R450 R450M R450T
A.V.R.

1 - GENERAL INFORMATION

1.1 - Description

The R450 AVR is supplied in a casing designed to be mounted on a panel with dampers.
- Operating temperature: 20°C to +70°C.
- Storage temperature: 55°C to +85°C.
- Shocks on the base: 9 g depending on the 3 axes.
- Vibrations: less than 10 Hz, 2 mm half-peak amplitude 10 Hz to 100 Hz: 100 mm/s, above 100 Hz: 8 g.

WARNING

The AVR is IP00, it must be incorporated in an environment which ensures it a IP20 protection.

1.2 - Identification

There are 3 different versions available:

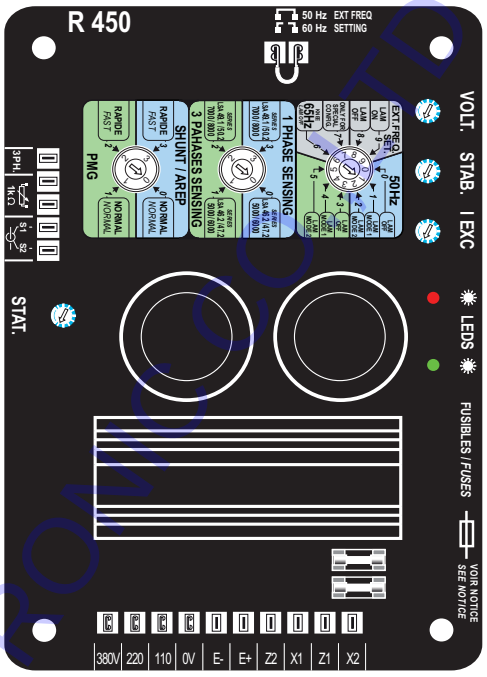
- R 450: single-phase sensing,
- R 450M: single-phase sensing,
- R 450T: three-phase sensing,

R450M & R450T are exactly identical in terms of characteristics and dimensions with “Mate N Lok™” connectors.

1.3 - Tools

The “Mate N Lok™” connectors tools references are the following:
- crimping pliers: Ref TYCO 654.149.1
- Extractor: Ref TYCO 539.972.1

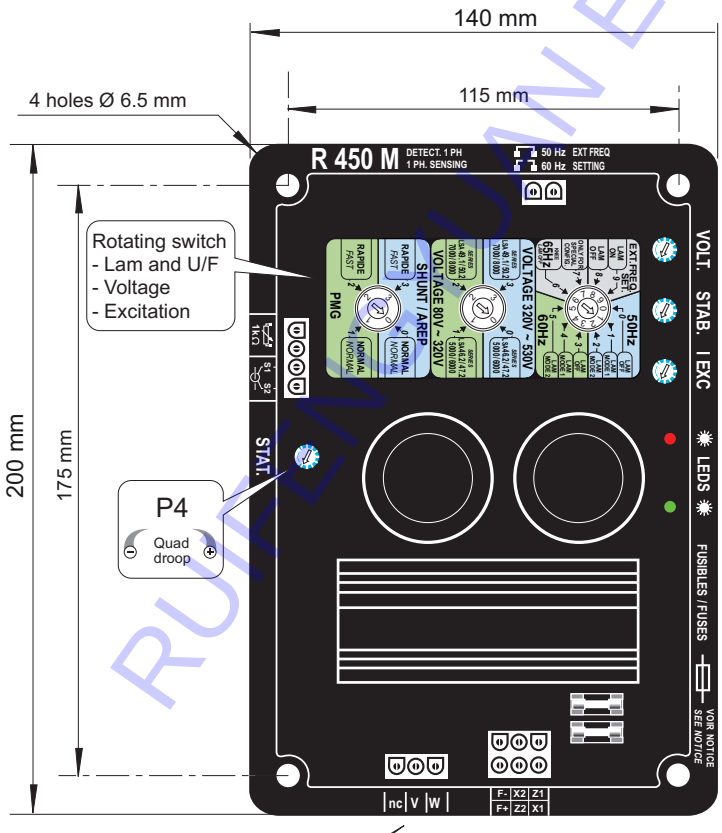
The connection of R450 is realised by “Faston” connectors and the voltage sensing is single - phase.



