

3 PHASE AUTOMATIC VOLTAGE REGULATOR AVR3LS



**Please note product might visually differ from image shown*

Customer Name	
Site Name / Location	
Country of Installation	
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P1 PROJECT DETAILS

Customer Name	
Site Name / Location	
Country of Installation	
AVR Description	AVR3LS
Features Included	<ul style="list-style-type: none">▪ Digital Meters▪ Output Circuit Breaker▪ Class II SPD
Serial Number	
Sollatek Stock Code	973LS075-K AVR3LS-70kVA 230/400V 3x100/75A M 973LS101-K AVR3LS-90kVA 230/400V 3x133/100A M 973LS151-K AVR3LS-140kVA 230/400V 3x200/150A M

CONTACT DETAILS

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P2 TECHNICAL SPECIFICATIONS

INPUT

Input Voltage	230/400 V \pm 20%
Frequency Range	45 Hz to 75 Hz
Additional Voltage THD	<0.2% at input (tested at 100% linear load)
Maximum Input THD	Can withstand <10% THD from the supply

OUTPUT

Output Voltage	230/400 V \pm 3%
Speed of Correction	750 V/s
Additional Voltage THD	<0.25% at output (tested at 100% linear load) (No PWM methods used)
Crest Factor	>1:3 permissible on load current (tested at 100% load)
Synchronisation	Output synchronised to the input
Permissible Overload	1000% for 100 mS 150% for 4 minutes 110% for 10 minutes
Load Types	Designed to run lighting, motors, battery chargers, communications equipment, office equipment, SMPS, air-conditioners, compressors, industrial machines, medical equipment and others. Suitable for all domestic, commercial and industrial sites.

GENERAL

Technology	All solid-state Silicon Controlled Rectifiers (SCR or Thyristor) switching
Efficiency	>98% (at 100% linear load)
Control	Microcontroller based control system provides self-checks, system integrity monitoring and diagnostic indicators
Control Protection	Internal surge arrestors and filters in the control circuit protect against disturbances. Filtering algorithms fault-tolerant software protect against disturbances and false measurements
Power Connections	Supply phases, neutral and earth. Load phases, neutral and earth Input / output terminal box on the rear of the unit
Surge Protection	Heavy duty input and output surge arrestors to protect against extreme surges and lightning on the supply. Dual mode. 2880 Joules total. Class II, 8/20us, 80kA

Output Circuit Breaker	Output circuit breaker to protect against overload and short circuit	
Digital Meters	Accurate measurement of the AC RMS currents in three-phase systems. Accuracy: 0.5% + 1 digit	
Ambient Temperature	-10°C to +55°C	
Relative Humidity	<95%, non-condensing	
Environmental Protection	IP21	
Acoustic Noise	<45 dB (A), <65 dB with fans on	
Expected Service Life	>25 years	
Standards	Manufactured to comply with: ISO9001:2015, CE, EN 55022, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11	
Dimensions (mm)	Refer to General Assembly Drawing	
Weight (kg)	AVR3LS-70kVA 230/400V 3x100/75A M	250 kg
	AVR3LS-90kVA 230/400V 3x133/100A M	300 kg
	AVR3LS-140kVA 230/400V 3x200/150A M	400 kg



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1 INTRODUCTION

Unit consists of.

- Adjust transformer (auto-transformer)
- Thyristor assembly for tap selection
- Control card assemblies
- Cable interconnect system
- Meters



Functionality is based on an autotransformer with microprocessor controlled input/output tap selection providing an accurate output voltage for a wide range of input voltages. The taps are switched by generously rated thyristor banks to cope with motor start loads. This technique results in a voltage stabiliser which has no moving parts and responds quickly to voltage fluctuations.

The micro-controller also measures the frequency of the mains supply and compensates accordingly. This also means that the AVR will work over a frequency range of 45 - 75Hz automatically and down to as low as 30Hz for short periods to help cope with diesel generator loading problems.

Frequency and voltage measurements are filtered to remove noise and so prevent spurious tap changes.

A watchdog function is implemented in the microcontroller. This independently monitors the operation of the micro-controller and its software. If it detects a malfunction, it will reset the micro and re-initialise the control system.

Additionally, a hardware reset circuit is included which monitors the supply rail for the control circuit. If the mains supply remains low so that the control circuit will not function correctly, the monitor circuit will put the micro-controller into the reset state and turn off all thyristors.

When the mains supply increases to a usable level, the monitor circuit will restart the micro and the system will re-initialise. This ensures an orderly and controlled restart from a brownout or blackout condition. The circuit is designed with a large hysteresis so that the unit will not attempt to turn on again until the supply voltage is sufficient to withstand possible starting surges. This avoids the possibility of a current surge causing the supply to dip sufficiently to turn the unit off again.

Additional protection is provided by temperature sensors fitted to each transformer. If the AVR is used at full load and either the ambient temperature is excessively high, or the ventilation grills have been obstructed, the temperature of the transformer may increase beyond reasonable limits. In such an event, the temperature sensor will disconnect the supply to the corresponding control board and thereby turn the output off. When the transformer has cooled sufficiently, the sensor will restart the AVR.

When restarting after the above condition the AVR may cause equipment to begin to operate suddenly. Steps should be taken to ensure that this does not expose persons to risk.

2 IMPORTANT SAFETY INSTRUCTIONS



THE AVR INTERNALLY CONTAINS LETHAL VOLTAGES.
ONLY AUTHORISED PERSONNEL SHOULD WORK ON IT.

2.1 The Dangers of Electricity

Harm can be caused to any person when they are exposed to 'live parts' that are either touched directly or indirectly using some conducting object or material. Voltages over 50V_{AC} or 120V_{DC} are considered hazardous.

Shocks from faulty equipment can cause severe and permanent injury and can also lead to indirect injuries, due to falls from ladders, scaffolds, or other work platforms. Faulty electrical appliances can also lead to fires. As well as causing injuries and loss of life, fires cause damage to the plants, equipment, and property.

Most electrical accidents occur because of individuals:

- a. Are working on or near equipment, which is thought to be dead, but which is, in fact, live.
- b. Are working on or near equipment, which is known to be live, but where those involved are without adequate training or appropriate equipment, or they have not taken adequate precautions.
- c. Misuse equipment or use electrical equipment which they know to be faulty.

2.2 Reducing The Risk of Electric Shock

To reduce the risk of electric shock:

- Ensure a Safe System of Work (SSW) is produced to include RAMs, Safety Programme, Isolation & Earthing diagram, and a Permit to Work.
- Install the AVR in a temperature and humidity-controlled indoor area free of conductive contaminants. Ambient temperature must not exceed 55°C
- Remove watches, rings, and other metal objects.
- Use tools with insulated handles.
- Wear PPE.

2.3 First Aid

Before commencing any work:

- Find out the location of a suitably stocked first aid box.
- Find out the arrangements that exist on-site for first aid, and who is responsible for taking charge of these.

3 UNPACKING, INSPECTION & PREPARATION

Perform the following unpacking and inspection procedure immediately on receipt of the shipment.

3.1 Inspect 'Shockwatch' And 'Tip 'N' Tell' Indicator Status.

3.1.1 Shockwatch

'Shockwatch' is a label affixed to the unit's shipping crate to monitor handling in transit. If the unit has not sustained any unacceptable shock in transit, the label's indicator tube will retain its original clear appearance. However, if the unit is subjected to more than its acceptable acceleration level, a highly visible red dye is released into the length of the tube.

