

**TOSHIBA**  
Leading Innovation >>>



**vlp**  
technology™

**PLUS PACK** >>>  
**LOW VOLTAGE DRIVE**

# REVOLUTIONIZING RUGGED RELIABILITY



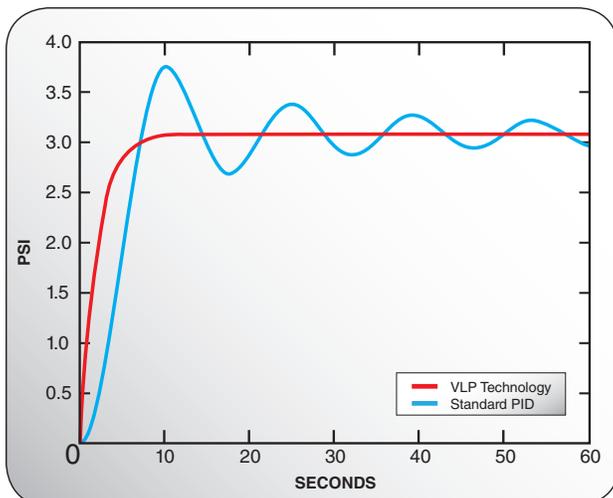
Toshiba's Plus Pack outdoor adjustable speed drive is revolutionizing the industry by combining Toshiba's robust Plus Pack technology and Toshiba's proprietary, ground-breaking VLP Technology™ (Virtual Linear Pump). VLP Technology allows the Plus Pack to directly, precisely, and linearly control pressure, temperature, level, or flow using single or multiple devices while balancing the load between them. This innovative drive is designed to withstand even the harshest of conditions and is engineered to provide tight speed control, while offering the industry's most user-friendly operator interface.

- Available in NEMA™ 1 or NEMA™ 3R Packages
- 6-Pulse, 12-Pulse, & 18-Pulse Input Rectifier Design with Patented Auto-Transformer Technology (12-Pulse Requires Additional Transformer)
- Heat Exchanger Technology Increases Cabinet Heat Dissipation & Minimizes Footprint
- VLP Technology:
  - Maximizes Energy Savings on Variable Torque Loads
  - Self-Calibrates & Eliminates Common Anomalies in Pumps & Other Devices
  - VLP Setup Wizard Allows User to Configure System in Five Simple Steps, Providing Complete Control in Only Minutes
  - Solves Problem of Load-Balancing over Multiple Devices

## > VLP TECHNOLOGY MAKES PID TUNING A THING OF THE PAST

Toshiba's breakthrough VLP algorithm has taken PID and made it obsolete, completely reinventing how users control pressure, temperature, level, or flow. With this new technology, after simply inputting a few values into the Plus Pack, optimum control is attained. Toshiba's VLP Setup Wizard effortlessly guides the user through the entire process.

The setup process defines the operating boundaries by establishing a minimum and a maximum VLP point. By defining the minimum and maximum points, VLP creates an operating domain within the drive that is directly and proportionately related to the specific system to which it is connected.



Once VLP points have been established, the Plus Pack performs the following functions:

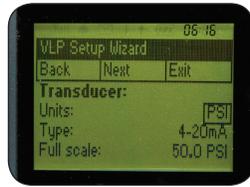
- **Monitor Multiple Systems** for Friction Losses, Impeller Variations, & Other System Variables
- **Adjust System** Accordingly to Ensure Only Necessary Pumps/Fans are Operating
- **Balances Flow Rates** for Each Operating Pump/Fan Under All Conditions
- **Maintains Same Load** for All Operating Devices

## > SIMPLE STARTUP AS IT'S NEVER BEEN SEEN BEFORE

Toshiba stands at the forefront of innovation with our remarkably intuitive and user-friendly startup. In fact, out-the-box, the Plus Pack is only minutes from complete configuration and optimizing your system's performance.



