

# TQ10 Series



**UL** and **CE (LVD)**

## Cost Effective Brushless Servo Systems

The TQ Series servo drives from Compumotor bring high performance to a small, low cost brushless servo system. Without the need for an external power supply, the TQ series offers a cost effective solution to a number of brushless servo applications.

The TQ10 Series is offered with an array of Compumotor brushless servo motors. The drives are also compatible with many 3-phase, brushless motors utilizing hall effect feedback. All models are equipped with a recirculating PWM amplifier, providing reduced heating in the motor and drive. With speeds up to 7,500 RPM and continuous torque up to 320 oz.-in., the TQ system is well suited to meet the demands of today's customers.

The TQ10 Series is available in three versions: TQ10, TQ10SD and TQ10X. The TQ10 is a torque amplifier, utilizing an industry standard  $\pm 10V$  analog input. It is directly compatible with industry standard servo controllers. The TQ10SD uses the same command interface found on most step motor amplifiers, allowing for easy upgrade from step motor, to the higher performance levels found in brushless servo systems. The TQ10X integrates a simple, yet powerful, servo controller with the TQ10 torque amplifier, creating a complete single-axis servo system.

Easy and reliable installation is accomplished by utilizing removable screw terminals for all connection points. Five diagnostic LEDs indicate seven different status and error conditions. The drives are housed in a rugged steel metal casing.

TQ series drives, whether matched with a Compumotor controller, or using an integrated controller, form a convenient and flexible system for solving a variety of motion control applications.

### Features

#### Performance

- Torque mode operation with TQ10,  $\pm 10V$  analog input
- Step and Direction operation with TQ10SD, step and directional input
- Built-in X Language controller with TQ10X, 2Kbyte BBRAM for non-volatile memory
- Powered from standard 120V AC line
- Recirculating PWM amplifier design
- An array of Brushless servo motors are available providing torque up to 320 oz.-in. continuous and 640 oz.-in. peak

#### Protection

- Over temperature protection for drive heat sink
- Fully short circuit protected final power stage
- Power dump circuit protects drive against regenerated power
- Motors include thermal switch

#### Physical

- 95-132VAC power input
- Enable, Drive Temp, Motor Fault, Peak Current and Regen diagnostic LEDs
- Removable connectors on all signals for easy installation



**TQ10X Specifications**

	Parameter	Value
Performance	Position Range	±1,073,741,823
	Velocity Range	0.01 to 200 rps
	Acceleration Range	0.01 to 9999 rps <sup>2</sup>
	Velocity Accuracy	±0.02% of max rate
	Velocity Repeatability	±0.02% of set rate
	Resolution	400–65,532 encoder counts/rev
	Speed/Torque Curves	Located on page 156
Power Input	Voltage	95-132VAC single phase
	Frequency	50/60 Hz
Power Output Motor	Peak Current	10 A (approx 2 sec max duration at 45°C ambient temperature)
	Continuous Current	5 A with TQ10-EHS or mounted to heatsink at or below 45°C
	Voltage	170VDC nominal
	Peak Power	830 W (1.1 hp) @ 170V supply voltage
	Continuous Power	420 W (0.56 hp)
	Switching Frequency	20 kHz
	Bandwidth	2 kHz typical (dependent on motor)
	Transconductance	1 volt = 1.0 amp
	Commutation	120° hall effect sensors for six-state commutation method or brushed DC motor
	Short-Circuit Protected	Yes
Power Output Hall Effect Sensors	Voltage	+5VDC ±0.5VDC
	Current	50 mA (max)
	Short-Circuit Protected	Yes
Power Output To Encoder	Voltage	+5VDC
	Current	200 mA max each output
Hall Inputs	Low State	Ø-2V
	High State	Internal 3KΩ pull-up resistor to +15V (open-collector hall outputs should be used)
	Input Frequency	Ø-2 kHz max
Inputs	Programmable Inputs	5 user-defined, TTL signal levels: low = 0.8V; high = 2–5V
	End-of-travel limits	CW/CCW, 0–5V, TTL signal levels: low = 0.8V; high = 2–5V
	RS-232C	3-wire (Rx, Tx, GND) connections
Outputs	Programmable outputs	2 user-defined, TTL signal levels: low = 0.8V; high = 2–5V
	Fault Output–Isolated LEDs	24V max voltage; 10 mA max current
	Indication	
	-Enable (Bi-color)	Green = enabled; Red = power on, not enabled
	-Drive temp	Red = fault (drive overtemp, etc.)
	-Motor fault	Red = fault (short circuit, motor overtemp, etc.)
	-Peak current/Foldback (Bicolor)	Green = current is near peak (over~75%) Red = in foldback (peak current time exceeded)
-Regen (Bi-color)	Green = regen active; Red = overvoltage fault	
Digital Servo Loop	Update Time	266 µsec
	Output	12-bit DAC
	Servo Tuning	Via RS-232C
	Tuning Parameters	PID with digital filter
Protective Circuits	Short Circuit	Turns off outputs to motor; latched
	Overtemperature	55°C ±5°C trip temperature; latched
	Undervoltage	80V min
Physical	All connection points	10 pin screw terminal, removable
	Environment	Drive Temperature ambient: 0-50°C (32-122°F) Humidity: 0-95% non-condensing Storage: -40-85°C (-40-185°F)

