



International

Precision voltage regulator

Isolation transformer

**VRp-ILc model**

**16500-0338**

16.5 kVA  
16.5 kW  
input - 4 wires  
400 vac delta  
output - 5 wires  
230/400 vac wye  
three phase

# Precision PWM Automatic Voltage Regulator with Isolation Transformer, Automatic Bypass and Automatic Cutoff

Continuous fast and no-break PWM regulation

TSi Power's VRp-ILc automatic precision voltage regulator with built-in low-impedance isolation transformer allows trouble-free operation of electronic equipment over a very wide mains ac voltage range of 400V +/-20% (+/-30% for short durations) found in many developing countries.

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There is no switching of taps or otherwise a break in the power path thanks to continuous PWM (Pulse-Width-Modulation) switching of a buck-boost transformer primary winding.

## Typical VRp-ILc applications

Designed for applications where absolutely safe and precisely regulated ac power is required, such as outdoor mobile telecommunication, TV/radio broadcasting or industrial equipment.



## Key features of the VRp-ILc Series precision automatic voltage regulator with isolation transformer

- Outstanding voltage regulation: under normal input range of 400vac +/- 20%, output voltage will be 230vac +/-1% (47 to 63Hz)
- No switching of power path and unit always starts up on sine wave zero crossing
- Over and under voltage cutoff, with automatic restart when ac mains voltage returns to normal (safe) condition
- Failsafe: automatic bypass (even during bypass, the over/under voltage protection is active)
- Lightweight design
- Three separate low-impedance isolation transformers (one per phase) are used for maximum reliability
- Coordinated surge protection per IEC61312
- Common-mode noise elimination
- Advanced noise and interference filter reduces dV/dt from 6kV/μS to less than 10V/μS
- IP20 rated enclosure with two separate compartments
- Two year warranty



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## VRp-ILc



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PWM voltage  
regulator  
with isolation  
transformer

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### Key VRp-ILc benefits

The lightweight, high efficiency VRp-ILc is easy to install in indoor environments. The unit comes in a specially designed IP20 rated enclosure with thermostatically controlled fans and has removable lifting eyes to enable use of lifting equipment.

The automatic bypass assures that connected equipment will not shut down, even if VRp-ILc fails. VRp-ILc is compatible with all loads as it does not switch any components in the power path. VRp-ILc's ultra-low impedance assures stability even with the most demanding loads.

The automatic over-voltage/under-voltage cutoff with automatic restart ensures that operation is off-line during serious over-voltage or under-voltage situations that could damage the system and/or load, and then restarts without intervention when the ac mains voltage becomes within the operating range.

The ILc isolation line conditioner components provide maximum equipment protection against surges, spikes and transients, for higher equipment reliability and maximum equipment operating life. In addition, improved repeatability, fewer reboots or system lock-ups. In addition, a reduction in equipment down time and service costs can be expected.

TSi's use of three separate transformers, one per phase, minimizes the dangers associated with single phasing or lost phase problems associated with a three phase transformer built on a common (single) core.

Maximum transformer and regulator performance, reliability and lifetime is achieved by a design with no moving mechanical parts other than cooling fans.

### How the VRp-ILc Series works

The VRp-ILc unit is comprised of a VRp section - an automatic precision voltage regulator, and an ILc section - an isolation line conditioner, each in its own separate compartment.

The high frequency IGBT driven converter microprocessor takes the incoming ac power, measures against the nominal voltage and adds or subtracts voltage, 20,000 times per second, to achieve precisely regulated 230/400 vac three phase output, cycle by cycle. Voltage correction times do not exceed 1 cycle, or 20 milliseconds for all mains ac voltage changes, even for instantaneous voltage changes from 160 to 300vac or from 300 to 160vac.

The automatic bypass will be activated when there is a fault condition. Three LEDs display unit status, the Green LED indicates Normal (regulating protected mode operation), Yellow LED indicates Bypass (non-regulated output), and the Red LED indicates a Fault condition.

The over-voltage and under-voltage cutoff is activated whenever the ac mains input voltage becomes dangerously high or low (>300 vac or <160 vac). It automatically restarts whenever ac mains voltage is restored within <300 vac and >160 vac.

Three separate low-impedance isolation transformers provide complete isolation between the primary and secondary, and permits bonding its output neutral to ground, which completely eliminates all disturbances between neutral and ground.

The leakage inductance of the isolation transformers, in combination with capacitive elements and MOVs, provide superb noise filtering, as well as coordinated multi-stage surge protection in accordance with the principles of IEC-61312.

High reliability cooling fans control the unit's internal temperature, with intake and exhaust through vents on sides of the unit.

# VRp-ILc



Front-right side view

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TSi's ongoing product improvement process makes specifications subject to change. Other companies product names herein are for identification purposes only, and may be trademarks of their respective companies.



