

VRp-ILc-15000-5339 Three-Phase Precision AC Voltage Regulator (AVR) with Three-Phase Isolation Transformer Line Conditioner

Total 8 pages

INSTALLATION AND MAINTAINANCE INSTRUCTIONS

1. Introduction

The VRp-ILc automatic precision voltage regulator is designed and manufactured primarily for outdoor installation. The system has a built-in low-impedance three-phase Isolation transformer allows trouble-free operation of electronic equipment over a very wide mains ac voltage range of $400V \pm 20\%$. This highly engineered isolation transformer provides 100% isolation from the input AC line and the secondary neutral-to-earth bond eliminates all surge voltages between neutral and earth thus provide protection and noise filtering superior to conventional surge protection and filtering devices.



Figure 1a – external view of VRp-ILc-15000-5339

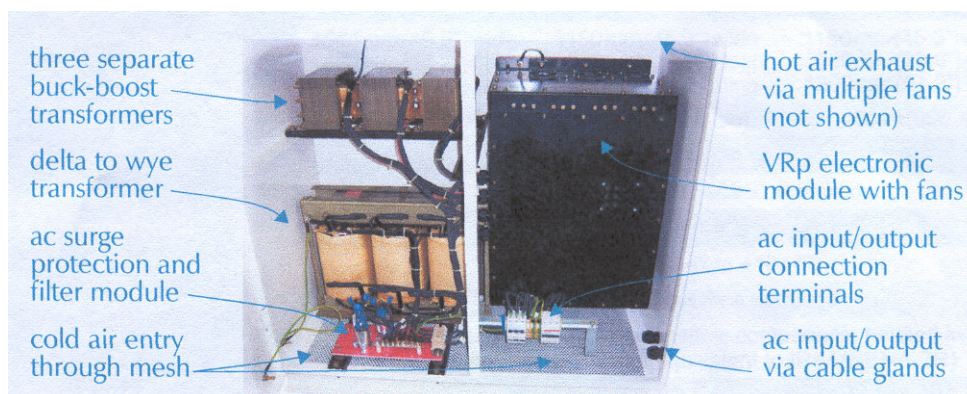


Figure 1b – internal layout of VRp-ILc-15000-5339

Before installing the VRp-ILc-15000-5339 please read and understand instructions and recommendation described in this document.

VRp-ILc-15000-5339 is designed and manufactured by Romarsh Ltd England in collaboration with TSi Power Corp. USA
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2. Inspection and Unpacking

Inspect the packaging for obvious damage caused during transit. Normally one pallet package contains up to 2 units. Each unit is individually steel banded and suitably padded. The palletized package is protected by outer protection material and shrink-wrapped for water ingress protection.

If no visible damages to the packaging are found, proceed to remove the shrink wrap. If a Stanley knife or a sharp knife is used then care should be taken not to scratch the immaculate paintwork of the cabinet.

Proceed to remove the side packing materials to expose the units. Use a suitable steel cutter or a metal snip to cut off the steel band. Care should be taken as the steel bands are highly tensioned and can retract very rapidly when snipped and cause injury.

To remove the unit one by one from the pallet, use a suitable lifting device which is capable of lifting 250kg. For safety you must note the following:

- (i) Lifting of the unit must be done using lifting slings/belts/straps. Two (2) lifting belts of suitable lifting weight capability (min. 125kg each) and suitable length (min. 3.5m) must be used. Each lifting belt should be positioned at the base of the unit such that each belt is located centrally between the base channels enwrapping the base. (see figure 2)
- (ii) Centre of gravity is not at the centre of the cabinet so lifting the unit using less than 2 lifting belts will cause the unit to tilt and may cause accident.
- (iii) Under no circumstances should the unit be lifted by other anchorage points on the cabinet.
- (iv) The unit, once lifted up, may swing. It is therefore important to make sure that sufficient space is provided and that collision with personnel or other units are avoided.