3.1.2 Tip'n'Tell

Tip'n'Tell is another label affixed to the unit's shipping crate, designed to monitor for excessive tipping. If the crate is tipped to slightly less than - or beyond - 90°, the label's clear arrow becomes permanently blue.

Contact the carrier in writing immediately if either label has been activated, or if the crate shows other signs of transit damage.

3.2 Inspection of The Unit

3.2.1 Cabinet/Casework

Check for visible signs of damage to exterior panels, doors, and fittings. If cracks, scratches, or dents are visible there is a chance of internal damage. Sollatek must be notified if transit damage is evident.

3.3 Tools Needed

- Standard Electrician's toolkit
- Spanners for cable termination

3.4 Green Disposal of Packaging

Wood packaging waste from items such as skips or crates accounts for UK 1.2 million tonnes a year. Your local authority may offer a waste collection and wood recycling service. Alternatively, contact a local waste disposal company that offers wood waste disposal facilities.

3.5 Temporary Storage

The unit must be protected from environmental extremes during storage as well as after installation. Ingress of dust and moisture must be prevented. The heating of the room may be necessary to prevent any incidence of humidity during storage or before commissioning.

4 INSTALLATION



1. **SAFETY: NEVER, UNDER ANY CIRCUMSTANCES, WORK ON THE UNIT UNLESS THE SUPPLY IS ISOLATED.**
2. **ENSURE A SAFE SYSTEM OF WORK (SSW) IS PRODUCED TO INCLUDE RAMS, SAFETY PROGRAMME AND ISOLATION & EARTHING DIAGRAM (TO IDENTIFY THE METHOD FOR THE SAFE ISOLATION OF THE INSTALLATION) BEFORE ANY WORK IS AUTHORISED (PERMIT TO WORK).**
3. **A FULLY DOCUMENTED METHOD STATEMENT AND RISK ASSESSMENT MUST BE PRODUCED BEFORE INSTALLATION OF THE AVR. THIS WILL ENSURE A SAFE AND PROFESSIONAL INSTALLATION.**

Before installation work commences, as a minimum the following points must be actioned on the existing installation:

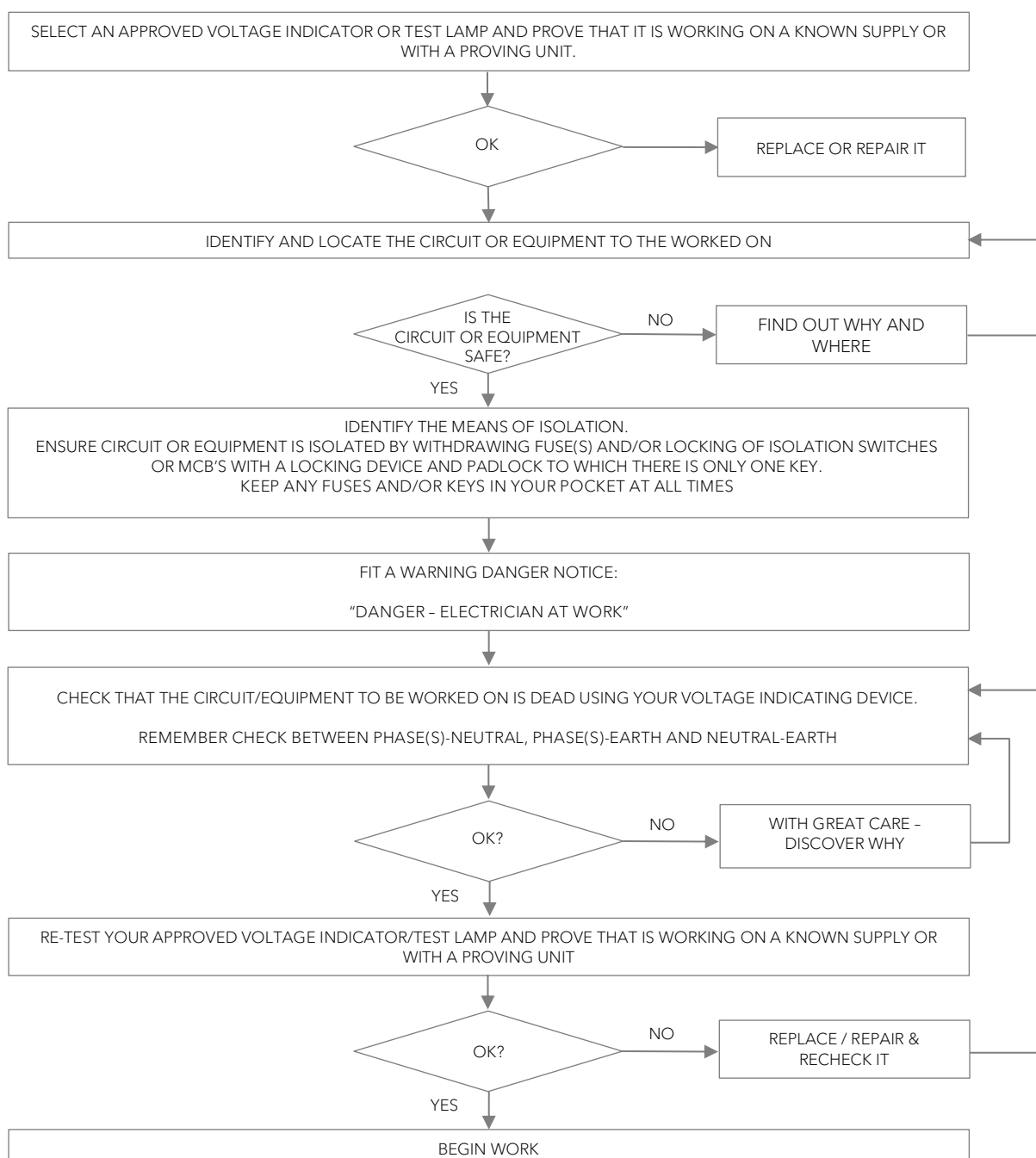
- Check phase rotation and identify phase sequence 321 or 123.
- Check earth fault loop impedance of existing installation.
- Measure voltage at the main incomer fused switch/MCCB and at regular intervals along the entire ring main for each phase, noting the maximum voltage drop under full load conditions. This record will identify whether certain existing older 240V equipment may require supplementary voltage regulation.
- Check earth continuity between head, existing trunking, and the proposed connection point of the AVR.
- The AVR normally operates in series between the main incomer isolator/switch and the main distribution board (DB). The installation engineer needs to ascertain at what point this intersect is practicable. Inspect the existing installation to verify if removable links are present or if the busbar requires modification.
- All new and existing installs must be done according to BS 7671 or local regulations as applicable.
- Part of the Project Engineer's Method Statement should include a flow chart to identify the method for the safe isolation of the installation before any work is actioned on existing wiring.

As guidance, see the following Safe Isolation flow chart example on the following page.

SAFE ISOLATION FLOWCHART. For guidance only.



YOU ARE RESPONSIBLE FOR YOUR SAFETY, PLEASE MAKE SURE THAT THE CIRCUIT YOU ARE WORKING ON IS 'DEAD'. NEVER TAKE ANYONE'S WORD THAT THE CIRCUIT OR EQUIPMENT IS SAFE!



