



Your Investment in Productivity

Why is the TSi Static Power Conditioner your **best investment** in boosting machine performance and productivity?

Equipment are Under Threat

- Industrial equipment are susceptible to break downs & malfunctioning due to **poor power quality** accompanied with voltage fluctuations, sags, surges, spikes & electrical noises:
 - CNC machines
 - Micro-processor based machines
 - IT equipment with AC input switch-mode power supplies
 - Rectifier chargers and UPS
 - Air-conditioning equipment
 - Process control & monitoring equipment

Industries are Under Threat

- Industries, most affected in following sectors, lose millions of dollars in burnt cards, downtime & productivity loss, consequent upon electronic equipment break-downs & malfunctioning due to **power quality issues**. Most affected industries are in the following sectors:
 - **Telecommunication**
 - **Information Technology**
 - **Office, Commercial, Residential spaces**
 - **Defense & Radar**
 - **Automotive**
 - **Textiles**
 - **Engineering**
 - **Medical, Diagnostic & Pharmaceuticals**
 - **Process industry**

Why is the threat growing?

- Developing countries have an insufficient infrastructure for the generation and distribution of electricity.
- Too many users are competing for the limited power with primitive distribution capacities, causing significant voltage fluctuations and power interruptions.
- The mains voltage could vary from +/- 10% to +/- 25% in many countries!
- Short duration sags could take the voltage down by -30% or more for up to 200 milliseconds!
- Standard AC drives, rectifiers & electronic controllers are not designed to withstand such a wide input voltage window.
- The likely result is lesser reliability and/or the possibility of equipment failure, leading to unscheduled downtime; and increased costs for maintenance and repair.

Need for the **next generation** of power conditioning

The right solution is in using a highly reliable, maintenance free, fast correcting Automatic Voltage Regulator, coupled with a suitable spike & noise filter.

What would the next generation be like?

- The old generation, aka Servo-motor based or tap-switching type AVRs have a very slow response time and inherent performance limitations. They have become obsolete for sensitive load equipment using solid-state devices, because of their inability to control sags, sudden fluctuations, transients & noises.
- The use of expensive UPS for power conditioning leads to major investment and even more power losses.
- **The next generation would be smarter and economical.** Everything that no Servo or UPS can ever provide!

TSi VRP the ideal Line Conditioner

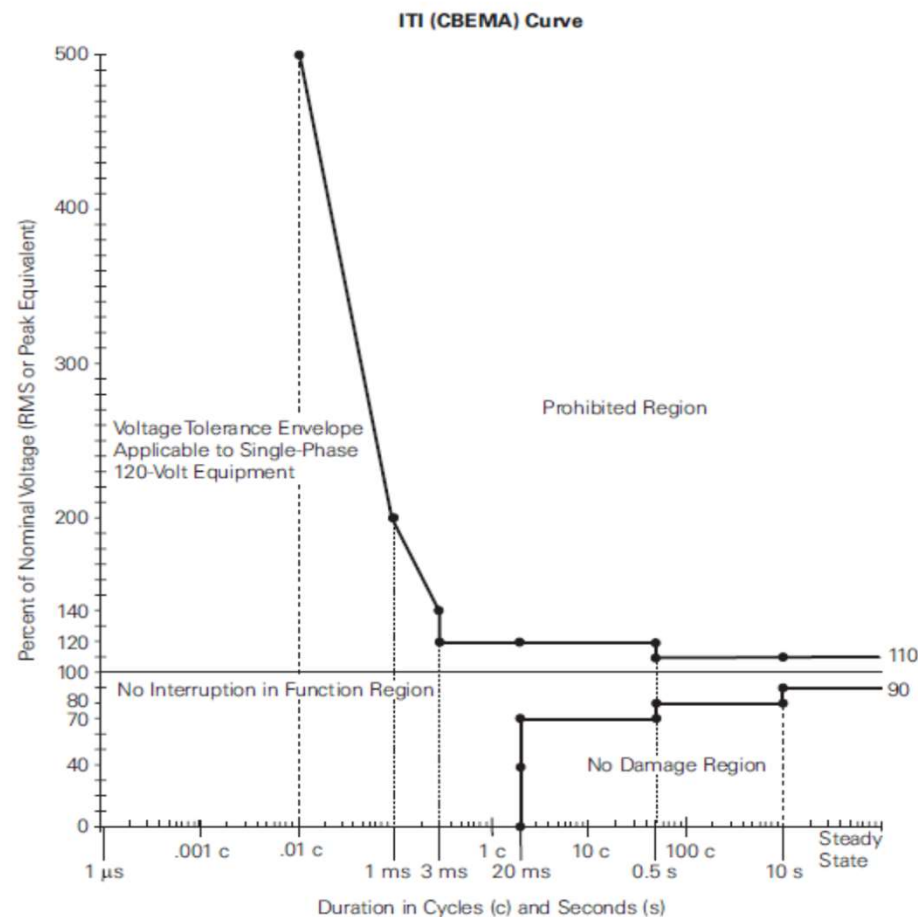
- VRP provides **real-time, precision control** of:
 - Voltage Fluctuations
 - Sags
 - Surges
 - Spikes
 - Electrical Noises
- Voltage is corrected instantaneously, with a **20 millisecond response-cum-regulation time** thus keeping the voltage cycle uninterrupted! There is no switching of taps or any other breakage in the power path.
- Its high frequency insulated gate bi-polar transistor (IGBT) driven converter takes the incoming AC power, measures against the nominal voltage and adds/subtracts voltage, to achieve precisely regulated 230 VAC output.

