# TG-540

## Networked, Servo/Stepper Trajectory Generator


The TG-540 is a full featured motion and I/O module that provides velocity and position trajectory commands to digital servo and stepper drives. It offers the benefits of scalability (one axis at a time), easy distribution, flexibility to select the optimal motor and I/O technology in any combination without software ramification, and ultra-smooth double-jerk-limited move profiles.

The TG-540 sends digital trajectories instead of analog torque commands to provide superior noise immunity and allow OEMs to capitalize on modern drive technology. The TG-540 is extensible per axis, so you won't waste money on unused axes or risk running out of axes if design requirements change. Each TG-540 has a DSP on each device, so performance will not degrade as the number of axes increase. And perhaps most importantly for OEMs who desire a broad range of options, the TG-540 does *not* require an interface protocol. It natively interfaces to virtually any digital drive or I/O device from any manufacturer, so OEMs are not limited by the availability of components with dedicated protocols.

The TG-540 is compatible with ControlPoint™—Teknic's distributed, open-architecture machine control system. ControlPoint™ offers OEM machine designers a wide array of control components to allow interconnectivity to nearly any digital or analog sensor, stepper, digital servo, brushless servomotor, and other machine control devices.

## ELEGANT TRAJECTORY CONTROL

### Ultra-Smooth Motion

The TG-540 utilizes a proprietary, time-based jerk-limiting algorithm to provide ultra-smooth motion. This provides the benefit of a constant rate of jerk limiting throughout the entire move, so it delivers consistent smoothness. Moreover, the amount of jerk limiting is selectable and will not vary with changes in commanded acceleration, so the effective jerk on the mechanics remains constant—*even if you command higher acceleration.* The smoothness improvement vs. S-curve profiles is pronounced, especially with high-acceleration axes or those reaching constant velocity in a short period of time.

### Profiles of any Nature

In addition to trapezoidal moves with jerk limiting, OEMs can create any motion profile. Choices include asymmetric profiles, Head-N-Tail™ moves that provide smooth, continuous profile for axes needing multiple velocities and/or accelerations (this increases throughput while controlling energy transfer in insert applications). The TG-540 can also generate arbitrary profiles.

## UNIVERSAL OUTPUT INTERFACE

Using digital trajectory commands, the TG-540 will control virtually any digital servo or stepper drive on the market with no restriction on manufacturer, size, power, motor type, etc. And you can interchange the drive and motor technology with no impact on software. In addition, you can select virtually any type of sensor or output device to compliment your motion technology The end result is not only ease of use, but OEM engineers have more compatible options available from more manufacturers then are available for all network systems that require specific protocol compatibility *combined.*

## POWERFUL DEVELOPMENT TOOLS

TG-540s have rich software tools that enable rapid development of machine application software.

### Rapid Prototyping Capability

The ControlPoint Rapid Prototyping Environment (RPE) allows code to be written by software novices so they can get a machine cycling in a few hours or a single axis moving in a few seconds. This reduces the load on an OEM's software resources and allows mechanical and electrical testing to occur independently of software development. The RPE includes one-click control of the most common TG-540 functions and a powerful, interpretive scripting environment.

### Application Development Tools Include

- Each TG-540 has a built-in Programmable Logic Array that provides configurable high-speed logic functions so each TG can quickly and autonomously respond to an array of user-defined inputs.
- Interrupt generation over the network allows simple, event-driven coding.
- A single software driver tightly links machine motion and I/O to greatly simplify development.
- Motor power can be off while sensor and communication functions are active, easing safety compliance efforts.
- Dynamically latched inputs capture rising and falling edges to ensure transient events are captured.
- High-speed encoder latching.
- Software trace utility helps automatically locate logic errors, reducing debugging time.

## ADDITIONAL CAPABILITIES...

**Excellent Coordination Performance**

Coordinating motion between axes or between motion and I/O can be accomplished in a multitude of ways with varying levels of simplicity. The simplest method provides deterministic coordination within a couple milliseconds (exact timing is machine layout dependant). The most elegant coordination method will deliver microsecond level coordination regardless of machine layout. So as OEM performance requirements evolve, the TG-540 provides the flexibility to continue to meet changing needs.