4.1 Environmental Conditions

The AVR is intended to be housed in a switch room or similar enclosure isolated from the general work area. Operatives working near the AVR should not require ear protection during normal operation of the unit. Cooling fans will operate intermittently.

CHOOSING A LOCATION AND FIXING METHODS

The unit should be sited on a firm, level, and dry surface, away from sources of heat, dust, vibration, or moisture.

Suitable indoor locations include Switch / Power Rooms and other areas dedicated to housing live electrical equipment. The unit is not suitable for installation in offices or other areas of regular occupancy. The unit has a standard IP rating of 21. Outdoor installation is possible provided the unit is housed within a suitably IP-rated enclosure. Whether installed within a building or outside, the AVR environment should be maintained within an ambient temperature between 0°C and 55°C and an operating humidity level below 95% (non-condensing).

The unit should not be positioned in direct sunlight or near exhaust outlets.

4.2 Ventilation

The unit should be positioned to allow a free flow of air. It is especially important to ensure that front and rear cooling fan outlets are free from obstruction. A space of at least 500mm should be left front and rear of the unit. Floors surrounding the AVR must be kept free from dust.

The AVR does not depend on forced cooling to operate; the fans act to maximise operational life.

4.3 Positioning

The AVR is fitted with castors that should be locked in place after final positioning.

4.4 AVR System Connectivity

The AVR is designed to be installed directly after the Utility Mains Incomer (fuse head) by modification of the busbar chamber if fitted, or at an appropriate position downstream where only part of the building supply requires voltage regulation.

- The AVR is supplied with an output breaker MCB.
- The AVR will supply downstream loads using the existing installation's distribution board fuses or any other protection if employed.

- Utility incomer supply (fuse head) or a fused Isolator switch to AVR must be appropriately fuse protected at 1.4 times AVR Amp rating to allow for max boost/load conditions. Supply cable to AVR must also be appropriately sized to allow for additional boost current.

4.5 AVR Configuration (Set-up)

Configuration of AVR is facilitated locally using direct communication with a laptop/door-mounted USB/RS232 interface. A Configuration and Diagnostics Platform software (CDP) is provided on request. Although the AVR is factory set, certain parameters can be changed on-site such as nominal voltage. Due to its autonomous design, there is no remote-control facility for the AVR during normal operational service.

4.6 Incoming and Outgoing Connections

Rear mounted distribution boxes contain all necessary input and output terminals and optional MCBs. Remove the top two screws and lower the cover to expose the terminals. Ensure the input terminals Perspex cover is intact. There is no reason to remove the cabinets lid unless required for maintenance purposes.



Fig 4.6. AVR site connections



THE BEST PRACTICE IS TO CHECK CONNECTIONS
WITH AN INFRARED CAMERA.

AUX CABINET CONNECTIONS	INCOMING	OUTGOING
L1	Phase 1 in	Phase 1 out
L2	Phase 2 in	Phase 2 out
L3	Phase 3 in	Phase 3 out
N	Fully rated Neutral in	Fully rated Neutral out
E	Main Earth Pillar	Main Earth Pillar
<i>Connections should be made using suitable ring terminals.</i>		

Table 4.3: Main connections of AUX cabinet

4.7 Earthing

- The system is to be earthed in accordance with BS 7671 or equivalent.

4.8 Cables and Terminations

4.8.1 Cable Sizing

The system designer will calculate the correct cable size and type depending on the AVR model and in accordance with BS 7671 or equivalent. Care must be taken to minimise voltage drop and excessive heat dissipation along the cable length. Current capacity of cable to be 1.4 times AVR Amp load rating to allow for max boost/load conditions.

4.8.2 Cable Terminations

Cables must be terminated with suitable crimped lugs.

4.8.3 Bend Radius

HO7 type is recommended for cabling. See cable supplier's specifications for guidance.

4.8.4 Cable Support

External trays or trunking must support cables according to BS 7671 or equivalent. Take care to ensure adequate heat dissipation (de-rating factors) when using cable trunking.

5 PRINCIPLES OF OPERATION

5.1 AVR Voltage Regulation – Theory of Operation

The AVR comprises 3 single-phase units which operate individually to regulate their incoming raw mains to a pre-set L-N output of 230 V \pm 3%.

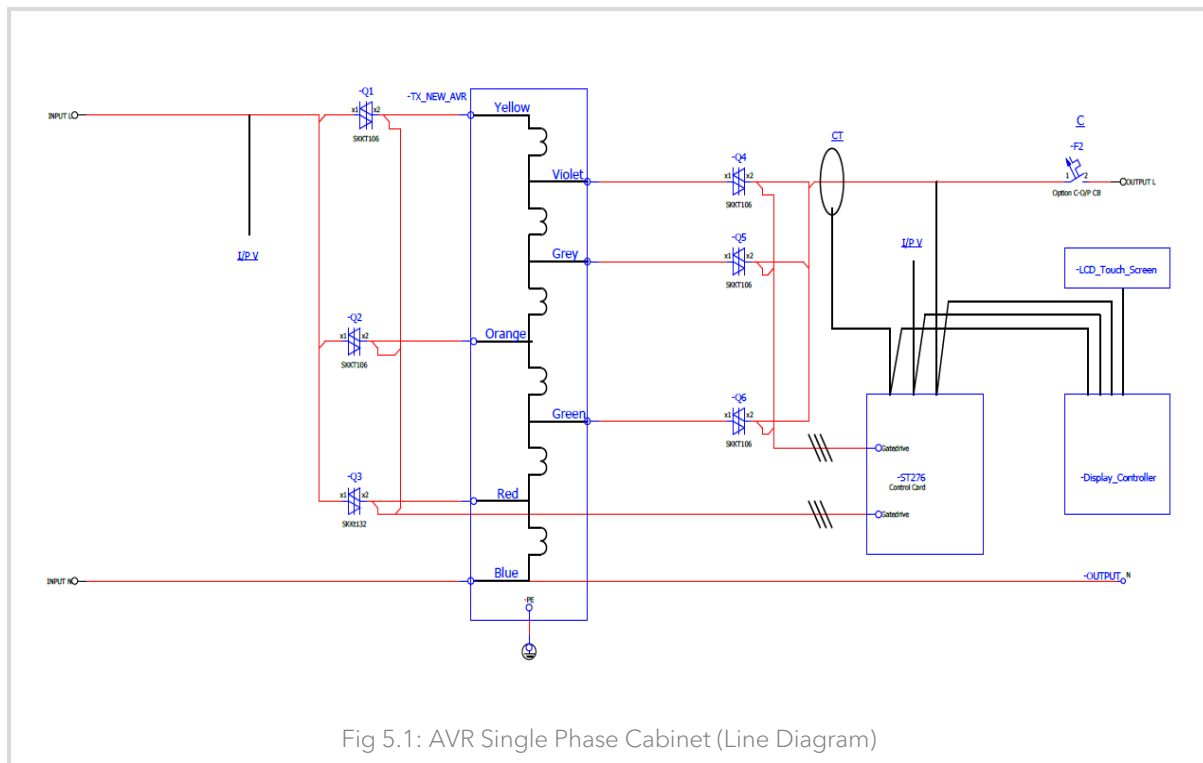


Fig 5.1: AVR Single Phase Cabinet (Line Diagram)

AVR achieves voltage optimisation by Thyristor switching of a single auto transformers input and output taps.