The **20 milliseconds** voltage correction magic time!

This ensures any fluctuation, how-so-ever sudden, any sag or any surge in voltage is corrected wave-to-wave, on real-time basis, so as to maintain voltage profile as per ITIC curve, which forms the basis of electronic components design worldwide. Ensures pure power desired by electronic components to keep performing.

Other AVR technologies take anywhere from 200~3000 mS (0.2~3 seconds) before voltage gets corrected, hence they can NEITHER control sag cycles NOR surge cycles.

This **20 milliseconds** voltage correction magic time tunes with a **surge, spike & noise filter** to bring output voltage within ITIC curve. **Vow, pure power for your electronics!**

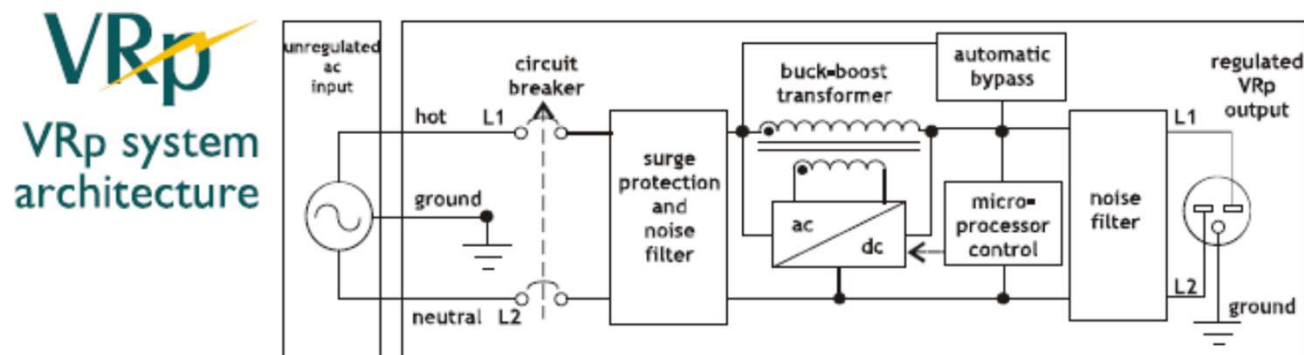


The same technology of **20 milliseconds** voltage correction magic time which saves customer's valuable electronics also provides ITIC curve power to our own IGBT regulation engine! **Vow, high reliability for our electronic card too!**

The voltage regulation engine of VRP is located on its output, hence energized by the output power, unlike a servo stabilizer, whose dimmers are energized by the input power. Please see VRP system architecture below.

Because the VRP provides output power conforming to ITIC curve, therefore its own IGBT regulation engine gets the same output power which keeps it performing at highest reliability. Thereafter, the same conditioned power also energizes user's equipment, thus providing high reliability to all electronics energized by VRP.

Very interestingly, therefore, our design is centered around providing highest quality power to reliably run both our own electronic card as well as customer's expensive electronic machines.



