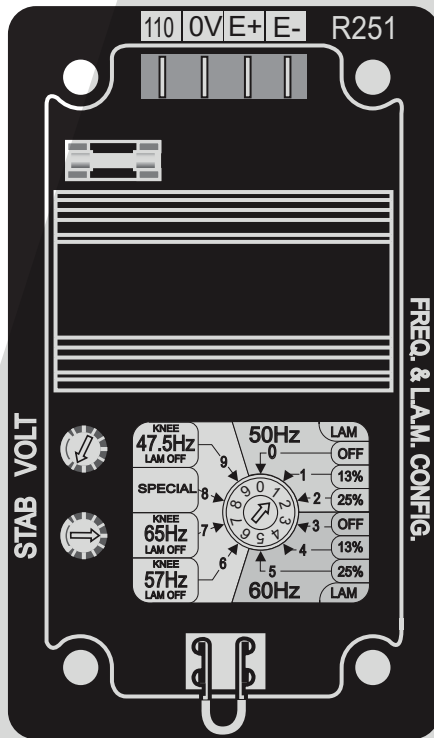




Power



# R251

AVR

# R251 AVR

**This manual concerns the alternator AVR which you have just purchased.  
We wish to draw your attention to the contents of this maintenance manual.**

## SAFETY MEASURES

Before using your machine for the first time, it is important to read the whole of this installation and maintenance manual.

All necessary operations and interventions on this machine must be performed by a qualified technician.

Our technical support service will be pleased to provide any additional information you may require.

The various operations described in this manual are accompanied by recommendations or symbols to alert the user to potential risks of accidents. It is vital that you understand and take notice of the following warning symbols.

### WARNING

**Warning symbol for an operation capable of damaging or destroying the machine or surrounding equipment.**



**Warning symbol for general danger to personnel.**



**Warning symbol for electrical danger to personnel.**



**All servicing or repair operations performed on the AVR should be undertaken by personnel trained in the commissioning, servicing and maintenance of electrical and mechanical components.**



**When the generator is driven at a frequency below 28 Hz for more than 30 seconds with an analogue AVR, its AC power supply must be disconnected.**

## WARNING

**This AVR can be incorporated in a EC-marked machine.  
This manual is to be given to the end user.**

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# R251 AVR

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### Disposal and recycling instructions

The R251 is an IP00 product. It must be installed inside a unit so that this unit's cover can provide IP20 minimum total protection (it must only be installed on our alternators in the appropriate location so that when viewed externally, it has a higher degree of protection than IP20).