The result is a regulated output voltage within \pm 3% of the pre-set value as defined by user firmware (CDP user software). The standard factory-set optimised voltage setting is 230V, other options are available for configuration.

The control board senses the incoming voltage's excess over the pre-set value of 230 V \pm 3%. Sophisticated algorithms within the control board firmware use this difference value to select one of the available tap ratios.

This combination of controllable autotransformers and a microcontroller system results in a voltage stabiliser which has no moving parts and responds quickly to voltage variations, providing a stable optimised output voltage at 230 V.

5.2 AVR Sub-Assemblies

Each phase unit comprises of the following ten main sub-assemblies.

- Series auto-transformer
- Thyristor switching bank for boost/buck regulation.
- Measuring circuits and Regulation control boards (ST276)
- Single phase metering
- Forced cooling.

6 USE & KEY COMPONENTS

6.1 Appropriate Use

The AVR series is designed exclusively for regulating the wide range of voltage to customer loads.

The manufacturer expressly prohibits any modifications to the construction of the AVR as well as changes to the control system without written permission.

The appropriate use of the installation includes following these operating and maintenance instructions. Moreover, maintenance intervals must be observed to ensure the proper operation of the unit.

6.2 Key Components (Access is restricted to Sollatek workshop personnel only).

MAIN TRANSFORMER.

Three off single phase auto transformers with multiple in/out tap connectivity.

THYRISTOR ASSEMBLY FOR TAP SELECTION.

Main controller board (ST276 card) selects the required tap via smart gate-driver circuits .

These thyristors are mounted on generous heat sink modules and cooled by 4 temperature controlled fans.

OUTPUT CIRCUIT BREAKER (F2)

Output is protected by a 4 pole MCB.

METERING

The front panel incorporates 3 single phase digital meters to display input/output voltages and load current.

USB PORT

To facilitate connection of the control and diagnostics platform interface and interrogation of AVR.

SURGE PROTECTION

The AVR cabinet is protected by integrated Input and Output Class II surge protection 8/20us, 80kA. 2880 Joules total.

MAIN CONTROLLER (ST276 CARD) .

The microprocessor-based regulation controller forms the heart of the AVR unit. The output is constantly monitored and via tap selection regulated to +/-3% of the chosen nominal. Each phase is independently regulated. LED status of the card is explained in fig 6.1.

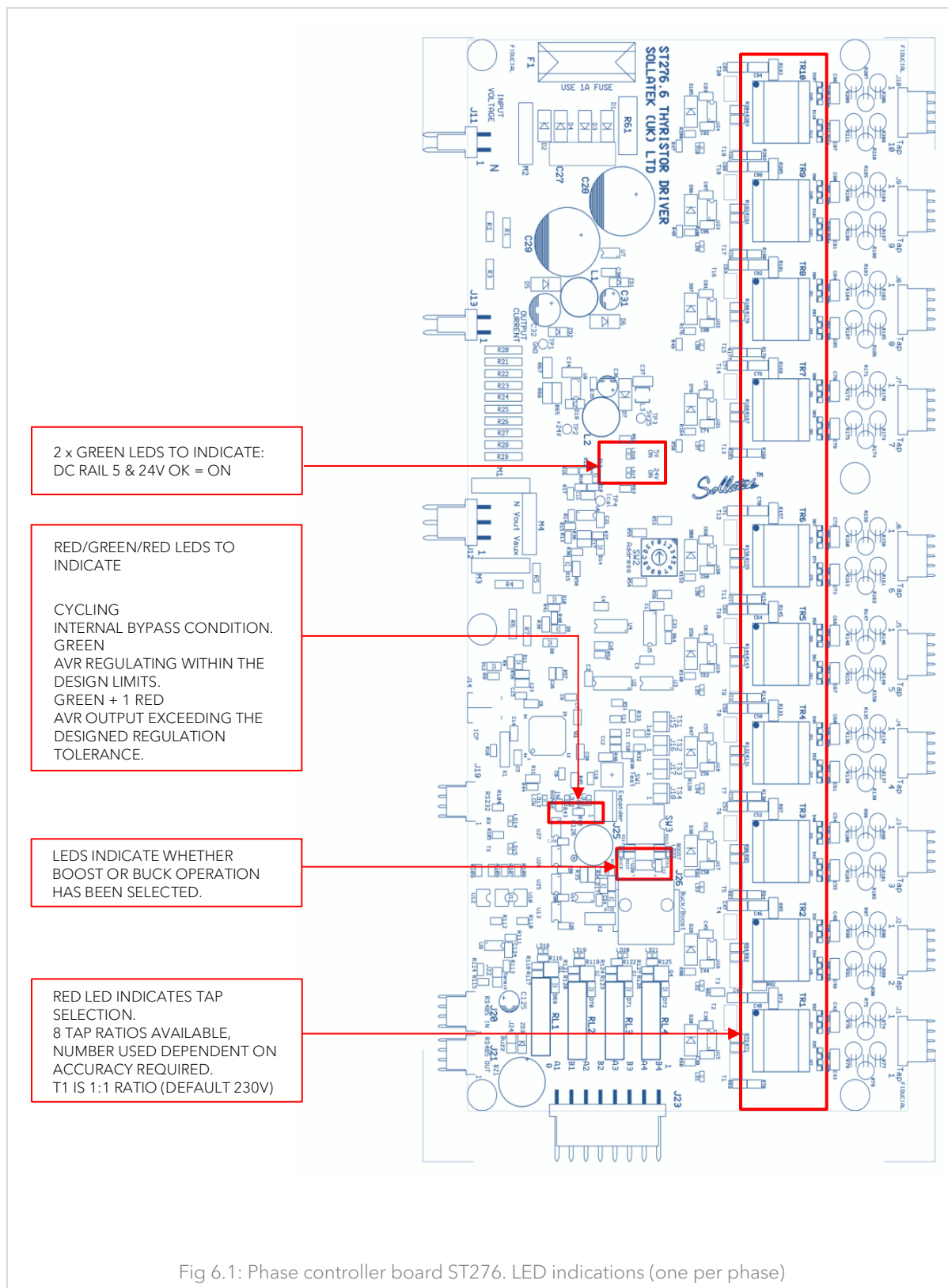


Fig 6.1: Phase controller board ST276. LED indications (one per phase)