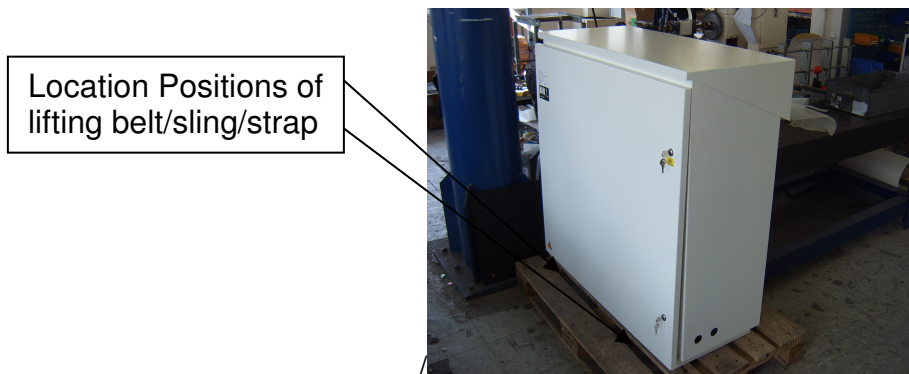


Figure 2 – Correct lifting point where lift belt should be positioned

If damages are found on the packaging and on the units, record the damages with photographic evidence and file claim with the freight carriers. Contact Romarsh or TSi if a replacement unit needs to be purchased.

3. Mounting

VRp-ILc-15000-5339 is designed to be installed for outdoor and should be mounted floor stand on a solid plinth, platform or metal frame structure with a minimum height of 200mm. The minimum height is required to provide (i) adequate clearance between the base of the unit and earth and (ii) to avoid water ingress from the base of the unit due to heavy rainfall/ground water/snow accumulation. The unit must be solidly fastened by 4 pre-drilled fixing points on the base metal channel. The fixing dimensions are 890 x 300 mm. The fixing holes diameter is 13mm suitable for M12 size bolt. It is recommended that stainless steel fasteners should be used to avoid corrosion and weakening of the mounting points.

WARNING: VRP-ILC-15000-5339 IS DESIGNED WITH FORCED AIR COOLING WHERE INLET OF AIR IS LOCATED AT THE BASE OF THE UNIT AND AIR OUTLET IS AT THE TOP REAR STEEL HOOD. IT IS IMPORTANT THAT THESE AIR INLET AND OUTLET AREAS ARE FREE FROM OBSTRUCTION. IF THE UNIT IS INSTALLED WHERE PLANT/VEGETATION GROWTH IS EVIDENT IT IS RECOMMENDED THAT SUITABLE TREATMENT SHOULD BE APPLIED TO INHIBIT PLANT GROWTH AT LEAST 1M AWAY FROM THE UNIT.

Once the unit is securely mounted you can now proceed to electrical inspection and wiring (section 4)

4. Electrical inspection and wiring

The ILc part of the VRp-ILc-15000-5339 consists of an input 3 phase isolation transformer, capacitors and metal oxide varistors (MOVs) and provides a three-stage surge protection tested to class 2 and class 3 simulated lightning surge (combination wave). The surge protection system is designed to supply anti-surge AC power to the VRp electronic module only.

Unlock the front panel door with keys and open it fully for electrical wiring. The keys are packed in an envelope marked “KEYS”. This envelope is securely attached externally on top of the enclosure.

WARNING: DO NOT CONNECT ANY OTHER POWER DEVICES TO INPUT OR OUTPUT OF THE ISOLATION TRANSFORMER (ILC). ANY UNAPPROVED MODIFICATION AND CONNECTION OF ADDITIONAL POWER DEVICES WILL INVALIDATE THE WARRANTY.

The VRp-ILc-15000-5339 requires a three phase 400V (L-L), 50Hz input supply (3 wire plus earth = 4 wire). The output of the ILc part provides a three-phase 400V (L-L), 50Hz isolated output with neutral and earth (5 wire)

The input stage (ILc part) uses a three-pole, 40A circuit breaker for current protection and is connected in series with the input. **THIS CIRCUIT BREAKER IS NOT AN ISOLATOR NOR DOES IT PROVIDE INPUT PROTECTION.** The VRp part has a three-pole, 40A circuit breaker on its output (see figure3a)

The ILc and VRp combination provide the necessary input/output protection.