# R251 AVR

## 1 - POWER SUPPLY

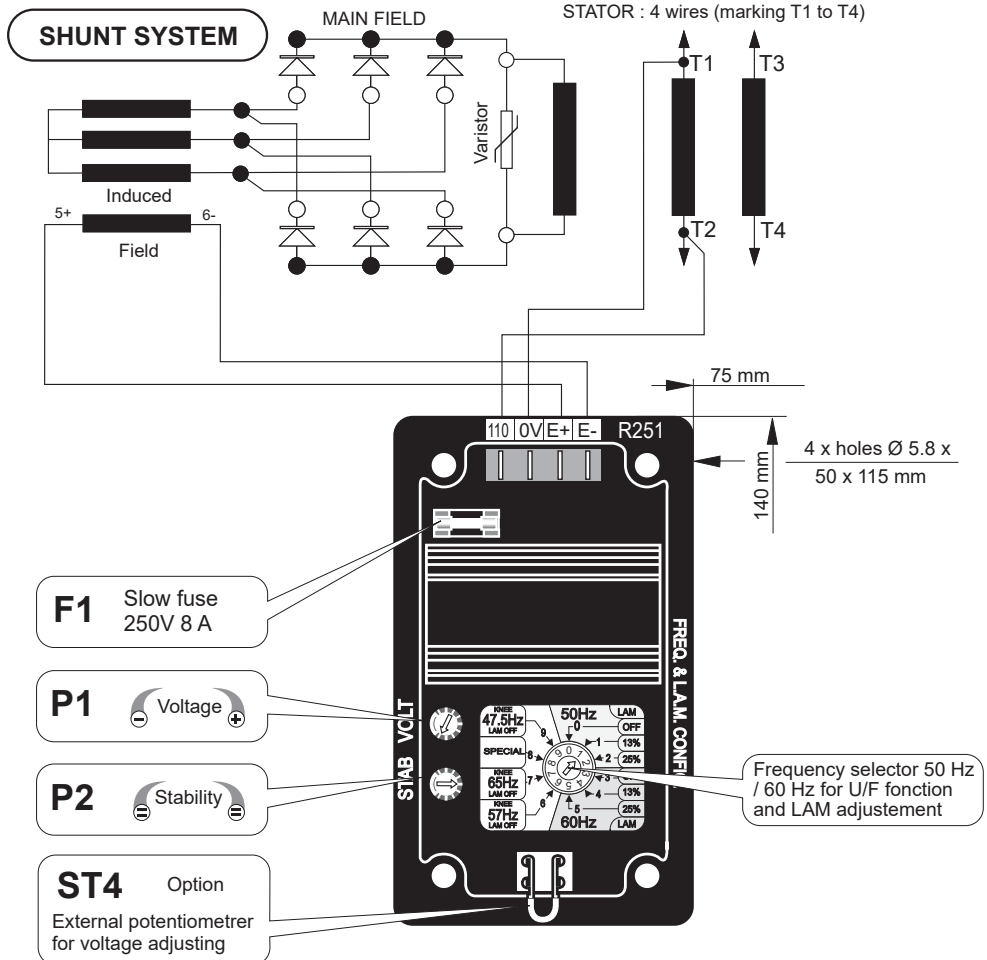
### 1.1 - SHUNT excitation system

The SHUNT excitation alternator is auto-excited with a R251 voltage regulator.

The regulator controls the excitation current according to the alternator's output voltage.

With a very simple conception, the SHUNT excitation alternator does not have a short circuit capacity.

The R251 is a R250 with a specific excitation ceiling = 4 A during 30 s (set for the dedicated single phase alternator with type M or M1).



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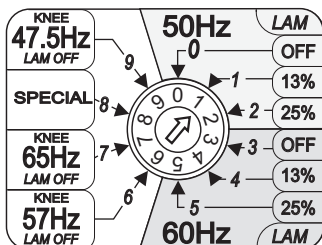
## 2 - R251 AVR

### 2.1 - Characteristics

- Storage: -55°C; +85°C
- Operation: -40°C; +70°C
- Voltage regulation: around  $\pm 0,5\%$
- Supply range/voltage detection 85 to 139V (50/60Hz).
- Rapid response time (500 ms) for a transient voltage variation amplitude of  $\pm 20\%$ .
- Voltage setting **P1**
- Stability setting **P2**
- Power supply protected by 8 A fuse, replacement product: Ferraz-Shawmut T084013T fast-blow fuse, 8 A FA 250 V, breaking capacity 30 kA.

### 2.2 - U/F function and LAM

The threshold position (50 Hz - 60 Hz) to action the U/F function as well as the LAM setting type is selected using the potentiometer.



**WARNING:** The jumper settings must correspond to the rated operating frequency (see the nameplate on the alternator).

Risk of destruction for the alternator.

The threshold position and LAM function settings are done with the jumper.

### Operating at 50 Hz: (U/F gradient)

**0:** threshold at 48 Hz without LAM for impacts between 30 and 40% of the rated load.

**1:** threshold at 48 Hz with LAM 13% for impacts between 40 and 70% of the rated load.

**2:** threshold at 48 Hz with LAM 25% for impacts > 70% of the rated load.

### Operating at 60 Hz: (U/F gradient)

**3:** threshold at 58 Hz without LAM for impacts between 30 and 40% of the rated load.

**4:** threshold at 58Hz with LAM 13% for impacts 40 and 70% of the rated load.

**5:** threshold at 58Hz with LAM 25% for impacts > 70% of the rated load.

### Specific operating

**6:** threshold at 57Hz without LAM for speed variations at a steady state > 2 Hz

**7:** threshold at 65Hz without LAM for variable speed and tractelec / gearlec (U/F gradient).

**8:** special: the factory setting 48Hz 2U/F gradient ; a special programme is possible on request. This programme must be specified before ordering, during the project study.