# TQ10X Summary of Commands

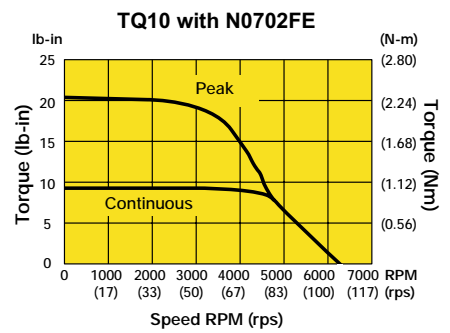
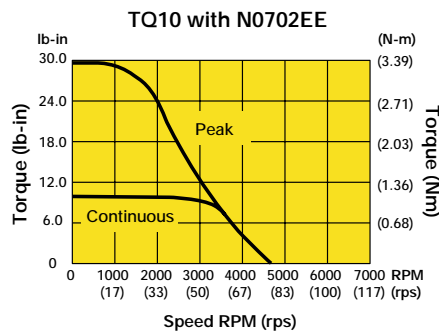
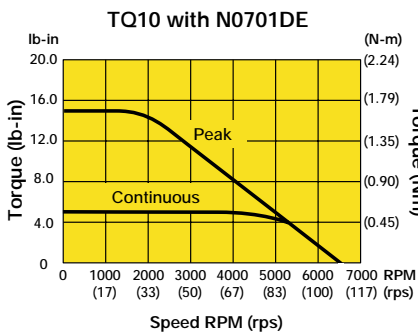
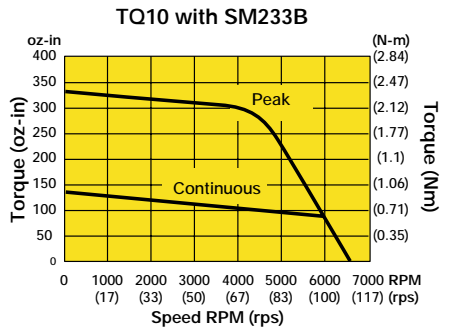
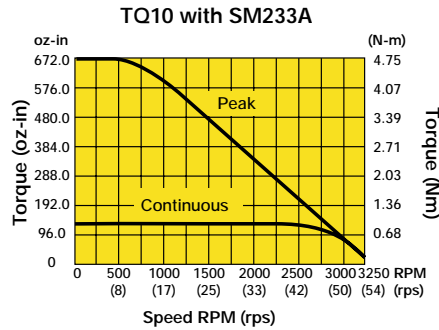
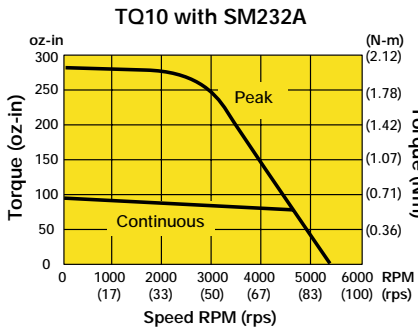
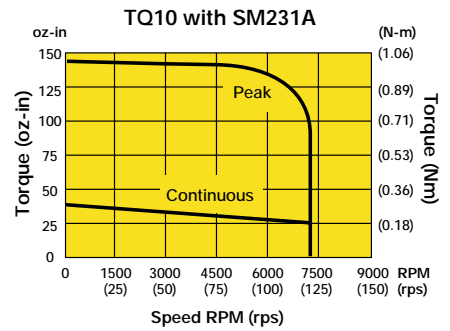
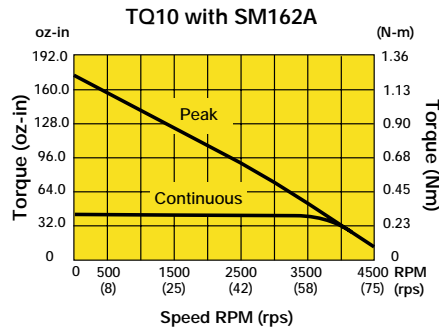
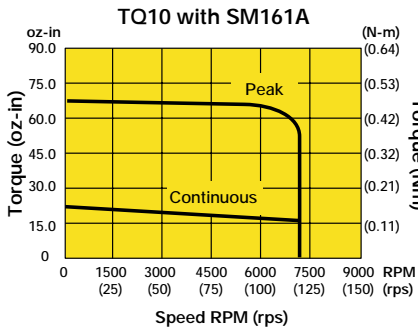
<b>AB</b>	A B BCDGG BCIG BCIL BCPE BCPG BCTG  BS	Acceleration Buffer Status Buffered Configure Derivative Gain Buffered Configure Integral Gain Buffered Configure Integral Limit Buffered Configure Position Error Buffered Configure Proportional Gain Buffered Configure Derivative Sampling Period Buffer Size Status	<b>P</b>	PR PS PX PZ	Report Commanded Position Pause Report Absolute Encoder Position Set Absolute Counter to Zero
<b>CD</b>	C CDG CEW CIG CIL CIT CPE CPG CR CTG D DPA DPE DVA	Continue Configure Derivative Gain Configure in Position Error Window Configure Integral Gain Configure Integral Limit Configure in Position Time Configure Maximum Position Error Configure Proportional Gain Carriage Return Configure Derivative Sampling Period Distance Display Position Actual Display Position Error Display Velocity Actual	<b>QR</b>	" Q1 Q0 R RA RB  RC RFS RM RSE RV	Quote Enter Velocity Profiling Mode Exit Velocity Profiling Mode Request Indexer Status Limit Switch Status Report Loop, Pause, Shutdown, Trigger Status Report Homing Status Report Return Servo Gains to Factory Settings Rate Multiplier in Velocity Streaming Mode Report Servo Errors Revision Level
