the motor will encounter.
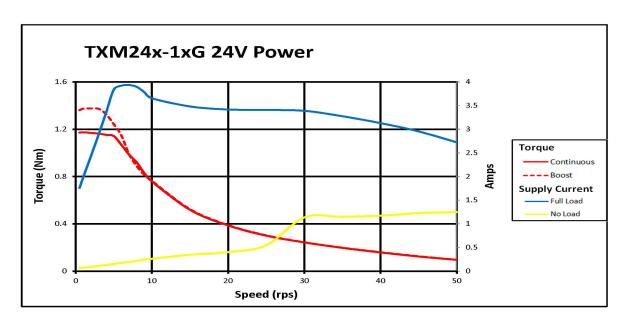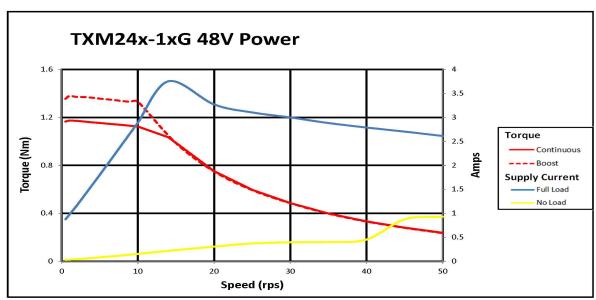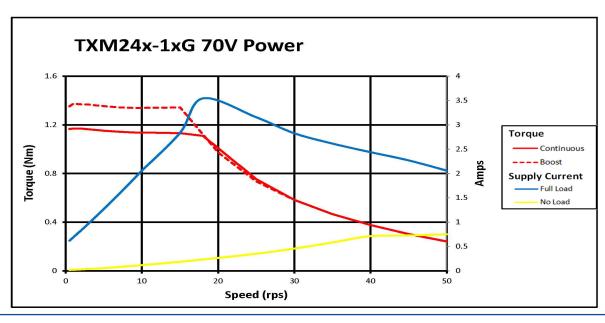

TXM24□-3□G 24V Power

TXM24□-3□G 48V Power

TXM24□-3□G 70V Power

TXM24x-1xG 24V Power

TXM24x-1xG 48V Power

TXM24x-1xG 70V Power

3 Installation/Connections

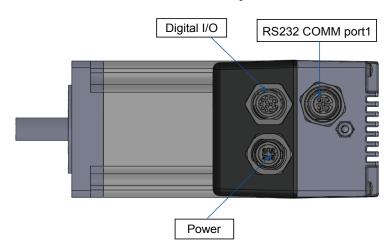To meeting the IP65 protection, a suitable mating connector should be chosen.

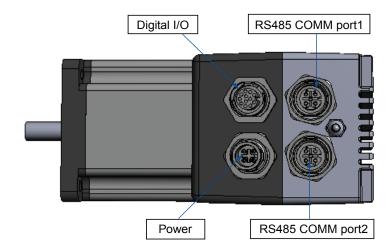For more information, please see the Accessories section.

3.1 Connecting the Power Supply

Use 16 to 20-gauge wire to connect the TXM24 to a power supply. It contains an internal fuse connected to the "+" terminal that is not user replaceable. If a user serviceable fuse is desired, install a 6.3 amp fast acting fuse in line with the "+" power supply lead.
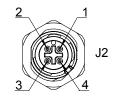
⚠️ **Be careful not to reverse the wires. Reversing the connection may open the internal fuse on the drive and void the warranty**

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Power

Signal	Color of mating cable Applied Motion P/N 3004-277-5M	Pin no.
V+	BN\BU	1\3
V-	WH\BK	2\4

View of motor side connector

Rev. D
920-0087
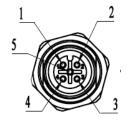
3.2 Connecting the TXM24 Communications

The TXM24 is available with two types of serial communications, RS-232 (TXM24S/Q -3AG) or RS-485 (TXM24S/Q -3RG). Each type requires a different hardware connection for interface to a PC or other Host system. The RS-232 version requires the user to provide the M12 mating cable to RS-232 port on PC. The RS-485 version requires the user to provide the M12 mating cable and the RS-485 interface. Below are descriptions of how to interface both of these serial communication types to a PC.