**9:** threshold at 47.5 Hz without LAM for speed variations at a steady state > 2 Hz.

For hydraulic applications, it is advisable to select:

- position 0 for 50 Hz
- position 3 for 60 Hz

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## 2.3 - AVR options

Potentiometer for remote voltage adjustment, 1000  $\Omega$  / 0.5 W min: adjustment range  $\pm 5\%$ .

- Remove the **ST4** jumper.



For wiring up the external potentiometer; the “earth” wires must be isolated as well as the potentiometer terminals (wires at the same voltage as the power).

## 2.4 - LAM characteristics (Load Acceptance Module)

### 2.4.1 - Voltage drop

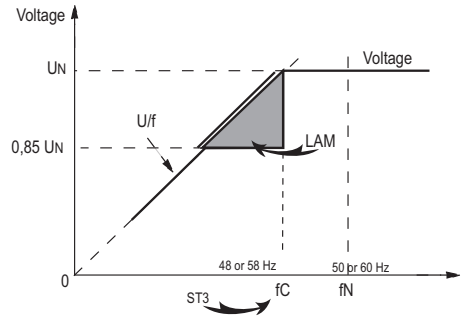
The LAM system is integrated in the AVR. It is active as standard. It can be adjusted to 13% or 25%.

- Role of the «LAM» (Load Adjustment Module):

On application of a load, the rotation speed of the generator set decreases. When it passes below the preset frequency threshold, the LAM causes the voltage to drop by approximately 13% or 25% and consequently the amount of active load applied is reduced by approximately 25% to 50%, until the speed reaches its rated value again.

Hence the “LAM” can be used either to reduce the speed variation (frequency) and its duration for a given applied load, or to increase the applied load possible for one speed variation (turbo-charged engines). To avoid voltage oscillations, the trip threshold for the “LAM” function should be set approximately 2 Hz below the lowest frequency in steady state.

It is advised to use the “LAM” at 25% for load impacts > at 70% of the genset rated power.

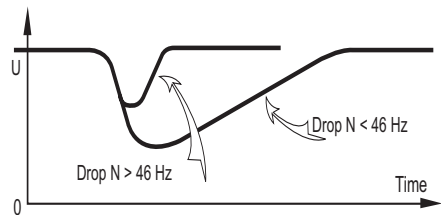


### 2.4.2 - Gradual voltage return function

During load impacts, the function helps the genset to return to its rated speed faster thanks to a gradual increase in voltage according to the following principles:

- if the speed drops between 46Hz and 50Hz, the rated voltage follows a fast gradient as it is restored.

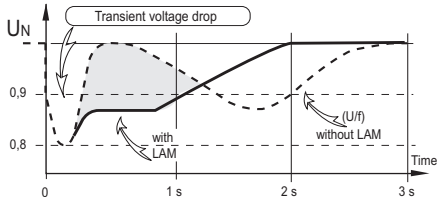
- if the speed drops below 46 Hz, since the engine needs more help, the voltage follows a slow gradient as it returns to the reference value.



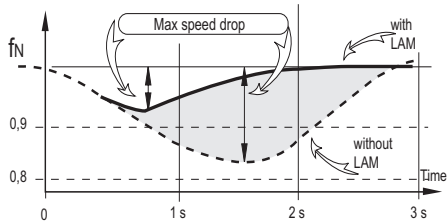
# R251 AVR

## 2.5 - Typical effects of the LAM with a diesel engine or without a LAM (U/F only)

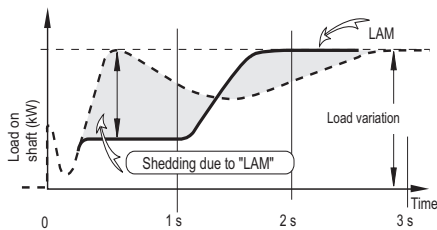
### 2.5.1 - Voltage



### 2.5.2 - Frequency



### 2.5.3 - Power



# R251 AVR

## 3 - INSTALLATION - COMMISSIONING

### 3.1 - Electrical checks on the AVR

- Check that all connections have been made properly as shown in the attached wiring diagram.
- Check that the position of the jumper corresponds to the operating frequency.
- Check whether the **ST4** jumper or the remote adjustment potentiometer have been connected.