Up to $\pm 1\%$ Realtime Output Voltage Stability

- Superior protection for all your IT equipment involving sensitive electronics
- Ideal for all electronic control panels involving ac/dc drives
- Minimized step voltage changes

Tap-changer AVR's typically provide only $\pm 5\%$ to $\pm 10\%$ output voltage stability. Servo AVR's can provide $\pm 1\%$ regulation only under steady state conditions of voltage. These become unstable under sudden voltage fluctuations & can not regulate within $\pm 1\%$ till the voltage correction cycle is complete.

Overload Capacity

- Upto 200% (for 10 cycles or 200 ms)
- Ideal for starting switch-mode supplies, rectifiers, air-conditioners, motors, X-ray machines and other loads with high inrush currents
- VRP does not have to be oversized
- VRP can comfortably handle regenerative loads as well.

Some AVRs have difficulty with motors, air-conditioners and other loads with high start-up current requirements. Servo AVR's become very unsteady under regenerative loads.

Reliability

- VRP has no moving parts
- VRP has few PCBs
- VRP has few interconnections
- In the unlikely event of a card failure, VRP has a fast automatic bypass which will keep the mains supply on, within a pre-set voltage cut-off range, free of surges/spikes & noises, as long as needed.

Servo AVR's require frequent brush replacement. Big problem if brush gets jammed. Tap-switching AVR's are quite complicated with too many parts and interconnections. Tap-switching AVR's are quite unpredictable during zero crossovers under inductive loads, which are present at cell sites. Both types need separate manual bypass systems in case of failure, resulting in unscheduled shut-downs.

Comparison of Servo v/s VRP

Limitations of existing technologies	Advantages with VRP
<p>SCR/ Relay Stabilizer switches the power path & has frequent failures due to inductive loads, causing site reliability issues.</p>	<p>VRP does not switch power path & handles any nature of loads/ regulations.</p>
<p>Servo stabilizer is an electro-mechanical device, with a limited correction speed. It is unable to offer real-time control of sudden voltage fluctuations & brown-outs</p>	<p>VRP technology corrects the harshest fluctuations instantaneously (within 20 milliseconds), so no brown-outs, no sags, no surges. Ideal condition for modern electronic machines.</p>
<p>Servo stabilizer brushes produce micro sparks, causing electrical noises, often necessitating an Isolation Transformer on its output</p>	<p>VRP is all solid state, there is no switching or sparking inside it, therefore its output is always free of electrical noise, so no need of an additional IT.</p>

Comparison of Servo v/s VRP

Limitations of existing technologies	Advantages with VRP
<p>Servo stabilizer does not have inbuilt surge & spike control ability.</p>	<p>VRP has inbuilt class II surge filter which ensures that any surge, spike or noise from the supply side is eliminated at the VRP input itself.</p>
<p>Due to dust accumulation, wear & tear of its moving parts, servo stabilizer is maintenance-prone.</p>	<p>VRP has very simple design, all solid state construction & no such maintenance issues.</p>
<p>Servo stabilizer gives high voltage overshoots in boost mode during mains outage/SAG cycles, thus damaging precious equipment & causing nuisance trips.</p>	<p>Due to instantaneous voltage correction, VRP never lets a SAG event persist & never generates an output surge during power cycling.</p>

Comparison of Online UPS v/s VRP

Stung by the failure of old technologies, & unaware of VRP technology, many electronic machine users have started using expensive online UPS as a power conditioner, even though power back-up is not mandatory. Here's why VRP is the most cost effective alternative to Online UPS:

Disadvantages of using UPS as a power conditioner	Advantages with VRP
Though online UPS is an all solid state technology, its entire throughput power goes through double conversion. Hence <u>low efficiency (typically 90%) & high OPEX.</u>	VRP is also an all solid state technology, but only the compensating power goes through double conversion, hence <u>much higher efficiency (typically 97%) & low OPEX.</u>
Due to double conversion of entire throughput power, online UPS comes out to be huge in size and very expensive, hence <u>high CAPEX.</u>	With double conversion of only compensating power, VRP is extremely compact and much smaller in size, hence <u>low CAPEX.</u>
Unable to handle regenerative loads.	Any type of loading is possible.

Our success story...