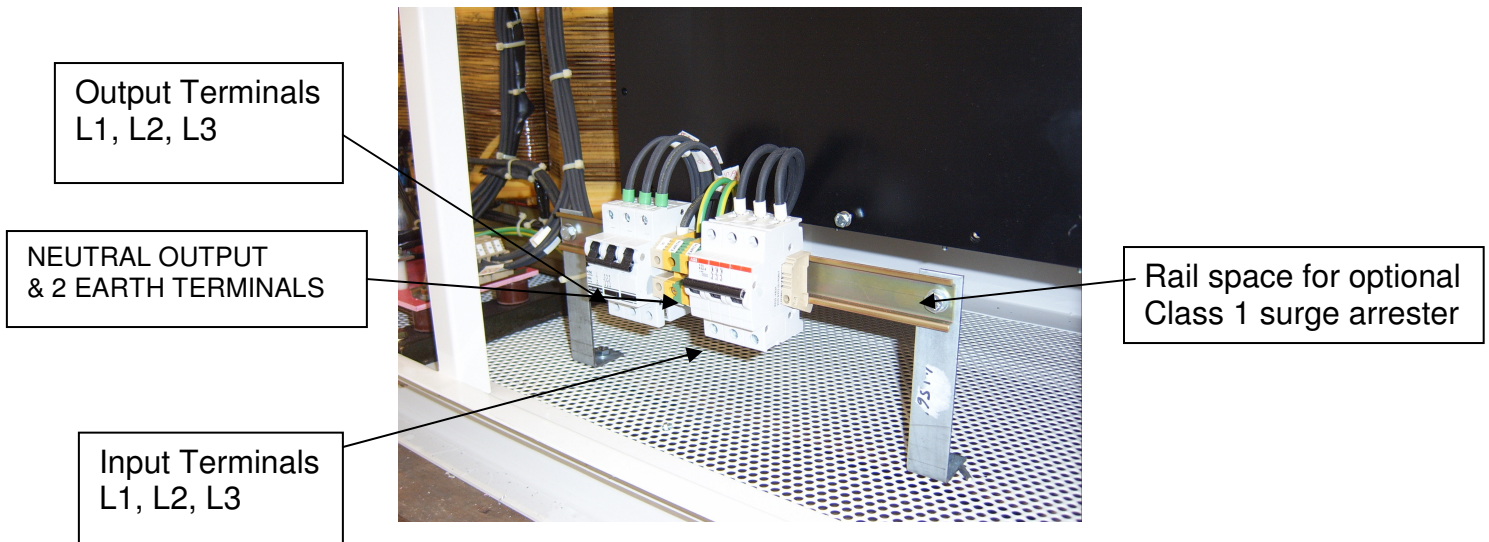


Figure 3a – Location of Input and Output circuit breakers, neutral and earth connection