<b>EFG</b>	E ER F G GH	Enable Communications Encoder Resolution Disable Communications Go Go Home	<b>STUV</b>	S SN SS SSA SSC SSG SSH ST T TR U V	Stop Scan Software Switch Function Status RS-232C Echo Control Output #1 on In Position Clear/Save Command Buffer on Limit Clear/Save Command Buffer on Stop Shutdown Time Delay Wait for Trigger Pause and Wait for Continue Velocity
<b>HIJKL</b>	H H IN IS K L LD LF	Delete Set Direction Set Input Functions Input Status Kill Loop Limit Disable Line Feed	<b>XYZ#</b>	XC XD XE XP XQ XR XRP XSD XSP XSR XSS XT XU Y Z #	Sequence Checksum Sequence Definition Sequence Erase Set Power-up Sequence Mode Sequence Interrupted Run Mode Run a Sequence Sequence Run with Pause Sequence Status Definition Sequence Status Power-up Sequence Status Run Sequence Status Sequence Termination Upload Sequence Stop Loop Reset Address Numbering
<b>MN</b>	MC MN MPA MPI N	Mode Continuous Mode Normal Mode Position Absolute Mode Position Incremental End of Loop	<b>O</b>	O OFF ON OS OSA OSB OSC OSD OSH	Output Servo Disable Servo Enable Report Homing Function Set Ups Define Active State of End-of-Travel Limits Back Up to Home Define Active State of Home Switch Enable Encoder Z-Channel for Home Reference Edge of Home Switch