7 OPERATING PRACTICES and advisories.

7.1 Operational Procedure

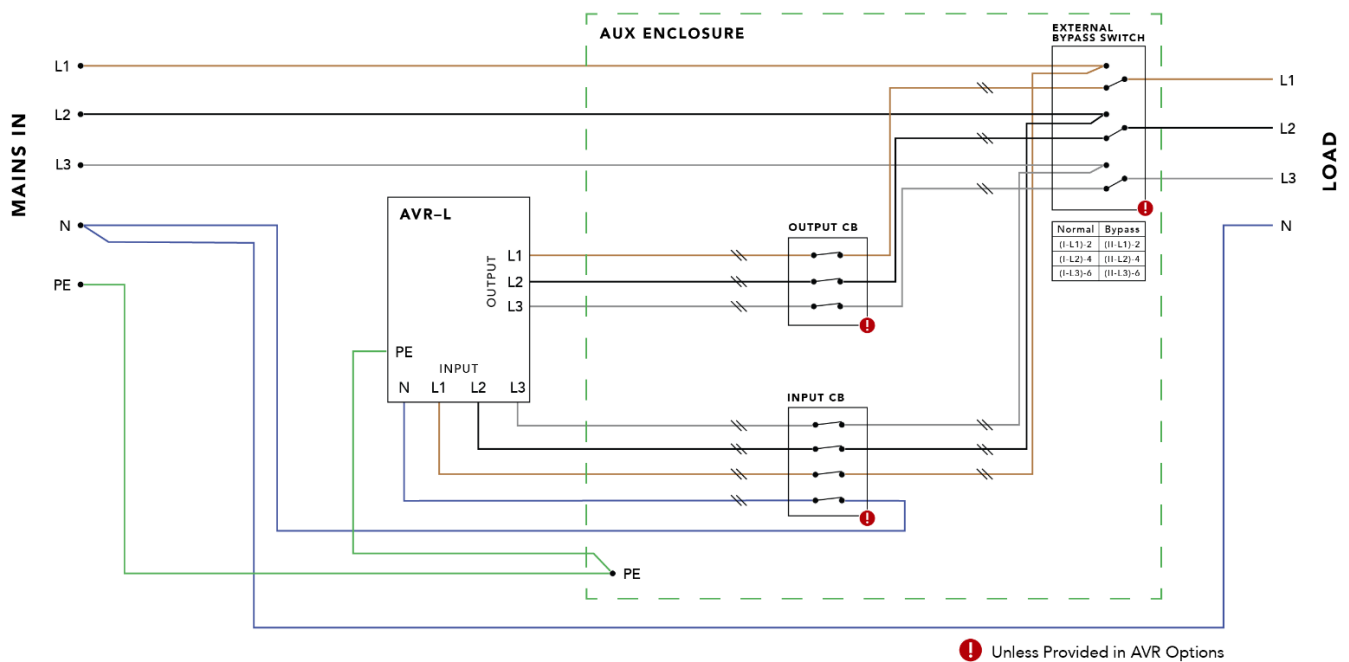


Fig. 7.1 AVR Single Line Diagram

7.1.1 To Power up the AVR

- AVR Output MCB CB is in the OFF position.
- Check downstream DB loads are ready to be energised.
- Apply incomer supply to AVR.
- Check digital meters are showing incomer supply and a 230V+/-3% regulated output.
- Close AVR output MCB.
- Measure downstream load voltages and equipment operation.
- Use CDP Interface to adjust the nominal voltage to ensure loads are receiving a nominal acceptable voltage. AVR output may have to be adjusted to allow for existing downstream voltage drops caused by cable conditions. AVR output voltage can be increased or decreased depending on requirements.
- Using the CDP Interface, input site name and take snapshots of each page for the site commissioning report.
- Record the digital meter volt and current readings in a notes section of the commissioning report.

7.1.2 To Turn the AVR Output OFF

- Download event logs using the CDP interface. This will record any operation anomalies.
- Switch Output MCB to OFF. AVR remains in an energised state. Door meters will show AVR input and output voltages.

7.1.3 To Power Down the AVR for isolation or maintenance purposes.

- Switch AVR Output MCB to OFF. AVR remains in an energised state. Door meters will show AVR input and output voltages.
- Isolate incoming power to AVR. Confirm the AVR supply has been switched to off, lock out and fit safety tag.
- Open the rear, **prove dead input and output terminals**. Refer to chp4.6 for information on terminal covers.
- The AVR is now ready for or its annual maintenance check to preserve warranty conditions.
- The AVR is now isolated from supply and load. The AVR cabinet lid can now be opened and worked on once a dead check has been successfully carried out. The AVR is an inductive type design, any residual voltages will be dissipated after power down.

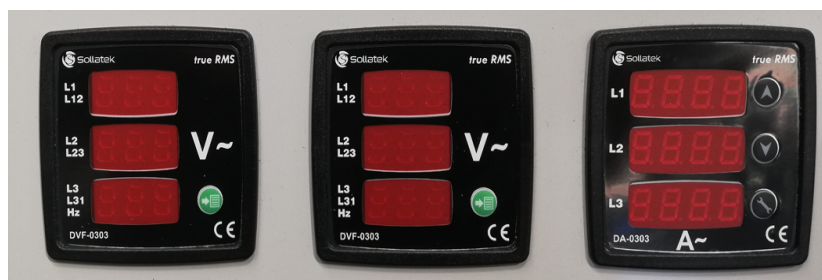
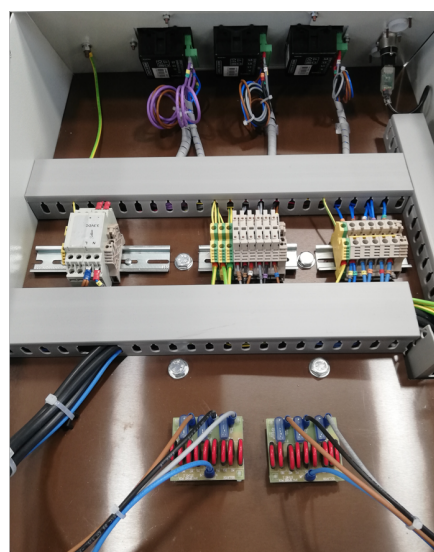


Fig 7.1.1.d. Input/Output Voltage and Output Current meters



Control card /fan fuses

ST145 Surge protection
modules (SPD)

Fig 7.1.3. Lid removed to show SPD and control fuses.

7.1.4 AVR annual maintenance requirements (maintain 2 years or extended warranty if applicable)

- a. Confirm AVR is isolated from upstream and downstream connections.
- b. Use a torch and check the fan inlet and outlet panel vents are clear of dust. Use a vacuum cleaner and fit hose close to vent grills to suck out any dust. Severe dust residue may require a Sollatek approved technician to investigate if a blocked vent has caused excessive heating issues. The CDP Event download may indicate history of high temp instances and if further actions are necessary.
- c. Remove lid. Check the DSP fuses are intact by removing their rubber covers. A blown fuse may indicate that the associated Class III MOV surge protection component has expired due to excessive transients from site operations.

Advisory note. The AVR incoming supply (Building incomer supply) must be fitted with a minimum of class II surge protection devices. Sollatek UK Ltd can advise on appropriate building surge and indirect lightning protection devices. Insufficient lightning and transient protection conditions will void warranty conditions if damage is determined by a Sollatek Technician to be as a result of 8/20uS and 10/350uS incidences.

- d. AVS. Additional protection recommended for when incomer supply exceeds the maximum operational conditions of the AVR, damage may occur and void warranty. To prevent the AVR being damaged by substantial overvoltage conditions, Sollatek recommend installing a switcher device (AVS3P) to shut off supply to AVR. Contact your local Sollatek agent for advice.

8 COMMISSIONING

8.1 Pre-Commissioning Inspection & Checks

Commissioning should be in accordance with the relevant construction design management procedures. Documentation should contain as a minimum, a project Method Statement and Risk Assessment. Installation and testing should be in accordance with BS 7671 or its local equivalent.



ENSURE THAT ANY SITE BACKUP GENERATORS ARE DISABLED AND WILL NOT SUPPLY POWER DURING MAINS ISOLATION.

Pre-energisation installation workshop tests, if required must be actioned before connection of supply.

The unit will have undergone factory final assembly L-E insulation checks. If on-site installation testing requires a further check, then please ensure the following precautions are actioned before the test commences.

Ref to fig 7.1.3. ST145 SPD. Temporarily disconnect neutral and earth connections. Terminals are accessible by removing the AVR lid. The MOV active components will clamp surges at approximately 320V_{RMS}.