Since 2002, over **30,000 TSi products** are installed in Africa, India, Asia, North America.

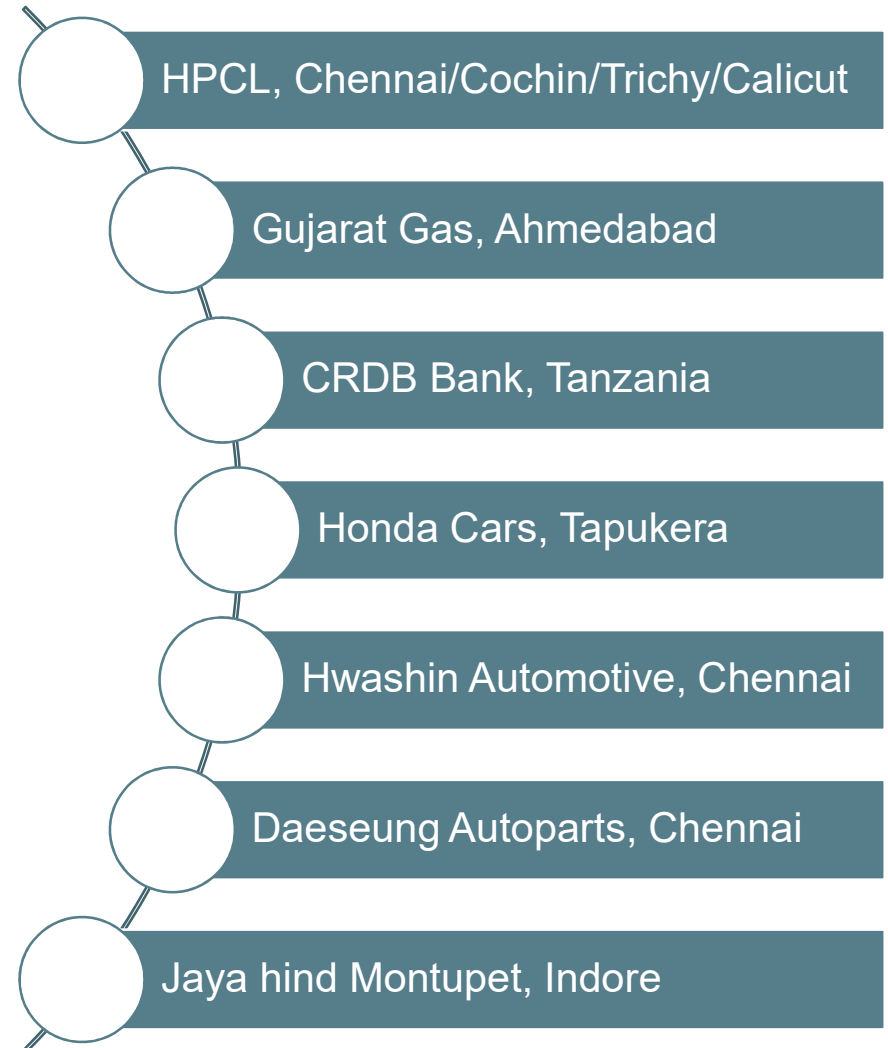
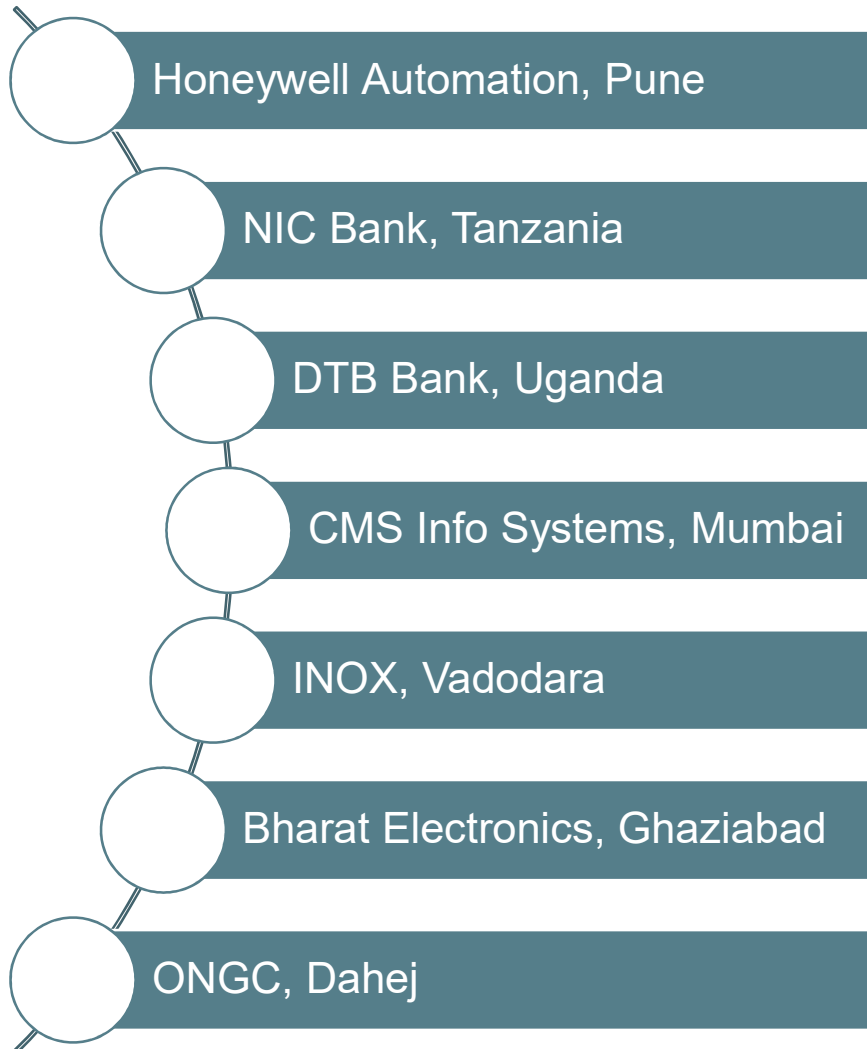
Since 2011, TSi-VRP units for Asian & African markets are manufactured and supplied from **Indian operations**.