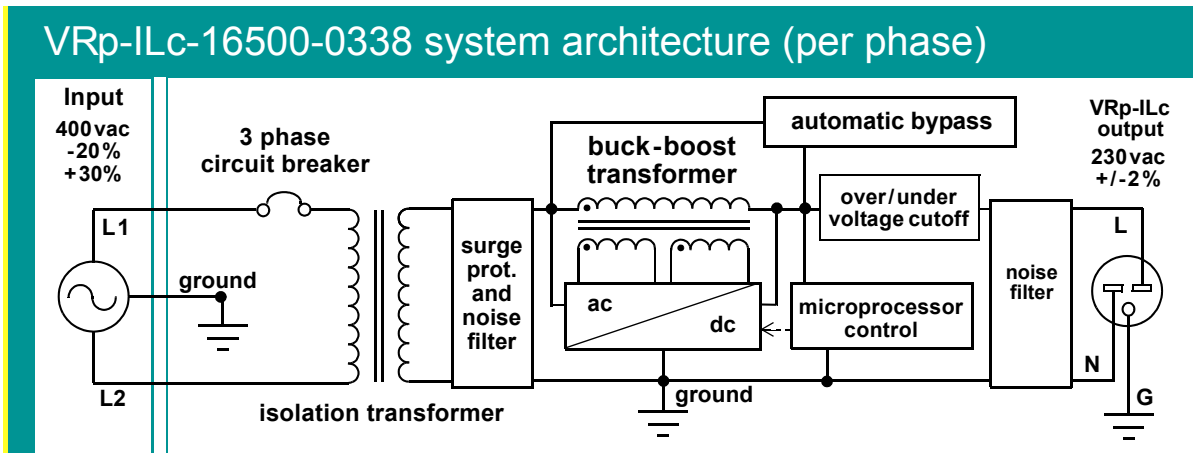
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Specification	VRp-ILc-16500-0338
<b>Electrical</b>	
Capacity in VA (watts)	16.5kVA (16.5kW)
Regulator technology	High frequency 20kHz IGBT driven voltage regulation converter. Pulse width modulated (PWM) ac to dc converter and dc to ac topology.
Transformer type	Three separate isolation transformers are used (one per phase).
<b>Input</b>	
Nominal voltage	Three phase delta: 400 volts ac
Normal operating range	Range: 400 vac, +/-20%. Short duration (less than 5 minutes) operation 400vac, +/-30%.
Nominal frequency	47 to 63 Hz
Input circuit breaker	Input circuit breaker (150% overload capability for heavy start load).
Over-under voltage cutoff with auto-restart	Over-under voltage cutoff activated when >300vac or <160 vac, with automatic restart when voltage becomes <300vac and > 160vac.
Circuit breaker rating	3 x 40 amps (ganged)
Input wire size	10mm <sup>2</sup> (8AWG)
Ac connection	Terminal block (L1, L2, L3 and ground wires) provided.
<b>Output</b>	
Nominal voltage	Three phase wye: 230/400 volts ac
Power efficiency	Better than 93% (at 400V input)
Voltage regulation	Factory set at 1%, long-term stability: <2%.
Relaxed Voltage regulation	230/400vac +/- 10% (over input range of 400vac +/- 30%)
Automatic bypass	Automatic bypass will be activated when there is a fault condition.
Safe start	Unit starts on sine wave zero voltage crossing point upon turn-on. Unit is fully functional/regulated within 5 seconds of mains restoration.
System status indicators (per phase)	System status LED's provided as follows: Green LED (blinking) indicates Normal (regulating mode operation); Yellow LED (blinking) indicates Bypass (non-regulated output); Red LED indicates Overload (system may shut down).
Surge protection	A three-stage surge protection system consisting of isolation transformer, capacitor and MOV is included.
Surge test conditions	Class 2 and Class 3 simulated lightning surge (Combination wave) Per ANSI/IEEE C62.41-1991, Cat. C test waveform: 6kV, 3kA, 8x20µS
Surge let-through voltages (system will continue to operate without interruption under these conditions)	Single pulse: L-N: 50V, L-G: 50V, N-G: 0.5V Ring wave: L-N: 20V, L-G: 20V, N-G: 0.5V Combination wave: L-N: 250V, L-G: 250V, N-G: 0.5V The measured rate of voltage rise/fall (dV/dt of the remnant waveform is less than 10V/µS with input test waveform dV/dt of 6kV/µS
Common mode filtering	Neutral-ground bond eliminates all noise or voltage on neutral (<0.5V)
Normal mode filtering	A built-in inductor-capacitor filter attenuates EMI/RFI noise from output.
Ac connection	Terminal block (L1, L2, L3, neutral and round wires) provided.
<b>Physical</b>	
Dimensions	800mm(32")wide x 1300mm(51")high x 300mm(12")deep
Weight	276 kg(242 lbs)
Enclosure	IP20. Painted metal.
<b>Safety</b>	
Standards	Design ready to meet EMC standards.
<b>Environmental</b>	
Ambient temperature	-5° to +35°C(23° to 95°F) (Air conditioned).
Cooling method	Fan cooled (Ball bearing).
<b>Warranty</b>	
Warranty	Two year limited warranty, parts and labor.



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with low-impedance isolation transformer



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