**STEP 1:**  
Input Motor's Electrical Specifications



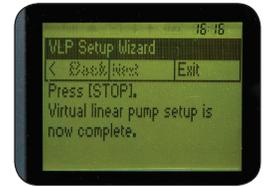
**STEP 2:**  
Input Transducer Specifications



**STEP 3:**  
Input VLP Maximum



**STEP 4:**  
Input VLP Minimum



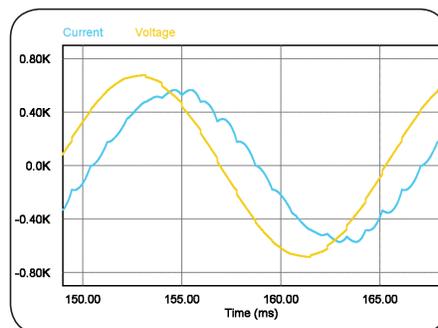
**STEP 5:**  
Complete VLP Setup

### Software Features Include:

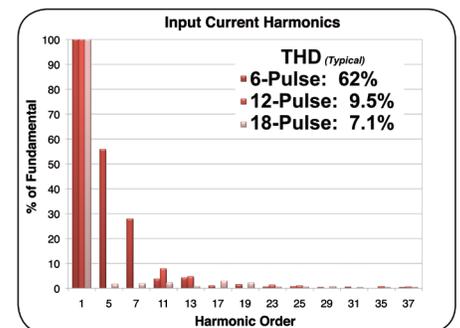
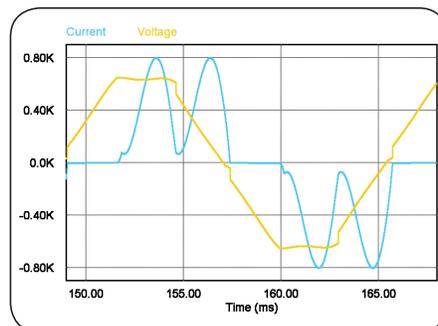
- ▶ **Start & Stop Points** determine when to start and stop the pump based on user-set values and system feedback on pump water levels. These points work with a delay timer to ensure that frequent fluctuations in the system feedback do not unnecessarily start and stop the pump.
- ▶ **A Sleep Timer** shuts off the pump/fan in order to reduce energy consumption and prolong the lifespan of the equipment after it has run at the VLP minimum for a user-specified amount of time.
- ▶ **A Run External Devices Feature** turns on external booster pumps/fans to support the primary system, as needed, to increase energy savings and minimize system failures.
- ▶ **A No-Flow/Low NPSH Cut Off Feature** stops the pump once loss of feed water or a closed output valve has been detected to protect against cavitation.
- ▶ **A Sealing Water/Vacuum Priming Feature** automatically controls and improves system reliability by monitoring water flow and water level and starting the pump once water flows through the seal or the pump is full of water.

## > PATENTED 18-PULSE AUTOTRANSFORMER TECHNOLOGY

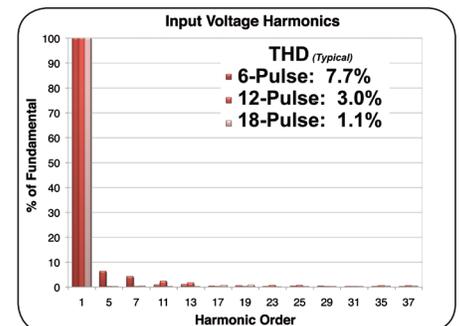
In order to reduce harmonic injection to the utility, the Plus Pack is available in 12-pulse and 18-pulse diode front-end designs. The 12-pulse drive can achieve a typical current Total Harmonic Distortion (THD) of 9% and must be used with a conventional drive-duty phase-shifting isolation transformer. The 18-pulse Plus Pack is furnished with built-in phase-shifting patented auto-transformer technology which eliminates the need for complicated cabling and allows for a perfect blend of reliability, cost savings, and a reduced footprint.