Over last five years in India, topmost Indian & International companies in Automation, CNC, Engineering, Automobiles, Robotics, Textiles, Wood-working, Plastic Processing, Printing, Pharmaceutical, Oil & Gas verticals, IT have discovered the many benefits of powering modern machines with TSi- VRP and are hooked to this technology for reduced downtime, reduced card failures & increased productivity.

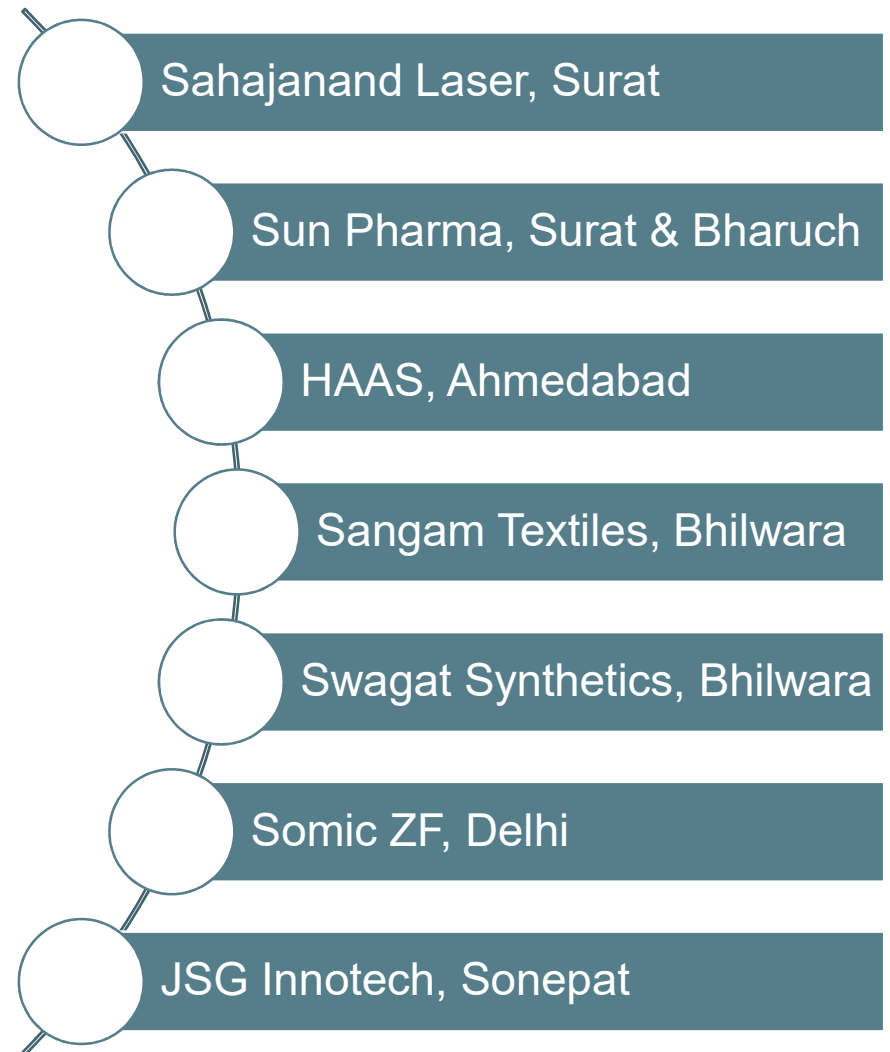
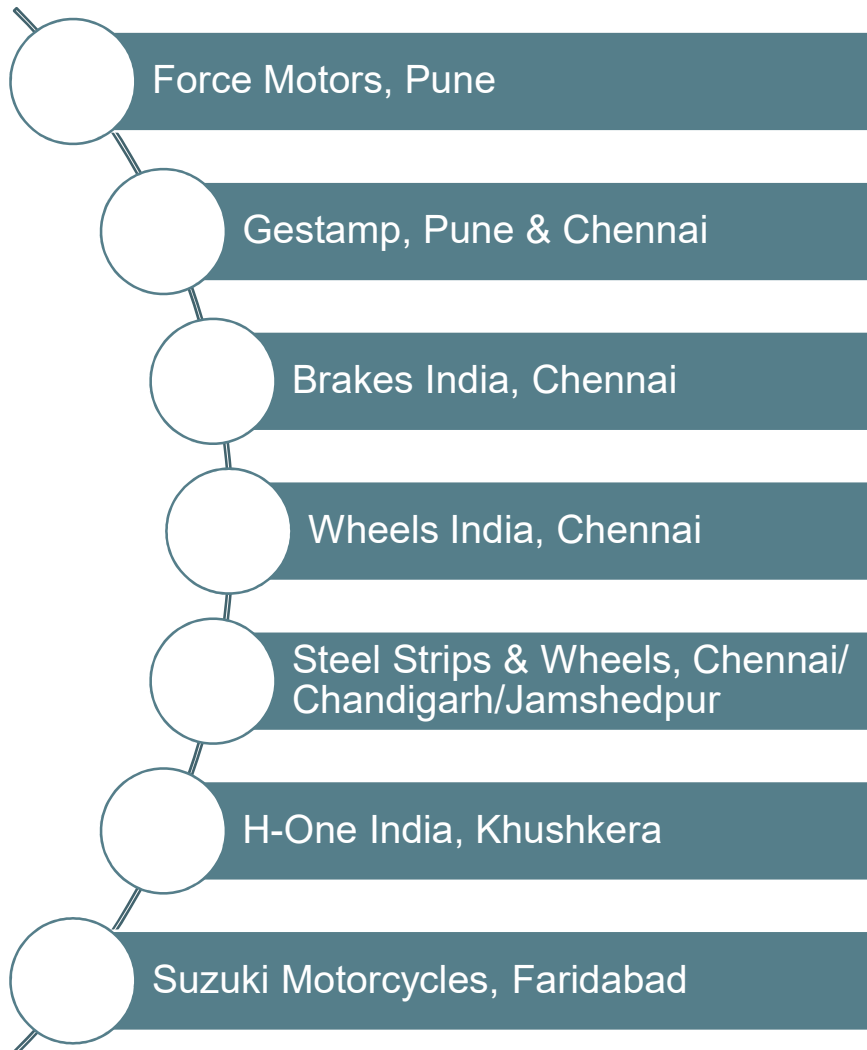


Sensitive Robotics running seamlessly at **Hyundai**, with the TSi VRP.

Few major customers who have adopted VRP technology



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