Drives & Drive/Controllers

Experienced Application Engineers Ready To Assist With Your Next Application. Call 1-800-358-9070.

# TQ10 Speed Torque Curves

For motor specifications and dimensions, refer to the SM and NeoMetric Servo Motors in the Servo Motor Section.



Drives & Drive/Controllers

## TQ10 Connections

### Connector 1 10-Pin Removable Connector

Pin No.	Type	Signal
1	Input	Enable In
2	Ground	Enable GND
3	Output	Fault Out+
4	Output	Fault Out-
5	Input	Reset In
6	Ground	Reset GND
7	Input	Command+
8	Input	Command-
9	Ground	Command Shield
10	Ground	Ground

### Connector 2 10-Pin Removable Connector

Pin No.	Type	Signal
1	Ground	Ground
2	Output	+15VDC
3	Output	-15VDC
4	Ground	Hall GND
5	Output	Hall +5VDC
6	Input	Hall 1
7	Input	Hall 2
8	Input	Hall 3
9	Input	Motor Temp+
10	Input	Motor Temp-

## TQ10SD Connections

### Connector 1 10-Pin Removable Connector

Pin No.	Type	Signal
1	Output	Velocity Monitor
2	Input	CPE 2 (Position Error 2)
3	Input	Step+
4	Input	Direction+
5	Input	Deriv. Gain Reduction
6	Input	Integral Gain Off
7	Input	CPE 1 (Position Error 1)
8	Ground	Ground
9	Input	Step-
10	Input	Direction-

### Connector 2 10-Pin Removable Connector

Pin No.	Type	Signal
1	Input	Shutdown+
2	Input	Shutdown-
3	Ground	Encoder Ground
4	Output	Encoder +5VDC
5	Input	Encoder A+
6	Input	Encoder A-
7	Input	Encoder B+
8	Input	Encoder B-
9	Output	Reserved
10	Output	Reserved

### Connector 3 10-Pin Removable Connector

Pin No.	Type	Signal
1	Input	Enable In
2	Ground	Enable GND
3	Output	Fault Out+
4	Output	Fault Out-
5	Input	Reset In
6	Ground	Reset GND
7-10		Not Used

### Connector 4 10-Pin Removable Connector

Pin No.	Type	Signal
1-3		Not Used
4	Ground	Hall GND
5	Output	Hall +5VDC
6	Input	Hall 1
7	Input	Hall 2
8	Input	Hall 3
9	Input	Motor Temp+
10	Input	Motor Temp-

Experienced Application Engineers Ready To Assist With Your Next Application. Call 1-800-358-9070.

# TQ10X Connections

## Connector 1 10-Pin Removable Connector

Pin No.	Type	Signal
1	Input	Input 1
2	Input	Input 2
3	Input	Input 3
4	Input	Input 4
5	Input	Input 5
6	Output	Output 1
7	Output	Output 2
8	Ground	Logic Ground
9	Output	RS-232 Tx
10	Input	RS-232 Rx

## Connector 2 10-Pin Removable Connector

Pin No.	Type	Signal
1	Input	CW Limit
2	Input	CCW Limit
3	Ground	Logic Ground
4	Output	Encoder +5VDC
5	Input	Encoder A+
6	Input	Encoder A-
7	Input	Encoder B+
8	Input	Encoder B-
9	Input	Encoder Z+
10	Input	Encoder Z-

## Connector 3 6-Pin Removable Connector

Pin No.	Type	Signal
1	Input	Enable In
2	Ground	Enable GND
3	Output	Fault Out+
4	Output	Fault Out-
5	Input	Reset In
6	Ground	Reset GND

## Connector 4 7-Pin Removable Connector

Pin No.	Type	Signal
4	Ground	Hall GND
5	Output	Hall +5VDC
6	Input	Hall 1
7	Input	Hall 2
8	Input	Hall 3
9	Input	Motor Temp+
10	Input	Motor Temp-

## Ordering Information



**Model No.**      **Description**

Drive:

All drives are UL recognized and CE marked (LVD)	
TQ10	Torque Servo Drive
TQ10SD	Step and Direction Servo Drive
TQ10X	Servo Drive/Controller
TQ10-EHS	Torque Servo Drive with top and bottom panels and heatsink/fan
TQ10SD-EHS	Step and Direction Servo Drive with top and bottom panels and heatsink/fan
TQ10X-EHS	Servo Drive/Controller with top and bottom panels and heatsink/fan