**Multiple Brake Modes**

The TG-540 will control external brakes via software. In addition, active-clamping hardware provides a fast, microprocessor independent means of auto-asserting brakes. If an OEM chooses, this method removes software effort and testing from brake functionality.

**Noise Immunity**

Using digital commands, the TG-540 offers superior noise immunity compared to analog signals. Moreover, each TG is electrically isolated such that the drive/encoder are isolated from the network. GPI and GPO are fully isolated.

**IntelliStop™**

The TG-540 has programmable, controlled stopping for machine safety/emergency events.

**Built-in SSR GPOs & GPIs**

The two GPOs and two GPIs require no signal conditioning or breakout boards and wire directly to sensors or output devices.

**Onboard Sensor Power**

Eliminates external sensor powering needs and wiring complexity.

**Flexible Motion Performance**

With an open interface and no software impact, OEMs can freely choose motion technologies that provide the best value. So if needs change during development – or even after production begins – an engineer can change drive technology and/or motor type (linear, BL rotary, brush, pancake, galvo, voice coil, etc.) without a ripple effect on software and not be hindered by limited availability of compatible products.

## SPECIFICATIONS

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|---|---|---|
| **GENERAL** | Dimensions, in (mm): | 4.80 (122) x 4.049 (103) x 1.105 (28). |
| | Weight, oz (g): | 11.75 (366). |
| **ENVIRONMENTAL** | Temperature: | 0-40 Degrees C. |
| | Humidity: | 0-95%, non-condensing. |
| **DEDICATED INTERFACE INPUTS/OUTPUTS** | Inputs: | 1. Ready (confirms drive is not shut down).<br>2. Move done, In Acceptable Tracking Range, or All Systems Go (meaning of mode depends on drive set-up). |
| | Outputs: | 1. Enable (turns on/off drive power stage).<br>2. Mode (engages/disengages a variety of drive features, such as torque foldback, hardstop homing, etc.).<br>3. Digital Pulse and Direction (position vs. time command to digital servo or stepper). |
| | Limits: | 5 to 24V, courtesy wired to drive connector. |
| | Digital trajectory range: | Velocity: 1hz to 7.4 MHz (steps/sec).<br>Acceleration: 233 to 3.124E10 (steps/sec$^2$). |
| **GENERAL PURPOSE INPUTS** | # of points per TG: | 2. |
| | # Pins per point: | 4 (+,-,+5V, GND) Purges multi-wire crimps. |
| | Total courtesy supply current draw: | 200mA. |
| | Max current draw per point: | 350mA. |
| | Features: | Digital, fully electrically isolated (from power and each other), accepts 5, 12, 24 VDC inputs, optical isolation similar to a solid state relay, direct to sensor wiring, to-the-count encoder position capture (GPI-0). |
| **GENERAL PURPOSE OUTPUTS** | # of points per TG: | 2. |
| | # Pins per point: | 4 (Output, Logic return, Power return, GND). Eliminates multi-wire crimps. |
| | Max current per point: | GPO0=250mA max.<br>GPO1=500mA max. |
| | Features: | Full electrical/optical isolation, source or sink compatible, catch diode to handle inductive kick from solenoids and brakes, transistor outputs with active clamping, capable of driving 24V inductive loads directly, outputs can be triggered from encoder counter, built-in solid state relay functionality. |
| **ENCODER** | Interface: | Single ended or differential, user selectable. |
| | Max count rate: | 15MHz. |
| | Features: | Bad sequence detection, digital filtering. |
| **COURTESY POWER** | Power provided for: | Encoder, limits, GP inputs, dedicated outputs (mode, enable). |
| **POWER REQUIREMENTS** | Input voltage: | 40 VDC (supplied via network Cat 5 cable). |
| | Input current per TG: | Depends on I/O use, 125mA unloaded. |
| **BRAKE CIRCUIT** | Hardware brake: | Can be set up 1) to auto-assert brake on drive shutdown, 2) for user application control, 3) for dedicated input de-assertion. |
| **COUNTRY OF ORIGIN** | Manufactured in: | USA. |