

TOSHIBA
Leading Innovation >>>



SEVERE
DUTY

TX SERIES >>>>
LOW VOLTAGE SOLID STATE STARTER

ADVANCED CONTROL & SUPERIOR PROTECTION

The TX Series is a high-end, digitally programmable, reduced voltage solid state starter. This heavy-duty starter provides stepless soft starting of three-phase AC induction motors, which protects mechanical components from excessive torque stress as well as electrical systems from the effects of high motor inrush currents. The TX Series includes advanced motor and load protection features that rival expensive motor protection relays.

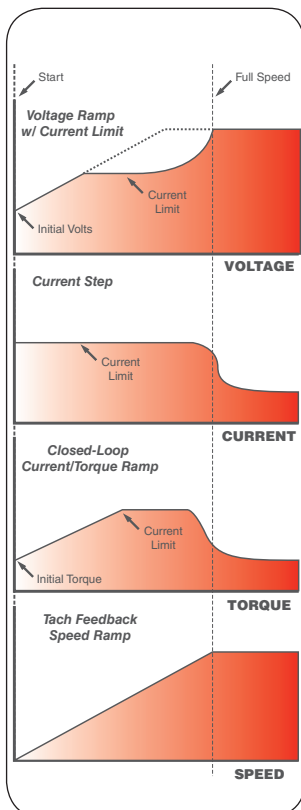
Most companies depend on critical equipment, like AC motors, for continuous production. Effectively controlling and protecting equipment is essential in order to maximize production in a cost efficient manner. Toshiba's TX Series solid state starter sets a new standard in control and protection for critical motors and loads.

- Highest Operating Capacity Available: 500% for 60 Seconds, 600% for 30 Seconds, & 200% for 2 Minutes
- Soft-Starting & Soft-Stopping Features
- *Pump-Flex™* Gradually Turns Off Load by Reducing Torque Over Time
- System Protection Features Provide All-in-One Coordinating Protection
- Latest Industrial Microprocessors Provide Flexibility, Programming, & Reliability
- Enhances Motor/Mechanical Applications to Continue Production Without Costly Downtime
- Retains Memory After Power Loss **Without Using Batteries**

➤ ADVANCED CONTROLS

SOFT STARTING

Soft Starting features protect mechanical components from excess torque stress and reduce surges in electrical systems. The powerful TX Series provides the following startup choices:



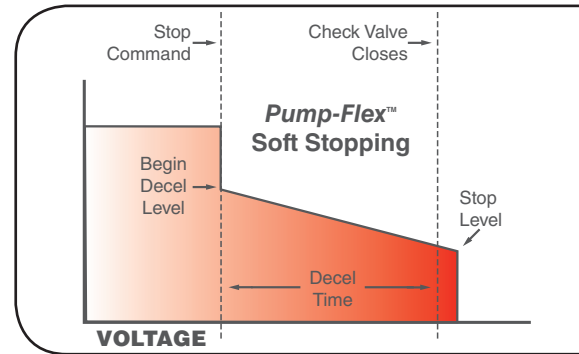
- ▶ **Voltage Ramping with Current Limit** is the most reliable method of starting occasionally varying loads while keeping electrical surges under strict control.
- ▶ **Current Step-Starting** adds a dimension of flexibility for tougher starting loads that need the most power at the start of an operation. This is especially useful where there are severe current restrictions.
- ▶ **Closed-Loop Current/Torque Ramping** controls accelerating torque with a PID feedback loop to provide smooth starting of inconsistent loads.
- ▶ **Tach-Feedback Starting** uses an optional shaft-mounted tachometer to ensure repeatable linear acceleration for loads that tend to “spring back” when exposed to excess torque.
- ▶ **Kick Start** free loads that are “stuck” due to high friction, high inertia, or occasional icing by providing an initial burst of energy to the motor.
- ▶ **Dual Ramps** offer the ability to choose two different starting methods and settings for applications with widely varying conditions. This is especially useful for restarting loaded systems after an unexpected power loss. The second ramp provides more starting torque, right up to “across-the-line.”
- ▶ **Jogging** directly connects with the solid state starter without causing stress to the bypass contactor.
- ▶ **Anti-Oscillation Control** incorporates all starting ramps to avoid unwanted surging of lightly loaded motors.