METHOD: WIRE LINK ALL LIVE MAIN POWER INPUT/OUTPUT TERMINALS AND NEUTRAL. CHECK CONTINUITY.

FAILURE TO DO THIS WILL RESULT IN DAMAGE TO THE ELECTRONICS AND WILL VOID THE WARRANTY.

Open all Control DIN rail fuses.

Set insulation tester to a **max 500V_{DC}** and apply this test voltage between the **linked terminals and earth terminal only**.

Certain installation tests require a physical connection of supply (e.g., earth fault loop impedance). See the following guidance notes. Close DIN rail fuses after testing. Reconnect ST145 connections. Close lid.

8.2 System Power-up

Before the system is powered-up for the first time the following checks should be carried out by qualified personnel only.

- Inspect the input and output cable terminations for tightness, correct wiring idents and phase rotation.
- Check that the building electrical service is of sufficient capacity to supply the input current of the AVR. See the AVR serial label on the inside door for specifications.
- Check building electrical service is of the correct nominal voltage, the wiring configuration and that the main upstream circuit breakers are suitable for the inductive nature of the AVR.
- Ensure that the load equipment is ready to be safely energised (work permits in place, personnel informed etc.).
- Ensure the person actioning the energisation is wearing full PPE (personal protective equipment).
- Ensure all equipment doors and covers are fitted where applicable.

Once the above conditions have been verified, input power may be applied to the AVR in accordance with the following pre-checks.

8.3 Setting the Output Voltage

The AVR optimised output voltage is factory set to 230V. A commissioning engineer's user interface software utility (the AVR Configuration and Diagnostic Platform CDP) is available for changing certain parameters of AVR operation.

8.4 Site Acceptance Test (SAT) Certificate

In addition to Method Statement and Risk Assessment documents a final site acceptance test certificate (SAT) should be produced.

The SATs include a standard Electrical Installation Certificate to BS 7671:2008 or equivalent provided by the main electrical contractor and a Schedule of Test Results (FAT and SATs).

Test results documentation should include a record of the following AVR information and settings. Include snapshots of the CDP pages in your report.

1. Site Code
2. Commissioning Date
3. Serial Number
4. Nominal Voltage
5. Load Current



Save a screen print of each phase configuration for easy review of the settings.

9 AVR DATA INTERFACE (CDP)



NOTE: In parts of this section, there are references to an iVolt this is an AVR that has a buck-only facility and is specifically used for energy saving (voltage optimisation).

Some functionalities in the CDP are relevant to the iVolt only such as IRT monitoring. Which measures and records energy savings. AVRs have IRT* disabled (factory default). In this section the words iVolt & AVR are interchangeable.

AVR Configuration and Diagnostic Platform (CDP) allow **local** comms via the panel mounted USB socket.

The function of the CDP software is to allow the commissioning engineer to

- Set certain parameters such as site code, commissioning date (sync with laptop date and time) and required optimised voltage level.
- Enable or disable and view the IRT* energy monitoring function (iVolt only).
- Observe recent Events data (Events include operational issues and transgressions of voltage and current thresholds)
- Observe real-time voltage, power factor and energy levels.
- Synchronise IRT* cycling of all 3 phases (iVolt only).

CDP allows access to two major functions:

- a. Configuration of:
 - Equipment details.
 - Voltage Control.
 - Events logging.
 - IRT* Settings (iVolt only).
- b. Diagnostics for:
 - Historical Event Data for individual and all phases.
 - IRT* Savings and financial summary (iVolt only).

9.1 Requirements

Hardware:

- Laptop with Windows XP or higher.
- USB cable with type A and B connectors.
- AVR Configuration and Diagnostic Platform (CDP)

9.2 Loading the CDP Software

A link will be provided to download the necessary software onto the commissioning engineer's laptop:

- Local AVR Configuration and Diagnostic Platform (CDP) software utility
- 1x RS485 to USB driver if required (older laptops)
- Net update if required.(older laptops)

9.3 Communicating with the AVR



NOTE: Useful tip in case of a USB connection issue.

View the USB Com Port configuration in the **Windows Device Manager**:

- Control/System/Hardware/Device Manager/Ports (COM & LPT)
- Right-click Properties, Port settings tab, and click on Advanced.
- Select COM3 for the USB connection if not already allocated.



NOTE: Default protocols used (9600-8-none-1-none).

9.4 Interrogating the AVR

Action the following to interrogate the AVR for configuration details:

- Locate the AVR Interface shortcut on the laptop desktop. Click on the icon. Load the home page.
- The red box in the graphic below shows where to select **single-phase** or **3-phase**. Then input username and password provided below.

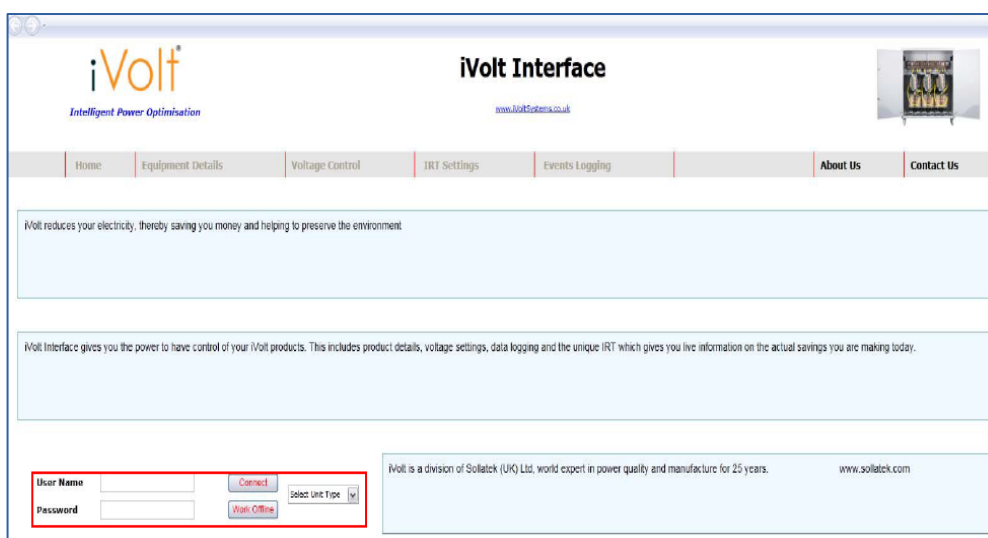
The CDP has 3 username accessibility levels.