3.2.1 Connecting to the PC using RS-232

Locate the TXM24 within 1.5 meters of the PC.

Communication port

Signal	Color of mating cable Applied Motion P/N 3004-278-5M	Pin no.
RX	BN	1
NC	WH	2
TX	BU	3
GND	BK	4
N/C	GN/YE	5

View of motor side connector

Note: If the PC does not have an RS-232 serial port, a USB Serial Converter will be needed.

You can contact Applied Motion Products to buy a USB to RS-232 converter.

The RS-232 circuitry does not have any extra electrical "hardening" and care should be taken when connecting to the RS-232 port as hot plugging could result in circuit failure. If this is a concern the RS-485 version should be used.
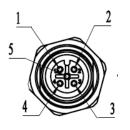
3.2.2 Connecting to a Host using RS-485

RS-485 communication allows connection of 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 300 meters or 1000 feet).

The TXM24 can be used with either Two-Wire or Four-Wire RS-485 implementation. 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).

NOTE: To use the TXM24 RS-485 version with the Step-Servo Quick Tuner software, it must be connected in the Four-Wire configuration (see below)

Communication port

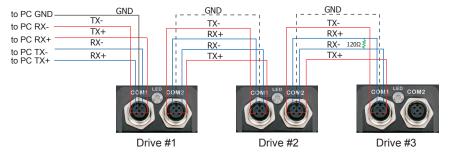| Signal	Color of mating cable Applied Motion P/N 3004-288-5M	Pin no.
RX+	BN	1
RX-	WH	2
TX+	BU	3
TX-	BK	4
GND	GN/YE	5

View of motor side connector

Four-Wire Configuration

Four-Wire Systems utilize separate transmit and receive wires. One pair of wires must connect the host's transmit signals to each drive's RX+ and RX- terminals. The other pair connects the drive's TX+ and TX- terminals to the host'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, only one drive's GND terminal should be connected to the host computer ground, others' GND terminal must not connect the logic grounds**.

Because the host in a four-wire system never needs to disable its transmitter, software is simplified. Some converters make this process very difficult to implement and can delay communications.
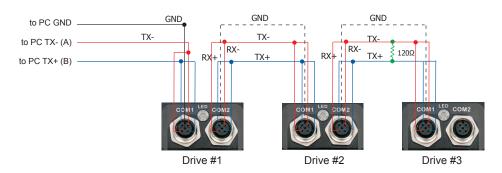

Drive #1   Drive #2   Drive #3

NOTE: If the PC does not have an RS-485 serial port, a converter is required.

You can contact Applied Motion Products to buy a USB to RS-485 converter.

Rev. D
920-0087

Two-Wire Configuration

In a 2-wire system, the host must disable its transmitter before it can receive data. This must be done quickly before a drive begins to answer a query. The TXM24 includes a transmit delay parameter that can be adjusted to compensate for a host that is slow to disable its transmitter. This adjustment can be made over the network using the TD command, or it can be set using the Step-Servo Quick Tuner software. It is not necessary to set the transmit delay in a four wire system.

NOTE: If the PC does not have an RS-485 serial port, a converter is required.

You can contact Applied Motion Products to buy a USB to RS-485 converter.

Assigning Addresses

Before the entire system is wired, each drive will need to connect individually to the host computer so that it can be assigned a unique address.

Once the drive has been connected to the PC as described above, launch the Step-Servo Quick Tuner software. Apply power to the drive. If a drive has already been configured, click the Upload button so that the Step-Servo Quick Tuner settings match those of the drive. When operating the drive in SCL mode it will need to be assigned an address. This is done on the Drive Configuration tab where a list of address options can be seen. The numerals 0..9 or the special characters ! " # $ % & ' ( ) * + , - . / : ; < = > ? @ may be used as addresses. Make sure each drive on the network has a unique address. On a 2-wire network, the Transmit Delay may also need to be set. Most adapters work well with 10 milliseconds. Once the address has been assigned, click Download to save the settings to the drive.