**INPUT WAVEFORMS**



**INPUT HARMONIC SPECTRUM**



## ➤ ADVANCED DESIGN FEATURES ENHANCE RELIABILITY

The Plus Pack has a variety of features that make this unique drive an ideal solution for a wide variety of applications requiring unparalleled motor control and rugged reliability.



- ▶ **Non Air-to-Air Heat Exchangers** eliminate the maintenance issues associated with refrigerant-based cooling units while preventing air exchange between air outside and inside the cabinet.
- ▶ **A Non-Ventilated Design** incorporates heat sinks out-the-back, heat exchangers, and gasketed doors which protrude from the back of the cabinet and are cooled by front-removable centrifugal fans.
- ▶ **Heat Exchanger Technology** is utilized to remove residual internal cabinet heat instead of relying on refrigerant-based cooling systems and is an unparalleled solution used to increase a cabinet's heat dissipation while minimizing footprint.
- ▶ **A Closed-Loop Air Cooling System** maintains a clean and sealed internal environment and ensures optimum performance and maximum life of electronic components, while protecting against external contaminants and humidity.

## ➤ COMMUNICATION OPTIONS

Toshiba's Plus Pack supports many common industrial communication protocols. These include:

- Modbus TCP
- Ethernet IP & TCP/IP
- DeviceNet
- Modbus RTU
- Modbus Plus
- Profibus DP

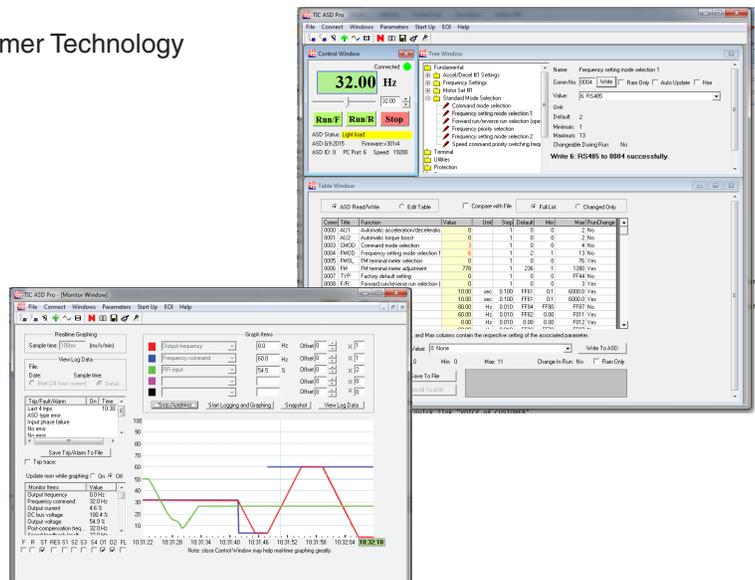
## ➤ ADDITIONAL OPTIONS

The Plus Pack can be supplied with additional options to expand control, allow greater flexibility, and provide better protection for a user's application. These options include:

- 12-Pulse Input Rectifier
- 18-Pulse Input Rectifier with Patented Auto-Transformer Technology
- Stainless Steel Enclosure
- Raycap Input Voltage Surge Suppressors
- Output Sinewave Filter

## ➤ OTHER SPECIAL FEATURES

- Toshiba's Proprietary Windows®-Based ASD Pro Software
- NEMA 1 & NEMA 3R Enclosures



## > APPLICABLE APPLICATIONS

- Blowers
- Centrifugal Pumps
- Conveyors
- Crushers
- Compressors
- Centrifuges
- Fans
- Lift Stations
- Water Towers

## > APPLICABLE INDUSTRIES

- Chemical
- City Municipality
- Food
- Industrial Marine
- Petroleum
- Power Plant
- Irrigation
- Mining & Mineral
- Oil & Gas
- Paper
- Water/Wastewater