Username	Password	Access Level	Description
user	user	Low	Read-only and download
site	site	Medium	Read, download, and change basic settings
sukl	TBA	High	Full access. (Sollatek approved engineers only)

NOTES	
user	The user can only view data from the AVR.
site	In addition to the above, the user has access to the following features: <ul style="list-style-type: none"> Editing commissioning date and site code Synch to PC (date and time) Setting the nominal voltage (only the 3 phases to the same level.
sukl	For Sollatek engineers only - All features are accessible

Table 9.1: CDP Usernames & Passwords

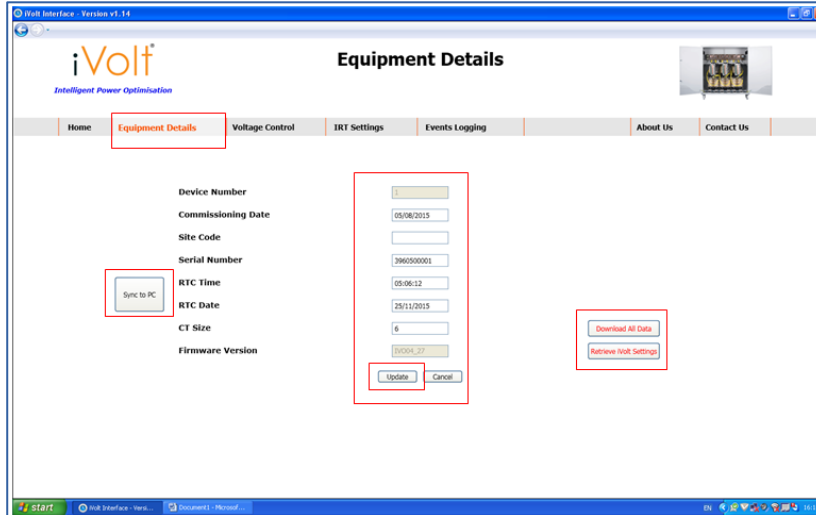
- Then click **"Connect"** and observe all permissible tabs are in bold (**Home**, **Voltage Control** etc.)
- Connection not established. Check that the laptop recognises the USB as in Ch. 6.3
- Click on a tab to access the appropriate function(s)



Note: Offline mode used for iVolt systems savings data only, not applicable to AVR.

9.4.1 Equipment Details (Including Time & Phase Sync)

Locate the AVR toolbar and click on **Equipment Details**



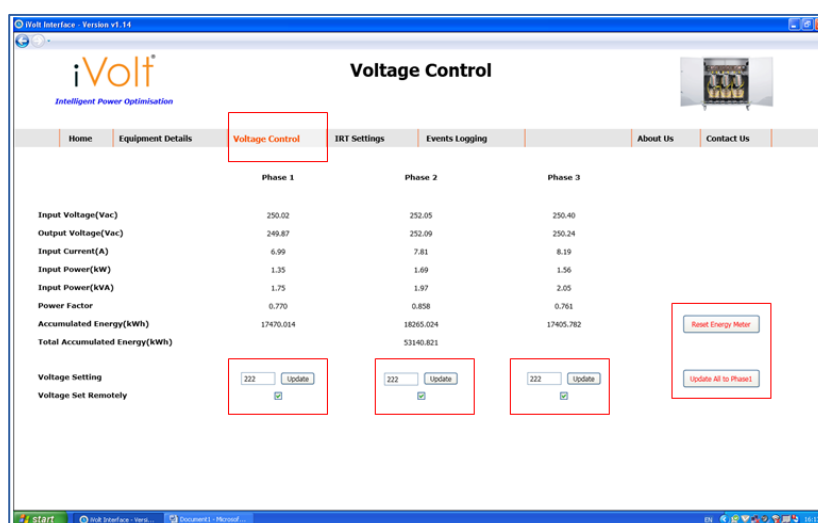
- Click on Retrieve AVR (iVolt) settings to download the existing AVR configuration.
- Unit details such as device number and serial number will be displayed in the associated boxes.
- An engineer can edit the white boxes if necessary. **Do not change the CT size.**
- Site Code is advised as this is used in remote access, alternatively, if no remote GSM Communications is available then the customer's description is acceptable.
- An engineer can synchronise the AVR to the laptop time and date by clicking on the '**Sync to PC**' button. Ensure laptop time is accurate.
- Any changes** are to be uploaded to AVR by clicking on the **UPDATE** button.



NOTE: The **Sync to PC** button and then the **Update** button will synchronise the time logs of all 3 phases. This action is advised during commissioning and Annual maintenance.

9.4.2 Voltage Control

Locate the AVR toolbar and click on **Voltage Control**



- AVR real-time metering will be displayed for all 3 phases
- To change the nominal voltage for a particular phase, edit the individual phase **Voltage Setting**, ensure the relevant box is ticked and click on that phase's **Update** button. When the box is un-ticked, the commissioning engineer is unable to alter the voltage locally and this function can only be actioned using the rotary switch on the control board (Sollatek engineer use only).

This function is only available for the topmost password access level (High).

- To update all 3 phases at the same time and with identical settings, edit phase 1 with relevant nominal voltage and click on **Update All to Phase 1** button.

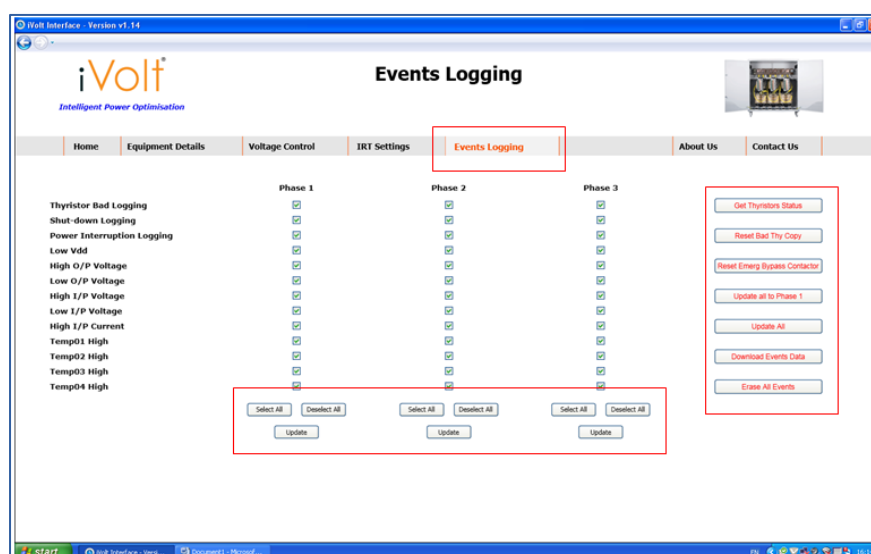
This function is available for low, medium, and high password access levels.



- Ensure all phases are at the same voltage setting when loads contain 3-phase equipment (improves 3-phase load balancing and mechanical reliability).
- Certain installations may require that an individual phase be set at a higher voltage due to existing excessive volt drop along with the site cabling.
- Resetting the Energy Meter will delete any stored info. Suggest this is done at the time of commissioning.

9.4.3 Events Logging

Locate the AVR toolbar and click on **Events Logging**



- Default factory settings have all tick boxes enabled to allow for comprehensive monitoring and logging of AVR/iVolt parameters. Do not disable unless requested by the manufacturer.
- Click on the update button to enable any tick box changes.
- Click on the **Download Events Data** button to retrieve all past events, a minimum of 60 minutes logging of data is recommended before downloading to provide a useful data set.
- A bar will appear showing the download in progress. On completion, you will be asked to save the spreadsheet (.csv) file in a location of your choice. Suggest save as Event, then Site ref and Phase number (Event. Big Shop. P1).
- **Events Data** is an event log detailing either operational issues or transgressions of voltage/current thresholds. Table 9.2 below lists the 31 monitored points and where applicable describes the limits. Please contact your Sollatek Customer Support Department if you require further assistance.
- The Event Data log is programmed to overwrite the earliest data when the event memory becomes full. The memory can be erased if required.
- Click on **Erase All Events** to clear the Event memory. Suggested on commissioning only.