### 3.2 - Settings



The different settings made during the trial are to be done by qualified personnel. Respecting the load speed specified on the nameplate is vital in order to start a settings procedure. After operational testing, replace all access panels or covers.

The only possible settings on the machine are to be done with the AVR.

#### 3.2.1 - R251 settings (SHUNT system)

Initial potentiometer positions

- voltage setting potentiometer **P1** for the AVR: full left
- remote voltage setting potentiometer: in the middle.

Operate the alternator at its rated speed: if the voltage does not rise it is necessary to re-magnetise the magnetic circuit.

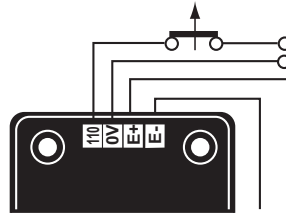
- slowly adjust the voltage potentiometer of the AVR **P1** until the output voltage reaches its rated value.
- Stability setting with **P2**.

### 3.2.2 - Special type of use

#### WARNING

**Excitation circuit E+, E- must not be left open when the machine is running: AVR damage will occur.**

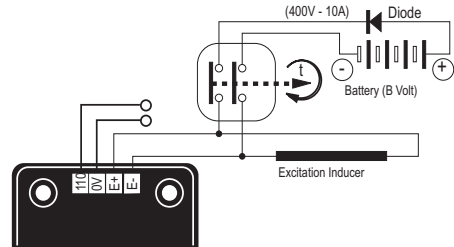
#### 3.2.2.1 - R251 field weakening (SHUNT)



The exciter is switched off by disconnecting the AVR power supply (1 wire - 0 or 110V). Contact rating: 16A - 250V AC.

**Do not reclose the power supply until the voltage has reached a value  $\leq 15\%$  of the rated voltage (approximately 5 seconds after opening).**

#### 3.2.2.2 - R251 field forcing



**Battery must be isolated from the earth.**



**Exciter field may be at line potential.**



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## 3.3 - Electrical faults

Fault	Action	Effect	Check/Cause
No voltage at no load on start-up	Connect a new battery of 4 to 12 volts to terminals E- and E+, respecting the polarity, for 2 to 3 seconds	The alternator builds up and its voltage is still correct when the battery is removed	- Lack of residual magnetism
		The alternator builds up but its voltage does not reach the rated value when the battery is removed	- Check the connection of the voltage reference to the AVR - Faulty diodes - Armature short-circuit
		The alternator builds up but its voltage disappears when the battery is removed	- Faulty AVR - Field windings open circuit (check winding) - Revolving field coil open circuit (check the resistance)
Voltage too low	Check the drive speed	Correct speed	Check the AVR connections (AVR may be faulty) - Field windings short-circuited - Rotating diodes burnt out - Revolving field coil short-circuited (check the resistance)
		Speed too low	Increase the drive speed (do not touch the AVR voltage setting before running at the correct speed)
Voltage too high	Adjust AVR voltage potentiometer	Adjustment ineffective	- Faulty AVR - 1 faulty diode
Voltage oscillations	Adjust AVR stability potentiometer		- Check the speed : possibility of cyclic irregularity - Loose connections - Faulty AVR - Speed too low when on load (or U/F bend set too high)
Voltage correct at no load and too low when on load (*)	Run at no load and check the voltage between E+ and E- on the AVR		- Check the speed (or U/F bend set too high) - Faulty rotating diodes - Short-circuit in the revolving field coil (check the resistance) - Faulty exciter armature (check the resistance)
<b>(*) Caution :</b> For single-phase operation, check that the sensing wires coming from the AVR are correctly connected to the operating terminals.			
Voltage disappears during operation	Check the AVR, the surge suppressor, the rotating diodes and replace any defective components	The voltage does not return to the rated value	- Exciter winding open circuit - Faulty exciter armature - Faulty AVR - Revolving field coil open circuit or short-circuited



**Warning: after operational testing, replace all access panels or covers.**

# R251 AVR

## 4 - SPARE PARTS

### 4.1 - Designation

Description	Type	Code
AVR	R251	AEM 110 RE 021

### 4.2 - Technical support service

Our technical support service will be pleased to provide any additional information you may require.