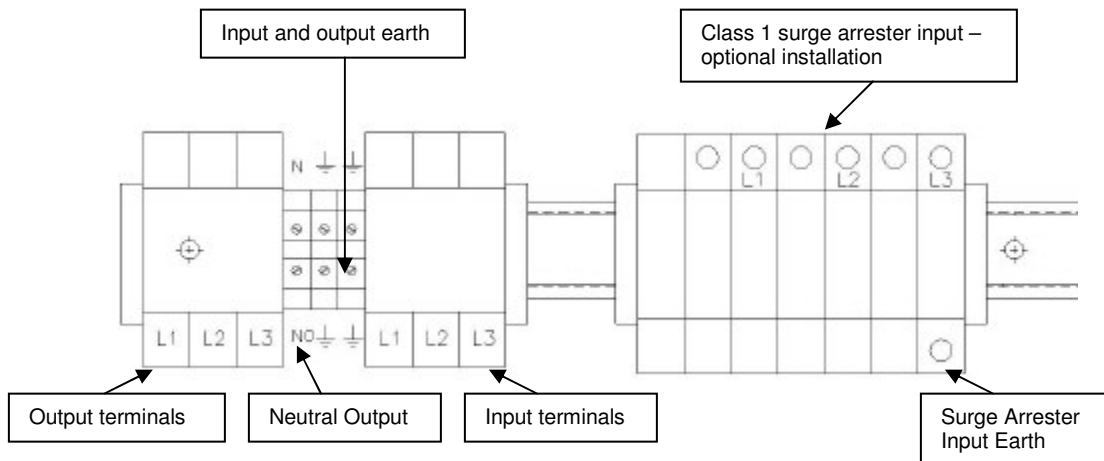


Figure 3b – Schematic diagram for Input and Output terminations with Optional connection with Class 1 surge arrester

WARNING: BEFORE COMMENCING WIRING ON THE INPUT TO IL_c PART MAKE SURE THAT VOLTAGE SUPPLY TO THE IL_c IS SWITCHED OFF. CONNECTION BETWEEN IL_c AND VR_p PART ARE FACTORY CONNECTED. YOU SHOULD ALWAYS FOLLOW LOCAL ELECTRICAL CODES AND PRACTICES WHERE THE UNIT IS INSTALLED

Input and Output cables are entered through two cable glands provided (see figure 4). The cable glands and lock-nuts are not installed and are supplied in a PVC bags attached to the transformer inside the cabinet. Both cable glands will accommodate up to one inch (1”) cable conduit (not supplied). This conduit must be used if compliance with North-American electrical standards is required.