TX SERIES

PUMP-FLEX™ SOFT STOPPING

Toshiba offers *Pump-Flex™* as a standard feature in the TX Series solid state starter. With *Pump-Flex™* the load is gradually turned off, reducing torque over time. Slowly reducing the output of the pump prevents the “water hammer” effect of instantly stopping where trapped kinetic energy is transformed into a shock wave. *Pump-Flex™* soft-stopping prevents costly damages to pipes, flanges, seals, mounts, and pump bases. All pump control features are adjustable, making the TX Series adaptable to any pump system. These features include:

- **An Adjustable Beginning Deceleration Level**, which allows the output voltage to immediately drop upon command. This prevents unwanted motor thermal stress caused by constantly starting at 100% voltage.
- **An Adjustable Deceleration Time**, which lasts up to 60 seconds, allowing the torque output to decrease at a rate slow enough for the energy to dissipate safely.
- **An Adjustable Stop Level**, which provides for an automatic turn-off point when the necessary task is completed, preventing unnecessary motor heating.



ADVANCED MICROPROCESSOR TECHNOLOGY

Using the latest in industrial microprocessors, the TX Series provides complete flexibility, intuitive programming, and reliability.

- ▶ **An Operator Interface** allows access to all of the TX Series features. The two-line, 20-character backlit LCD display reads out in plain-English text, augmented by status LEDs, and a tactile feedback keypad.
- ▶ **Non-Volatile Memory** uses a three-tiered system of EEPROM for user memory, EPROM for factory setting, and RAM for operating speed.
- ▶ **An Intuitive Setup** automatically adjusts all current-based features to the programmed motor nameplate FLA, not just the unit's maximum amp rating. Service factor is also entered according to the motor nameplate and all other affected features are automatically recalibrated.
- ▶ **Learning Modes** capture normal starting conditions and determine the best method of ramping and protecting the motor. This feature sets the TX Series apart from all other starter products on the market.
- ▶ **A Real-Time Clock** allows the TX Series to coordinate protection systems, metering functions, and fault history records in real time.
- ▶ **Three-Level Password Protection** allows different operators to access only the levels of programming deemed necessary for their use.
- ▶ **Two Analog Outputs** feed motor or load information into other devices or meters, easily coordinating with feeder drives, PLCs, SCADA systems, and process controllers.



> SUPERIOR PROTECTION

The TX Series offers advanced protection features that rival expensive motor protection relays. Digital microprocessor controls make the sophisticated programmable protection features possible, while the complex algorithms remain transparent to the user.

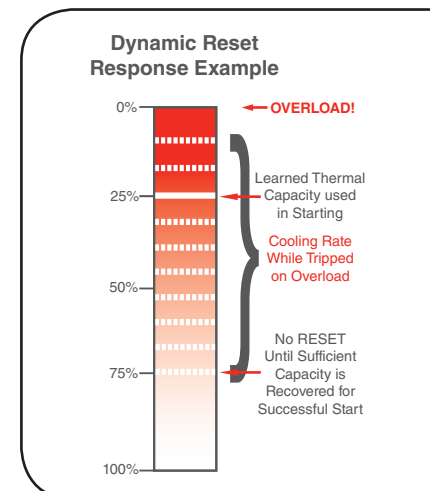
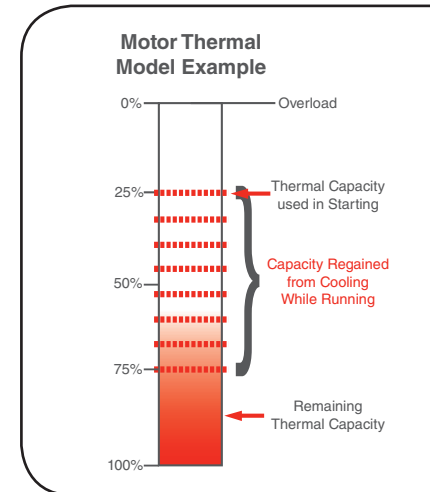
MOTOR THERMAL MODEL

The digital microprocessor creates a thermal register that monitors the motor load, power variations, and ambient conditions. This provides additional protection from motor winding problems, bearing failure, and high ambient temperatures.