3.3 Inputs and Outputs

The TXM24 has three types of inputs:

• High speed digital inputs for step & direction commands or encoder following, 5 to 24 volt logic
• Low speed digital input for other signals, 5 to 24 volt logic
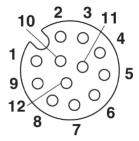• Analog input for analog speed and positioning modes

All drives include 3 digital inputs and 1 analog input

• STEP & DIR are high-speed digital inputs for commanding position. Quadrature signals from encoders can also be used. When not being used for the Step & Direction function these inputs can be used for CW & CCW Limit, CW & CCW Jogging and Run/Stop & Direction Velocity modes.
• EN is a low speed software programmable input and can be used for Motor Enable and/or Alarm Reset. This input can also be connected to a sensor, switch or other device for use with Wait Input (WI), Seek Home (SH), Feed to Sensor (FS), On Input (OI) and other commands.
• AIN is an analog input for a velocity or position command signal. It can accept 0-5 volts and has gain, filtering, offset and dead-band settings.

3.3.1 Connector Pin Diagram

IO

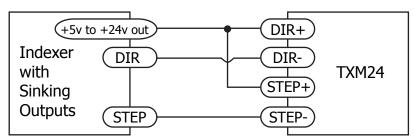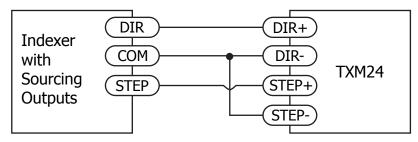| Signal	Color of mating cable Applied Motion P/N 3004-290-5M	Pin no.
Step+	BN	1
Step-	WH	3
Dir+	PK	5
Dir-	GY	8
En+	YE	6
En-	GN	4
OUT+	GYPK	11
OUT-	RDBU	12
+5V	RD	9
AIN	VT	10
GND	BK	7
N/C	BU	2

View of motor side connector

Rev. D
920-0087
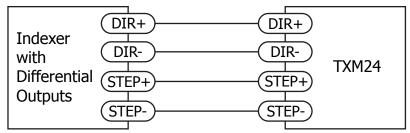
3.3.2 STEP & DIR Digital Inputs

The diagrams below show how to connect the STEP & DIR Inputs to various commonly used devices.
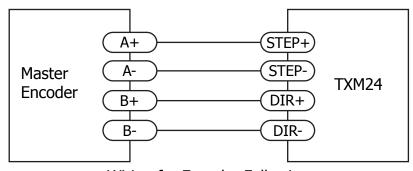

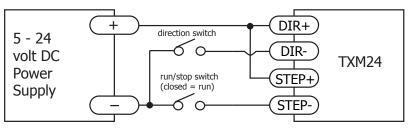Connecting to Indexer with Sinking Outputs

Connecting to Indexer with Sourcing Outputs

Connecting to Indexer with Differential Outputs
Many high-speed indexers have differential outputs

Wiring for Encoder Following

Using Mechanical Switches
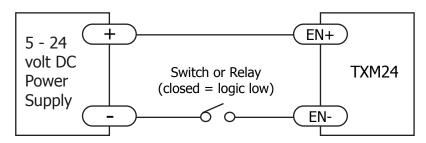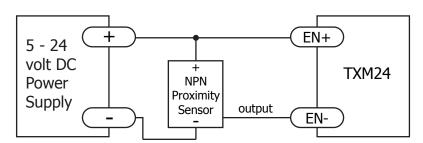
3.3.3 EN Digital Input

While the STEP and DIR inputs are designed for high-speed digital input operation, the Enable (EN) input is designed for low speed digital input operation between 5 and 24 volts.