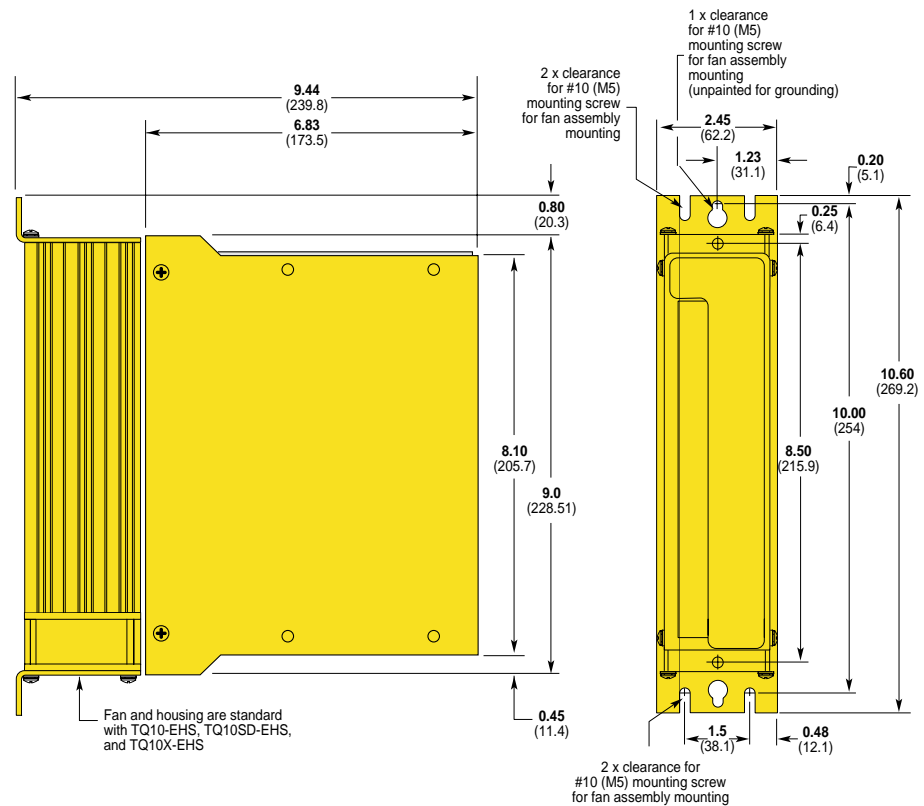
Ordering Information - cont'd

	Model No.	Description
<b>Motors:</b>	SM161AE-NTQN	Size 16, Normal Shaft, Encoder, TQ Connector, No Options
	SM162AE-NTQN	Size 16, Normal Shaft, Encoder, TQ Connector, No Options
	SM231AD-NTQN	Size 23, 1 Stack, 500Line Encoder
	SM231AE-NTQN	Size 23, 1 Stack, 1000 Line Encoder
	SM232AD-NTQN	Size 23, 2 Stack, 500 Line Encoder
	SM232AE-NTQN	Size 23, 2 Stack, 1000 Line Encoder
	SM233_D-NTQN	Size 23, 3 Stack, 500 Line Encoder (A or B Winding)
	SM233_E-NTQN	Size 23, 3 Stack, 1000 Line Encoder (A or B Winding)
	N0701DE-NTQN	70mm, Normal Shaft, Encoder, TQ Connector, No Options
	N0702EE-NTQN	70mm, Normal Shaft, Encoder, TQ Connector, No Options
	N0702FE-NTQN	70mm, Normal Shaft, Encoder, TQ Connector, No Options
	N0341DE-NTQN	Size 34, Normal Shaft, Encoder, TQ Connector, No Options
	N0342EE-NTQN	Size 34, Normal Shaft, Encoder, TQ Connector, No Options
	N0342FE-NTQN	Size 34, Normal Shaft, Encoder, TQ Connector, No Options
	J0701_E-NTQN	70mm, Normal Shaft, Encoder, TQ Connector, No Options
	J0702_E-NTQN	70mm, Normal Shaft, Encoder, TQ Connector, No Options
J0341_E-NTQN	Size 34, Normal Shaft, Encoder, TQ Connector, No Options	
J0342_E-NTQN	Size 34, Normal Shaft, Encoder, TQ Connector, No Options	
<b>Cables for SM Series Motors:</b>	23TQ CABLE-10	Encoder feedback and motor cable set for SM "TQ" motors, 10'
	23TQ CABLE-25	Encoder feedback and motor cable set for SM "TQ" motors, 25'
	23TQ CABLE-35	Encoder feedback and motor cable set for SM "TQ" motors, 35'
<b>Cables for 70mm NeoMetric and J Series Motors</b>	70TQ CABLE-10	Encoder feedback and motor cable set for Size 34 and 70mm "TQ" motors, 10'
	70TQ CABLE-25	Encoder feedback and motor cable set for Size 34 and 70mm "TQ" motors, 25'
	70TQ CABLE-35	Encoder feedback and motor cable set for Size 34 and 70mm "TQ" motors, 35'

**Please Note:**  
Refer to the Servo Motor Section beginning on page 186 for complete motor and cable specifications.

**TQ10, TQ10SD, TQ10X, TQ10-EHS, TQ10SD-EHS and TQ10X-EHS Dimensions**

Dimensions in inches (mm)



Drives & Drive/Controllers

Experienced Application Engineers Ready To Assist With Your Next Application. Call 1-800-358-9070.