- **Retentive Thermal Memory** provides protection after a complete power loss by immediately recalling the last thermal condition, observing off time, and adjusting the thermal register accordingly once power is restored.
- **Non-Volatile Memory** stores the thermal register along with user programs, factory settings, system statuses, and historical data.
- **True-Time Thermal Tracking** provides accurate cool down rates and eliminates unnecessary downtime by adjusting the thermal model for different cooling rates based upon motor temperature, running state, or power loss.
- **Dynamic Reset Response** allows the TX Series to learn how the motor responds when starting. After a trip, the TX Series will not reset until the motor has enough thermal capacity to start successfully.
- **Thermal Model Biasing** provides the TX Series with the ability to adjust the thermal model for the heating effects of phase-current imbalance or optional RTD inputs.

SYSTEM PROTECTION FEATURES

- ▶ **Overcurrent Trip** is a feature that can be used as an “electronic shear pin.” Programmable to levels lower than the overload, it is ignored during startup and trips when running current exceeds the setting. This can be used to protect against jammed loads, sand in pumps, or even to detect worn out chippers.
- ▶ **Undercurrent Trip** shuts down an under-loaded motor from field conditions such as shaft/belt breakage and loss of prime in pumping systems.
- ▶ **Dual-Mode Short Circuit Trip** is provided separately from the overcurrent trip. This consists of Toshiba’s exclusive “toe-in-the-water” circuit, which pre-checks the motor to prevent starting into a shorted load. In run mode, it becomes an “electronic fuse,” tripping faster than other fuses and circuit breakers.
- ▶ **Phase-Rotation, Phase-Loss, & Phase-Current Imbalance** trips are features designed to protect the motor from power supply problems. By monitoring current, these features protect against regeneration that causes false line-voltage detection.
- ▶ **Undervoltage, Overvoltage, & Voltage Imbalance** trips and alarms compliment phase monitoring.
- ▶ **Equipment Ground-Fault Protection** is provided using the residual current method for protection against damaged motor leads or poor connections. Zero-sequence CT input is optional.
- ▶ **Line-Frequency Trip** triggers tripping if the generator or utility power source frequency falls outside of a programmable window.
- ▶ **Coast-Down/Backspin Lockout** triggers tripping if the generator or utility power source frequency falls outside of a programmable window.
- ▶ **Starts-per-Hour Lockout** can help prevent equipment damage from repeated start commands.
- ▶ **Time Between Starts Lockout** provides a minimum time of 0 to 60 minutes between start attempts, preventing too rapid of a motor restart.



TX SERIES

ANSI #	DESCRIPTION	STANDARD	OPTIONAL
19	Reduced Voltage Start	x	
37	Under-Current Detection	x	
46	Current Imbalance	x	
47	Phase Rotation	x	
48	Locked Rotor/At Speed Indicator	x	
49	I ² t Electronic Motor Overload & Lockout	x	
50	Instantaneous Electronic Over-Current Trip	x	
51	Over-Current	x	
59/27	Over/Under Voltage Protection	x	
66	Starts-per-Hour & Time Between Starts	x	
81	Frequency Protection	x	
86	Lockout/Start Inhibit	x	
50N/51G/51N	Ground-Fault Detection, Instantaneous & Current	x	
49/38	Stator & Bearing RTD Protection		x
14	Speed Switch & Tachometer Trip		x



> A DESIGN FOR EVERY NEED

FLEXIBILITY

- Programmable Overload Trip Classes Selectable from NEMA/UL Classes 5 through 30
- Dual-Mode Overload Protection can Provide Separate Trip Curves For Starting & Running Modes
- Custom Overload Curve can Program Motor Manufacturer Data Based on Normal Running
- Automatic Overload Reset Activated when Operation Left Unattended
- Warning Levels can be Set Lower than Trip Levels & can be Tied to Output Relays or Sent To PLCs/Alarm Systems
- Programmable Time Delays Available for Most Trip Functions
- Four Built-In Output Relays Individually-Programmable to 1 of up to 19 Different Conditions

PACKAGING

- Panel-Mount for Retrofits & OEM Packages
- NEMA 1, 12, 3R, 4, or 4X Enclosures
- Combination or Non-Combination Starters
- Full Horsepower Rated, Bypass Contactor

APPLICABLE APPLICATIONS

- Chillers
- Compressors
- Fans
- Blowers
- Pumps
- Motors
- Water
- Conveyors

APPLICABLE INDUSTRIES

- Chemical
- City Municipality
- Coal Mine
- Food
- Industrial Marine
- Irrigation
- Paper
- Petroleum
- Power Plant
- Water/Wastewater