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.
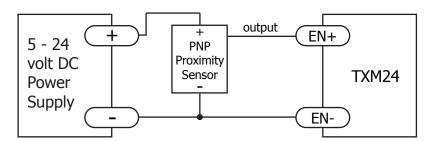
The diagrams below show how to connect the EN input to various commonly used devices.

Connecting the Input to a Switch or Relay

Connecting an NPN type Proximity Sensor to an Input
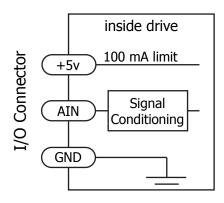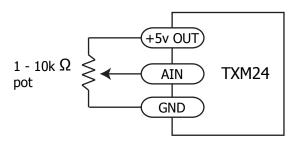(when prox sensor activates, input goes low)

Connecting a PNP type Proximity Sensor to an Input
(when prox sensor activates, input goes high)

Rev. D
920-0087

3.3.4 AIN Input

The TXM24 drives have an analog input (AIN) which can accept a signal range of 0 to 5 volts. The drive can be configured to operate at a speed or position that is proportional to the analog signal. Use the Step-Servo Quick Tuner software to set the signal range, offset, dead-band and filter frequency. The TXM24 provides a +5 volt 100mA limit voltage supply that can be used to power external devices such as potentiometers. It is not the most accurate supply for reference, for more precise readings use an external supply that can provide the desired accuracy.

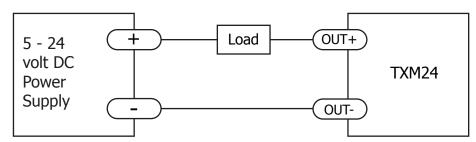Connecting a Potentiometer
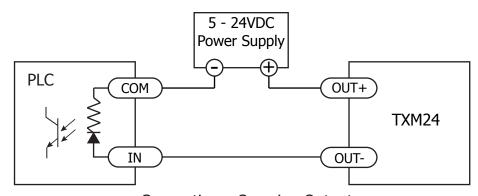to the Analog Input

3.3.5 Programmable Output

The TXM24 drives feature one optically isolated digital output (OUT). This output can be set to automatically control a motor brake, to signal a fault condition, to indicate when the motor is in position or to provide an output frequency proportional to motor speed (tach signal). Or the output can be turned on and off by program instructions like Set Output (SO). The output can be used to drive LEDs, relays and the inputs of other electronic devices like PLCs and counters. The OUT+ (collector) and OUT- (emitter) terminals of the transistor are available at the connector. This allows the output to be configured for current sourcing or sinking.
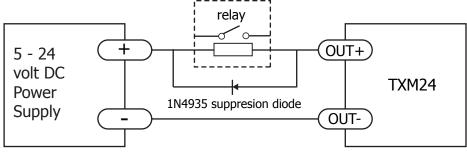
Diagrams of various connection types follow.

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

Connecting a Sinking Output

Connecting a Sourcing Output

Driving a Relay
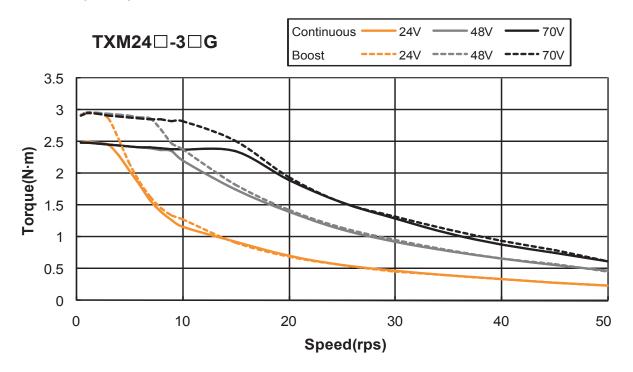
4 Troubleshooting

LED Error Codes

The TXM24 uses bi-colour LED to indicate status. When the motor is enabled, the green LED flashes slowly. When the green LED is solid, the motor is disabled. Errors are indicated by combinations of red and green flashes as shown below. This feature can be disabled for certain warnings but not for alarms.