For all spare parts orders or technical support requests, send your request to [service.epg@leroy-somer.com](mailto:service.epg@leroy-somer.com) or your nearest contact, whom you will find at [www.lrsm.co/support](http://www.lrsm.co/support) indicating the type and the code number of the AVR.

To ensure that our products operate correctly and safely, we recommend the use of original manufacturer spare parts.

In the event of failure to comply with this advice, the manufacturer cannot be held responsible for any damage.

# R251

## AVR

### Disposal and recycling instructions

We are committed to limiting the environmental impact of our activity. We continuously monitor our production processes, material sourcing and product design to improve recyclability and minimise our environmental footprint.

These instructions are for information purposes only. It is the user's responsibility to comply with local legislation regarding product disposal and recycling.

All materials listed above need special treatment to separate waste from reclaimable materials and should be entrusted to specialist recycling companies.

### Waste & hazardous materials

The following components and materials require special treatment and must be separated from the alternator before the recycling process:

- electronic materials found in the terminal box, including the automatic voltage regulator (198), current transformers (176), interference suppression module and other semi-conductors.
  - diode bridge (343) and surge suppressor (347), found on the alternator rotor.
  - major plastic components, such as the terminal box structure on some products.
- These components are usually marked with information concerning the type of plastic.

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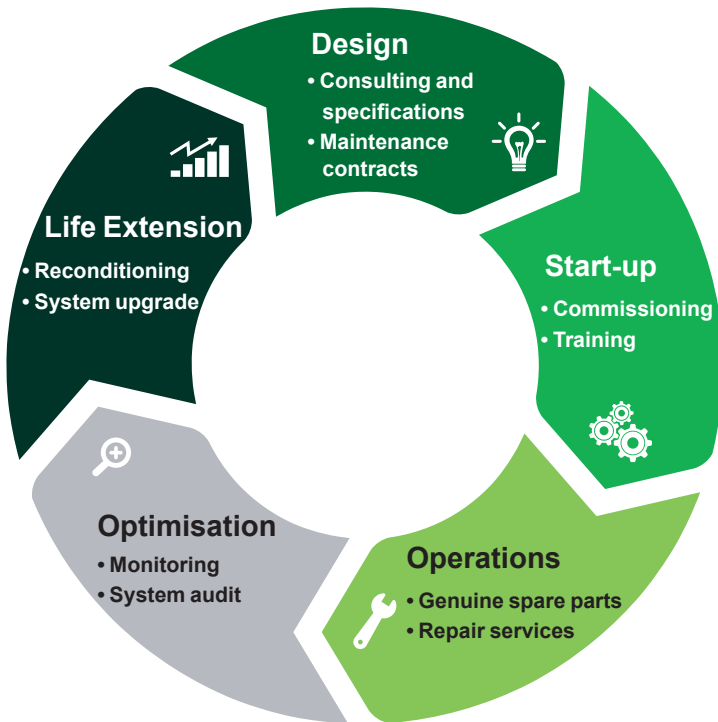
# Service & Support

Our worldwide service network of over 80 facilities is at your service. Our local presence is your guarantee for fast and efficient repair, support and maintenance services.

Trust your alternator maintenance and support to electric power generation experts. Our field personnel are 100% qualified and fully trained to operate in all environments and on all machine types.

We have a deep understanding of alternators operations, providing the best value service to optimize your cost of ownership.

How can we help:



Contact us:


**Americas:** +1 (507) 625 4011

**EMEA:** +33 238 609 908

**Asia Pacific:** +65 6250 8488

**China:** +86 591 8837 3010

**India:** +91 806 726 4867

 [service.epg@leroy-somer.com](mailto:service.epg@leroy-somer.com)



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