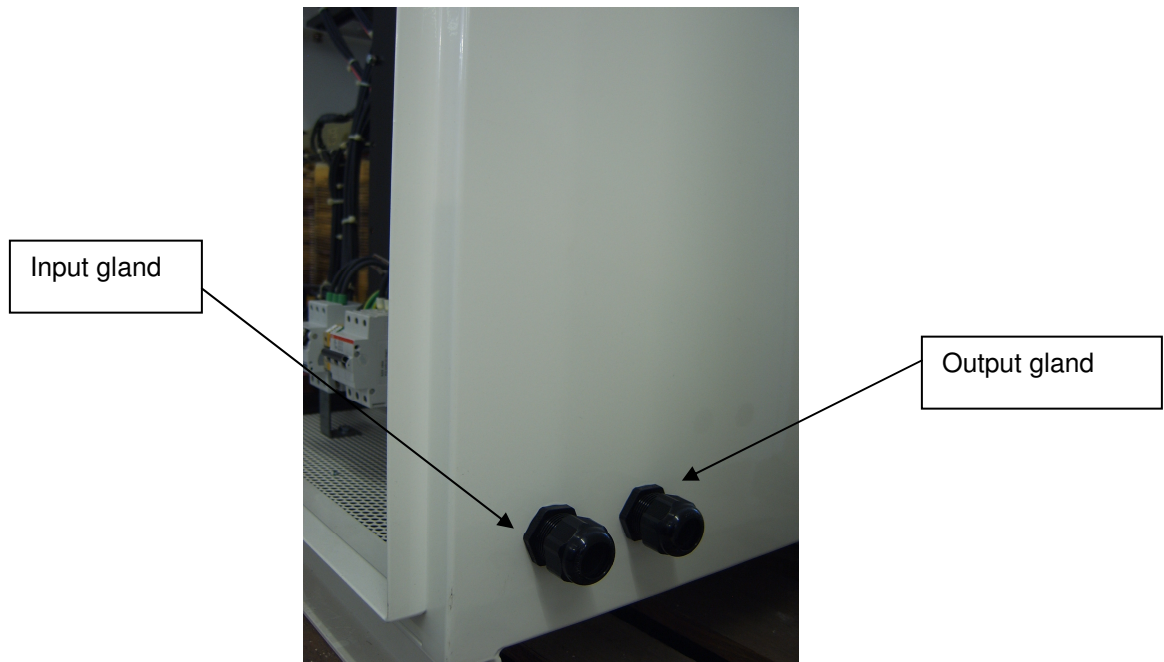


Figure 4 Location of Input and Output glands

It is recommended that minimum 6 square mm (AWG 10) cable size should be used. All conductors must be of the same size. TSi recommends stranded copper wire with a minimum 105°C insulation system. Note that three wires plus earth are required for the input and three wires plus neutral and earth are required for the output.

Insert wire through the strain-relief connectors. Ensure that there is enough wire length to reach the respective terminal, take care to leave enough slack. Strip approximately 3/8" (or 10 mm) insulation from the end of each pair of (5) wires. Input terminals marked L1, L2, L3, E as illustrated in Figure 3b.

Connect the 3 phase input cables to terminals L1, L2 and L3 such that L1 for phase A, L2 for phase B, L3 for phase C. The earth cable should be connect to terminal E. Carefully insert each wire into the appropriate terminal, taking care to ensure that all strands are inserted properly.

System with optional Class 1 surge arrester only - connect input cables terminals to surge arrester terminals L1, L2 and L3 as illustrated in Figure 3b

Connect 3 phase output cables to terminals L1, L2 and L3, output neutral NO and output earth, a total of 5 cables to the output terminals as shown in figure 3b.

**TAKE SPECIAL CARE TO ENSURE PHASE ROTATION IS IN A SAME CONNECTION SEQUENCE AS THE INPUT TERMINALS AS INCORRECT SEQUENCE CAN CAUSE SYSTEM FAILURE AND DAMAGE TO THE UNIT.
CHECK AGAIN ! - VERIFY PHASE SEQUENCE BEFORE PROCEEDING. MAKE ABSOLUTELY SURE THAT INPUT/OUTPUT ARE NOT REVERSED, AS SERIOUS DAMAGE WILL OCCUR WHEN ENERGIZING AN INCORRECTLY WIRED UNIT.**

Tighten each terminal screw, and perform a pull test to make sure the connection is adequate. Note that failure to follow these instructions can lead to malfunction or short circuit.

Securely close the front panel door and lock with keys. Make sure that the keys are safely location and assessable for emergency and maintenance use

5. Earthing and Bonding

VRp-ILc-15000-5339 is not a replacement for proper site earthing and bonding. Be sure to follow proper site preparation procedures which are **NOT CONTAINED HEREIN**.

6. Extra Lightning Protection

VRp and ILc together are designed to withstand Normal and Common-Mode indirect surge voltages and have internally coordinated surge protection devices.

If immunity against the more severe surges resulting from lightning strokes (defined by LPZ0a and LPZ0b) is required, it is recommended that a class 1 surge arrester capable of withstanding IEC-61312 specification must be installed. This optional equipment can be supplied by contacting TSi (USA) or Romarsh (Europe and Africa) direct.

7. Energising the system

Once you are fully satisfied that the input and output connections are checked and correct you can now proceed to switching on the system as follows:

- (i) Switch on the input circuit breaker to enable input power to be connected to the isolation transformer. The system is now energized. Do not at this stage switch on the output circuit breaker.
- (ii) The Green Normal LED and the OVP LED should both be ON – this indicates VRp part is in normal operation. This should apply to all 3 phases.
- (iii) Now you can switch on the output circuit breaker for power supply to the load.
- (iv) Check that all LEDs remained ON to indicate continuous normal operation.
- (v) **If any of the LEDs is OFF, a fault in that particular phase is detected. Consult TSi or its local representative immediately.**