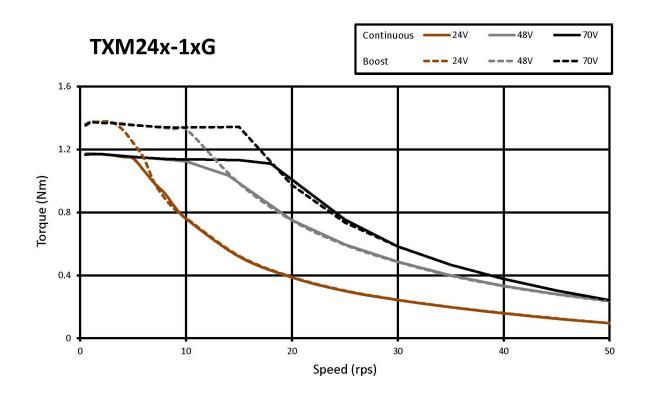|	Code	Error
🟢	Solid green	no alarm,motor disabled
🟢🟢	Flashing green	no alarm,motor enabled
🔴🟢	1 red,1 green	motor stall
🔴🔴🟢	2 red,1 green	ccw limit
🔴🔴🟢🟢	2 red,2 green	cw limit
🔴🔴🔴🟢	3 red,1 green	drive overheating
🔴🔴🔴🟢🟢	3 red,2 green	internal voltage out of range
🔴🔴🔴🟢🟢🟢	3 red,3 green	blank Q segment
🔴🔴🔴🔴🟢	4 red,1 green	power supply overvoltage or excess regen
🔴🔴🔴🔴🟢🟢	4 red,2 green	power supply undervoltage
🔴🔴🔴🔴🟢🟢🟢	4 red,3 green	flash memory backup error
🔴🔴🔴🔴🔴🟢	5 red,1 green	over current/short circuit
🔴🔴🔴🔴🔴🔴🟢	6 red,1 green	open motor winding
🔴🔴🔴🔴🔴🔴🟢🟢	6 red,2 green	bad encoder signal
🔴🔴🔴🔴🔴🔴🔴🟢	7 red,1 green	communication error
🔴🔴🔴🔴🔴🔴🔴🟢🟢	7 red,2 green	flash memory error

5 Reference Materials

5.1 Torque-Speed Curves

Note: all torque curves were measured at 20,000 steps/rev.
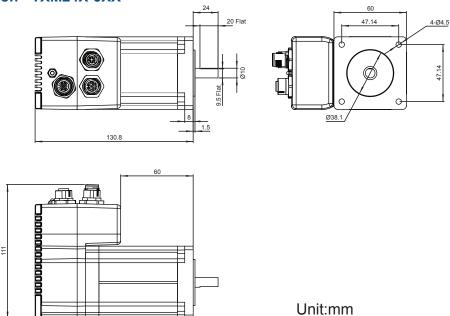
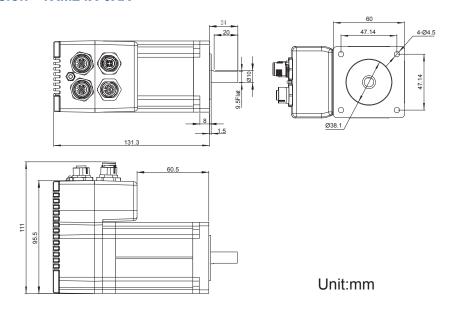Note: 6 amp rating is continuous, 7.5 amp rating is boost

Rev. D
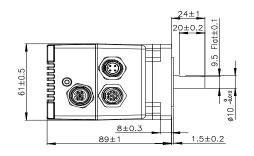920-0087
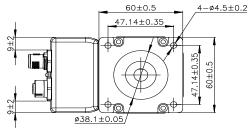
5.2 Mechanical Outlines