MAX AMPS	HP				kW (50Hz)	
	208 V	230 V	460 V	575 V	220 V	380/415 V
48	10	10	25	30	11	18.5
48	-	15	30	40	-	22
78	15	20	40	50	15	30
78	20	25	50	60	22	37
120	25	30	60	75	-	45
120	30	40	75	100	30	55
180	40	50	100	125	45	75
180	50	60	125	150	55	90
220	60	75	150	200	-	110
288	75	100	200	250	75	132
414	100	125	250	300	110	160
414	125	150	300	350	110	200
476	-	-	350	400	132	250
550	150	200	400	500	160	-
718	200	250	500	600	200	315
1006	250	300	600	700	-	400
1006	300	350	700	800	-	-
1150	350	400	800	900	-	-
1250	400	450	900	1000	-	-
1250	450	500	1000	1125	-	-

MODEL RANGE	10 to 1125 HP
AC Supply Voltage Rating	208 to 600 VAC
Enclosure Rating	Standard NEMA 1, 12, 3R, 4, & 4X Enclosure
Overload Capacity	500% for 60 Seconds, 600% for 30 Seconds, & 200% for 2 Minutes
Frequency	50 or 60 Hz, \pm 3Hz
SCR Rating	Standard PIV=1600 V
Bypass Contactor	Standard: On All Type 12, 3R, 4, & 4X Units 120A +; Option: Vacuum Bypass Contactors
Ambient	Operating Temperature: 0° to 50°C (32° to 104°F); Humidity: 5% to 95% Non-Condensing
Control	Standard: Two or Three-Wire 120 VAC; Options: 240 V for 50 Hz Units; CPT with Fusing
Output Relays	Four Programmable Relays, Rated 5A-240VAC Maximum
Analog Outputs	Two Analog Output Signals: 4 to 20 Max Amp or 0 to 10 VDC for Remote Metering/Signal Following

ADVANCED MOTOR PROTECTION

Two Overload Curves	Start Curve: Class 5 to 30; Max. I ² t; Custom Curve from Self-Learn Feature; Run Curve: Class 5 to 30; Custom Curve
Retentive Thermal Memory	Overload Circuit Retains Thermal Condition of Motor Regardless of Control Power Status
Dynamic Reset Capacity	Self-Learns Necessary Thermal Capacity Required for Restart After Trip
Phase Current Imbalance	Imbalance Trip Level: 5% to 30%
Ground Fault	Hi-Set and Lo-Set Levels
Over/Under Voltage	Line V: -10% to +10%
Over-Current Protection	Pin-Trip Level: 50% to 300% FLA
Load-Loss Trip Protection	Under-Current Trip Level: 10% to 90% FLA
Lockout Functions	Range: 1 to 10 Starts Time Between Starts: 0 to 60 Minutes; Coast-Down/Back-Spin: 0 to 60 Minutes
Trip Delay	0 to 20 Second Delay; Same for All Trip Functions

PROGRAMABLE OUTPUTS

Acceleration Control	Four Modes Built-In/Starting Torque: 10% to 100% V; 50% to 600% of Motor FLA; Ramp Time: 1 to 120 Seconds; Current Limit: 200% to 600% of FLA
Dual-Ramp Settings	Three Custom Ramp Curves; Eight Torque/Time Points Programmed by User
<i>Pump-Flex</i> TM Deceleration Control	Adjustable Beginning Deceleration Level: 0 to 100% V; Stop Level: 0% to 1% Less than Beginning Deceleration Level; Deceleration Time: 0 to 60 Seconds; Automatically Shuts Off when Pump Stopped
Jog Setting	5 % to 75% V
Kick-Start Setting	Kick Voltage: 10% to 100% or OFF; Kick Time: 0 to 2 Seconds

COMMUNICATIONS

Signal/Protocol	RS-485 with Modbus RTU Protocol; Optional DeviceNet, Profibus, & Ethernet
Signal	RS-232 with Windows [®] -Based Software for Communication with PC
Network	Up to 247 Devices per Mode

Digital Inputs that take standard 120 V industrial control eliminate the need for external power supplies. The **TX Series** can be used with two-wire or three-wire control systems without using any of the auxiliary relays.

TOSHIBA INDUSTRIAL PRODUCTS:

- Adjustable Speed Drives
- Motors
- Motor Controls
- Instrumentation & PLCs
- Uninterruptible Power Systems
- PAC

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