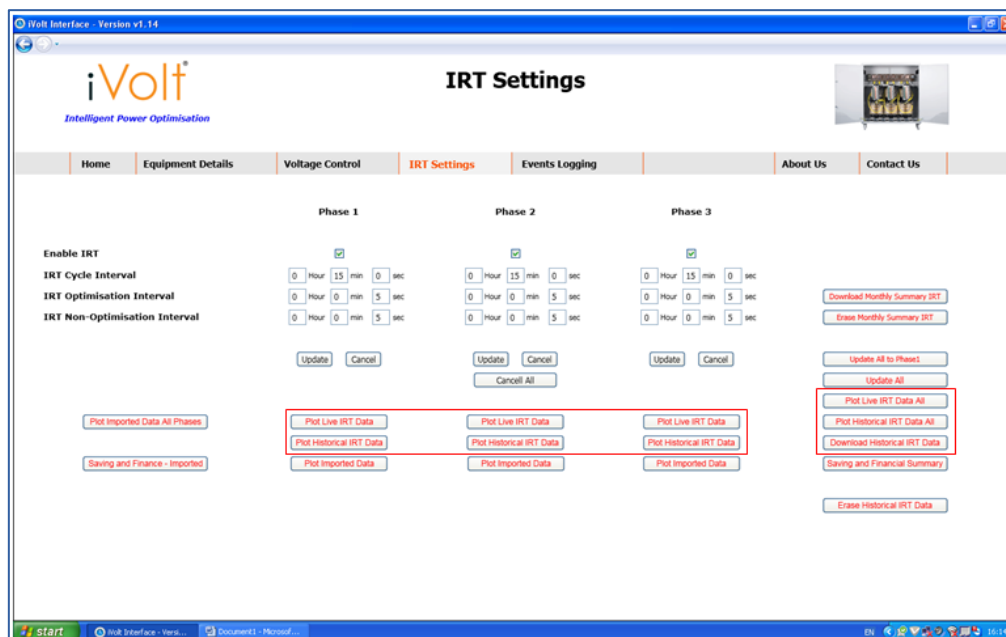
Event ID	Event Description	Threshold
1	Bad thyristor	
2	Shutdown mode	
3	Power interruption mode	
4	Vdd low	12V
5	Vdd back good	14V
6	O/P voltage high	240V _{AC}
7	O/P voltage low	200 V _{AC}
8	O/P voltage back good	230 V _{AC} & 210 V _{AC}
9	I/P voltage high	260 V _{AC}

10	I/P voltage low	150 V _{AC}
11	I/P voltage back good	250 V _{AC} & 200 V _{AC}
12	I/P current high	95%
13	I/P current back good	85%
14	Temp01 high	
15	Temp01 back good	
16	Temp02 high	
17	Temp02 back good	
18	Temp03 high	
19	Temp03 back good	
20	Temp04 high	
21	Temp04 back good	
22	Temp01 faulty	
23	Temp02 faulty	
24	Temp03 faulty	
25	Temp04 faulty	
26	Out of Sync	
27	Back in Sync	
28	O/P sense fuse bad	
29	O/P sense fuse back good	
30	Pri sense fuse bad	
31	Pri sense fuse back good	

Table 9.2: Events Monitoring Points & Limits

- The Event Data log is programmed to overwrite the earliest data when the event memory becomes full. The memory can be erased if required.
- Click on **Erase All Events** to clear the Event memory. Suggested on commissioning only.

9.4.4 Using the CDP Interface DIAGNOSTIC Functions



- **Note: Following IRT Data not available on AVR models.**
- Use the identified buttons to download the following Live or Historical Data for either individual or all phases.
- Plot Live IRT data all will only show the latest data since the command is requested, allow a few IRT cycles for sufficient information.
- Plot Historical IRT Data All will display a graph of the logged IRT for the last 32 days when a 15-minute IRT cycle is used. Increasing the IRT cycle to 30 minutes will allow 64 days of logging and slightly reduce savings accuracy if customer loads are sporadic.
- Downloading Historical IRT Data will prompt the engineer to save each phase's data in a .csv file in a folder location of their own choice. This data is then used for offline analysis using the graph and savings summary applications.
- The same functions can be used for the analysis of individual or all phases depending on which function is chosen by the engineer.

10 SPARES & SUPPORT

10.1 Recommended Spares

Component	Description	Qty
78081011	Fan 120mm 230V AC 90cfm Ball Bearing	3
78462011	Fan Finger Guard 120mm Metal	3
64606620	Panel Mtg Reversible USBA-USBB Connector	1
8M200100	Temperature Sensor Assembly - Brown	1
8M200800	Temperature Sensor Assembly - Grey	1
61306704	Fuse 6.3A AS 20x5mm HBC	10
8M292106	Thyristor Gate cable 100mm Unscreened	3
82761200	ST276 Thyristor Control Board Ass'd (B)	3
81450000	ST145 Surge/Spike 230V 3PH Ass'd 3x160J	2
11011220	Isolating Transformer 230V 20VA D1389	1
64606620	Panel Mtg Reversible USBA-USBB Connector	1
82882000	ST288 Thyristor G. Regular SKKT42 Ass'd	3
82892000	ST289 Thyristor G.Regular SKKT132 Ass'd	3
8M292105	Thyristor Gate Cable 170mm DWG 2642.03	3
54300790	Voltmeter 3 Phase Panel Mount	2
54720262	Ammeter 3 Phase Panel Mount	1
54610259/01	CT 100/5A Moulded Case	1
64611210	RJ45 Connector Panel Mount	1
75050706	Heat Sink Compound (Units in gram)	5g
64703520	USB to RS485 cable 1.8m	1
50103100	3.3V DC PSU DIN Rail	1
72830001	Castor Swivel + Brake AVR3X15-75 120kg	1
72820001	Castor Swivel AVR3X15-75 120kg	1
21240749	Thyristor Module 106A Ave 1400V	10
Component	Description	Qty
11100203	Transf AVR 100A 230V I/P+/-20% O/P+/-3%	1
21240750	Thyristor Module 136A Ave 1400V	3
62143106	Circuit Breaker MCB 100A 3 Pole	1
Component	Description	Qty
11075203	Trans AVR 75A 230V I/P $\pm 20\%$ O/P $\pm 4\%$	1
62073204	Circuit Breaker MCB 80A 4 Pole	1

10.2 Maintenance Requirements

The AVR requires minimum maintenance. A regular annual visual inspection is recommended for the following items.

1. Check the fan blades are free from dust build-up. If necessary, clean with a bottle brush.
2. Check the status of surge protection ST145 fuses.
3. Check the general condition of the unit.

In addition to the above visual inspection, it is recommended that the AVR event data is uploaded to verify that there are no anomalies. Contact Sollatek AVR Customer Support Dept. for assistance in analysing the Event data.

10.3 System Diagrams

Drawing Ref	Description
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Contact Sollatek UK Ltd for model specific drawing details.

10.4 Warranty

The AVR is supplied with a 2-year warranty on transformer windings and control boards. Please contact Sollatek Customer Support Department for advice on technical issues. An extended warranty and maintenance support is available upon request.

Expected Service life >25 years.



SAVE THESE INSTRUCTIONS!

THIS MANUAL CONTAINS IMPORTANT INSTRUCTIONS FOR YOUR AUTOMATIC VOLTAGE REGULATOR THAT SHOULD BE FOLLOWED DURING ITS INSTALLATION AND MAINTENANCE.