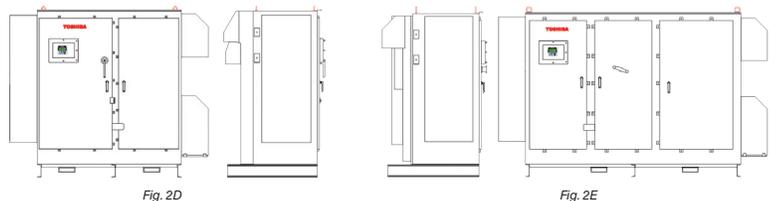
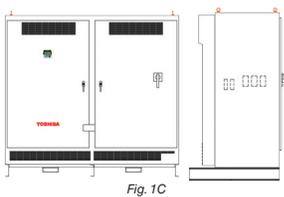
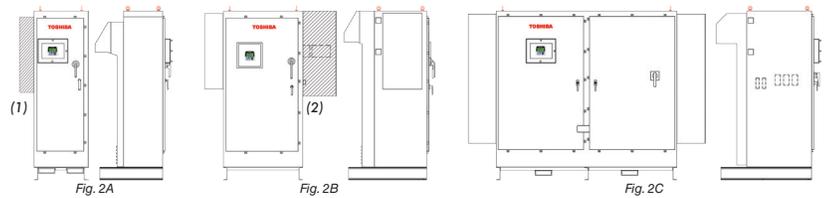
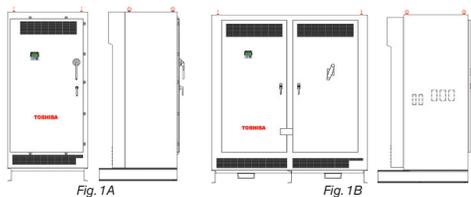


## > DIMENSIONS

Nominal HP (460 V)	60	75	100	150	200	250	350	400	500	600	700	800	900	1000	1200	1400	1500						
Drive Rating (A)	79	100	133	196	241	313	469	546	623	722	842	980	1121	1203	1443	1684	1804						
<b>NEMA 1 6-Pulse 12-Pulse</b>	H	81.5 in.										82.5 in.											
	W						37.0 in.					72.0 in.					84.0 in.						
	D	—										40.0 in.								46.0 in.			
	Figure	1A										1B					1C						
	Weight	1200 lbs.					1500 lbs.					2000 lbs.					3500 lbs.						
<b>NEMA 3R 6-Pulse 12-Pulse</b>	H	81.5 in.										82.5 in.											
	W	25.0 in.		31.5 in.		46.0 in.			61.0 in.			90.0 in.					110.0 in.						
	D	35.0 in.					42.0 in.					48.0 in.											
	Figure	2A					2B					2C											
	Weight	1000 lbs.					1200 lbs.			1500 lbs.			2000 lbs.					3500 lbs.					
<b>NEMA 3R 18-Pulse</b>	H	81.5 in.																					
	W	70.0 in.					93.5 in.					130.0 in.											
	D	35.0 in.					44.0 in.					46.5 in.											
	Figure	2D										2E											
	Weight	2550 lbs.					3950 lbs.					5800 lbs.											

### NEMA 1

### NEMA 3R



<b>MODEL RANGE</b>	<b>60 to 1500 HP</b>
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Voltage Rating	380 to 480 V
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### POWER REQUIREMENTS

Input Tolerance	Voltage: $\pm 10\%$ ; Frequency $\pm 2\%$
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Output Frequency	0 to 299 Hz
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### CONTROL SPECIFICATIONS