RS232 Version - TXM24X-3XX
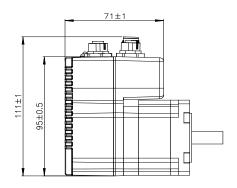

Unit:mm

RS485 Version - TXM24X-3XX

Unit:mm

RS232 Version - TXM24X-1XX

RS485 Version - TXM24X-1XX

5.3 Technical Specifications

Power Amplifier	
Amplifier Type	Dual H-Bridge, 4 Quadrant
Current Control	4 state PWM at 20 KHz
Output Torque	TXM24S/Q-3XG: Up to 2.4N•m Continuous (3.0 N•m Boost) TXM24S/Q-1XG: Up to 0.82N•m Continuous (1.03 N•m Boost)
Power Supply	External 12 - 70 VDC power supply required
Protection	Over-voltage, under-voltage, over-temp, motor/wiring shorts (phase-to-phase, phase-to-ground)
Controller	
Electronic Gearing	Software selectable from 200 to 51200 steps/rev in increments of 2 steps/rev
Encoder Resolution	20000 counts/rev
Speed Range	Up to 3600rpm
Filters	Digital input noise filter, Analog input noise filter, Smoothing filter, PID filter, Notch filter
Non-Volatile Storage	Configurations are saved in FLASH memory on-board the DSP
Modes of Operation	TXM24S: Step & direction, CW/CCW pulse, A/B quadrature pulse, velocity (oscillator, joystick), streaming commands(SCL) TXM24Q: All TXM24S modes of operation plus stored Q program execution
Digital Inputs	Digital Inputs Adjustable bandwidth digital noise rejection filter on all inputs **STEP+/-** : Optically isolated, 5-24 volt. Minimum pulse width = 250 ns, Maximum pulse frequency = 2 MHz Function: Step, CW step, A quadrature (encoder following), CW limit, CW jog, start/stop (oscillator mode), or general purpose input **DIR+/-** : Optically isolated, 5-24 volt. Minimum pulse width = 250 ns, Maximum pulse frequency = 2 MHz Function: Direction, CCW step, B quadrature (encoder following), CCW limit, CCW jog, direction (oscillator mode), or general purpose input **EN+/-** : Optically isolated, 5-24 volt. Minimum pulse width = 100 µs, Maximum pulse frequeny = 10 KHz Function: Enable, alarm/fault reset, speed 1/speed 2 (oscillator mode), or general purpose input
Digital Output	**OUT+/-**: Optically isolated, 30V/100 mA max. Function: Fault, tach, in position, brake, or general purpose programmable
Analog Input	AIN referenced to GND. Range = 0 to 5 VDC. Resolution = 12 bits
Communication Interface	RS-232, RS-485 or Modbus/RTU
Physical	
Ambient Temperature	0 to 40°C (32 to 104°F) When mounted to a suitable heatsink
Humdity	90% Max., non-condensing
Mass	TXM24S/Q-3XG: 2000 g = 70.55 oz TXM24S/Q-1XG: 1049 g = 37 oz
Rotor Inertia	TXM24S/Q-3XG:900 g•cm^2 = 1.27 X 10^{-2} oz-in-S^2 TXM24S/Q-1XG:260 g•cm^2 = 3.97E-03 oz-in-S^2
Length	TXM24S/Q-3XG 5.15 inches (130.8mm) TXM24S/Q-1XG 3.5 inches (88.9mm)

5.4 Accessories

Mating Cables

Position	Part Number	Description
Power	3004-277-5M	4-pin Mating Cable, M12, 2.0m, 22AWG, straight
I/O	3004-290-5M	12-pin Mating Cable, M12,1.5m, 26AWG, straight
RS232	3004-278-5M	5-pin Mating Cable, M12 1.5m 22AWG, straight
RS485	3004-288-5M	5-pin Mating Cable, M12 1.5m 22AWG, straight

6 Contacting Applied Motion Products

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