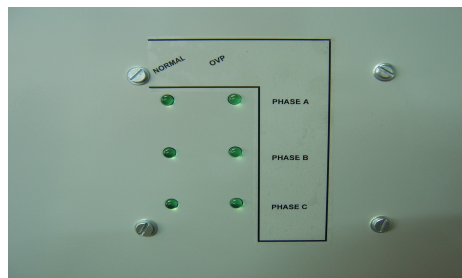


Figure 5 – LED indicator layout (note that the panel colour may vary)

8. Routine Maintenance

The following periodic maintenance is recommended (minimum 3 monthly interval) :

- (i) The external surfaces of the cabinet should be free from accumulated dust. Clean dust with a soft cloth impregnated with small amount of mild detergent.
- (ii) The air inlet and air outlet areas should be cleared from accumulated debris. Use a short length brush to clean off blockages. It is vital that the airway is clear and unobtrusive as these will affect cooling in the unit and overheating may occur as a result.
- (iii) If signs of insect trails or invasion to inside the cabinet are evident, the unit must be inspected internally to assess any possible damages. Insect infestation must be rectified immediately as short circuit and insulation failure can occur causing damage and failure to the unit. Consult Romarsh / TSi if damages have been resulted and replacement parts are required.
- (iv) The cooling fans installed in the ILc unit have a life span of 20,000 operating hours at 60°C operating temperature. Romarsh recommends that cooling fans should be replaced at a 2-year interval. Replacement fans are available direct from Romarsh and TSi.

SAFETY FIRST – WHEN CARRYING OUT MAINTENANCE WORK CARE SHOULD BE TAKEN IF THE UNIT IS LIVE. ANY WORK CARRY OUT INSIDE THE CABINET MUST HAVE THE INPUT POWER DISCONNECTED TO AVOID ACCIDENT AND ELECTROCUTION OF THE MAINTENANCE PERSONNEL.

9. Specifications

- Nominal input voltage, 3 phase 5 wire wye, 230/400Vac 50Hz
- Input range: 400V (line to line) -20% to +20% (320V-480V)
- Nominal output voltage: 3 phase + N, + E, 230/400Vac 50Hz
- Output voltage accuracy, Factory preset at $\pm 3.0\%$
- Max Power Capacity: 15.0kVA
- Over voltage cut off when mains voltage exceeds 274 Vac
- Automatic restart when mains voltage returns to normal
- Under voltage cut off when mains voltage decreases below 184Vac
- Automatic restart when mains voltage returns to normal
- Safe start: The unit shall always start on sinewave zero voltage crossing point upon turn-on. This minimizes turn-on surge current and stress on semiconductor devices in rectifiers and air conditioners. Unit shall be fully functional within 5 seconds after mains restoration The regulator shall always provide fully regulated output.
- Efficiency, 95% max
- Overload protection: Automatic circuit breaker at the input. 150% overload capability for heavy start load.
- Automatic regulator by-pass switch included

- Regulator status indicator LED's for "Normal" and "Fault".
- Cooling, Fan cooled (ball bearing)
- Protection class, IP44 overall (IP23 on outer enclosure and IP55 on inner enclosure)
- Design ready to meet EMC directives
- Ambient temperature operating, -20°C to +40°C (-4°F to +104°F)
- Class 2 and 3 transient and surge protection for protected equipment (system shall operate without interruption or damage for 4000V, 3000A, 50 microsecond simulated lightning surge input and output remnant pulse shall be reduced to a harmless ripple.)
- No mechanical or moving parts (other than cooling fans) are used for maximum regulator performance, reliability and lifetime.
- Microprocessor is used to monitor and correct incoming mains voltage on a cycle-by-cycle bases.
- Voltage correction time shall not exceed 1 cycle, or 20 milliseconds for all mains AC voltage changes – even for instantaneous voltage changes from 160 to 300 Vac or from 300 to 160 Vac.
- Overall dimension of AVR unit shall be 1040 wide x 450 deep x 1170 high (mm)
- Weight of the AVR unit is 250kg

Disclaimers

UNAUTHORISED MODIFICATIONS OR SERVICING OF THE EQUIPMENT WILL INVALIDATE THE WARRANTY

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