Control Method	Sinusoidal Pulse-Width Modulation (PWM) with VLP Technology
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Voltage Regulation	Main Circuit Voltage Feedback Control: Automatic, Fixed, & Off
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V/Hz Control	Constant Torque, Variable Torque, Automatic Torque Boost, Sensorless Vector Control, 5-Point V/Hz Custom Curve, & PG Feedback Vector Control
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PWM Carrier Frequency	Adjustable 0.5 to 15 kHz (For Drive Specific Information Consult Factory)
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Frequency Setting	Rotary Encoder Integrated into EOI, 0 to 10 VDC, $\pm 10$ VDC, 4 to 20 mA, Digital Input, Binary Input, & Motorized Potentiometer Input
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Frequency Precision	Analog Input $\pm 0.2\%$ of Maximum Output Frequency; Discrete/Communications Input $\pm 0.01\%$ of Maximum Output Frequency
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Speed Regulation	Open Loop: Up to 0.1%; Closed Loop: Up to 0.01%
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Main Protective Functions	Overcurrent, Overvoltage, Inverter Overheat, Load-Side Short Circuit, Ground Fault, ASD Overload, Communications Error, Auto-Tuning Error, Emergency Stop, Undervoltage, Overtorque, Open-Output Phase, Motor Overload, Low Operating Current, Option PCB Error, & Gate Array Error
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Retry	User-Set Number of Retries for Automatic System Restart After Trip
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Restart	Able to Smoothly Catch Freewheeling Motor (Bidirectional)
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Overload Current Rating	100% Continuous; 120% for One Minute
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### CONTROL INTERFACE

Digital Input	Eight Discrete Input Terminals Programmable to 68 Functions
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Digital Output	Three Discrete Output Terminals Programmable to 64 Functions; Two Form-A Contacts, One Form-C Contact
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Analog Input	Three Programmable: One 0 to 20 mA or 0 to 10 VDC Input, One 0 to 10 VDC Input, & One $\pm 10$ VDC Input
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Analog Output	Two Programmable: Both 4 to 20 mA Output
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Communication Ports	Half/Full Duplex RS485/RS232 & TTL Port
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### VLP TECHNOLOGY FEATURES

Start & Stop Points	Determine Start/Stop Based On User-Set Values, Transducer Feedback Signal, & Programmable Discrete Input Terminal; Work with Delay Timer to Ensure Pump Does Not Start/Stop Too Frequently Due to Unstable/Fluctuating Input Signal
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Sleep Timer	Shuts Off Pump After Running for User-Specified Time at VLP Minimum
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Run External Device	Turns on External Booster Pumps to Support Primary Pump Only when Necessary
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No-Flow/Low NPSH Cut-Off	Stops Pump Once Loss of Water Feed or Closed Output Valve has been Detected
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Sealing Water/Vacuum Priming	Monitors Water Flow/Water Level & Starts Pump Once Water Flows Through Seal Or Pump is Full of Water
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### ELECTRONIC OPERATOR INTERFACE (EOI)

Display	4x20 Graphical Plain-English Back-Lit LCD Display for Programming, Monitoring, & Diagnostics
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LED Indicators	Run (Red)/Stop (Green), Hand (Green), & DC Bus Charge Indicator (Red)
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Keys	Hand/Auto, ESC, Run, Mode, & Stop/Reset
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Monitoring	Frequency Command Screen; Multiple Parameters Displayed: Output Current, DC Voltage, Output Voltage, Run Time, VLP, Motor Load, Motor Overload, ASD Load, Output Power, RR Input, V/I Input, RX Input, RX2 Input, & AM/FM Output
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### CONSTRUCTION

Enclosure	ANSI-White; NEMA 1/NEMA 3R; Free-Standing; Front-Access Only
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Power Cables	Top/Bottom Access for Input/Motor Cables
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Cooling	Forced-Air Cooled; Heat-Sink Out the Back; Heat Exchanger
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Standards & Compliances	IEEE, UL Listed in US & Canada, NEMA, NEC, & American Recovery & Reinvestment Act Compliant (ARRA)
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### AMBIENT CONDITIONS

Ambient Temperature	-10 to 50°C (-10 to 40°C for 500, 1400, & 1500 HP)
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Altitude	4500 ft. Above Sea Level (Higher Altitude with Derating)
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Humidity	95% Maximum (Non-Condensing)
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Installation	Indoor/Outdoor; Protect from Corrosive Gases
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#### TOSHIBA INDUSTRIAL PRODUCTS:

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

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