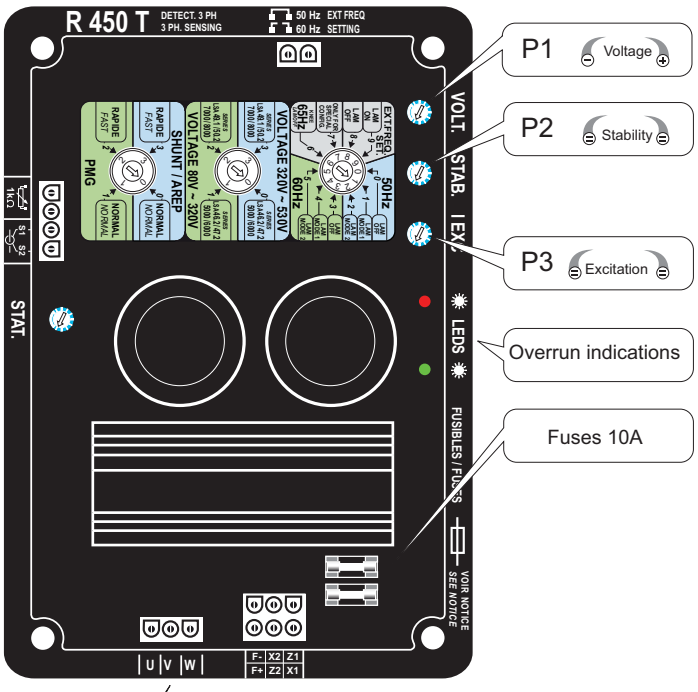
R 450

WARNING

Connectors must be unlocked before unpluging.



R 450 M



R 450 T

2 - POWER SUPPLY

Both the AREP & PMG excitation systems are controlled by the AVR.

2.1 - AREP excitation system

With **AREP** excitation, the electronic AVR is powered by two auxiliary windings which are independent of the voltage sensing circuit.

The first winding has a voltage proportional to the alternator main voltage (Shunt characteristic), the second one has a voltage proportional to the stator current (compound characteristic : Booster effect).

The power supply voltage is rectified and filtered before being used by the AVR monitoring transistor.

The rotating switch should be in the AREP position (see 3.2.3).

2.2 - PMG excitation system

With **PMG** excitation, a permanent magnet generator (PMG) added to the alternator supplies the AVR with voltage which is independent of the main alternator winding. These two excitation principles provide the machine with a short-circuit current overload capacity of 3 IN for 10 s.

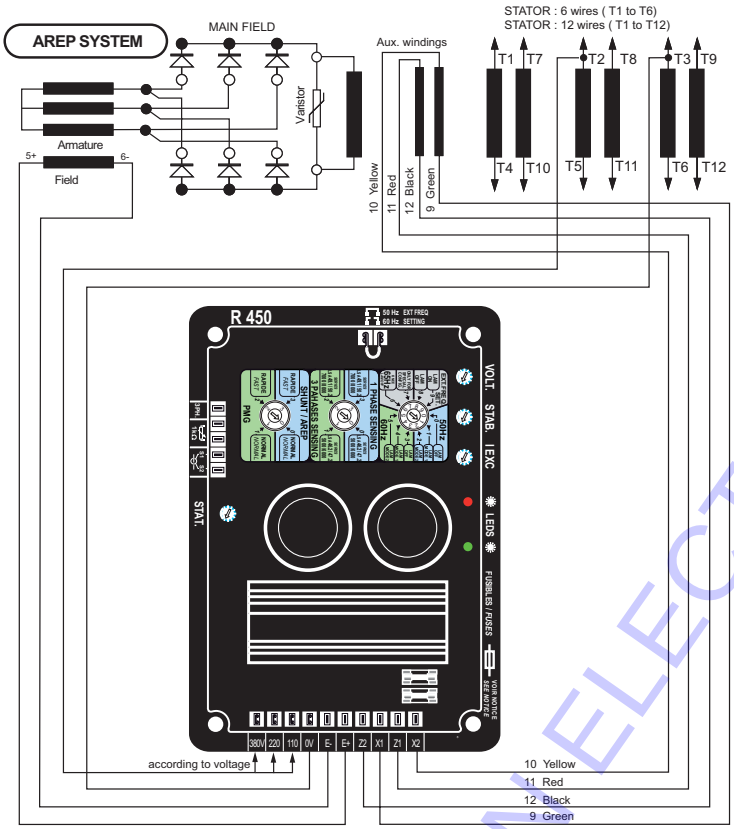
The AVR monitors the alternator output voltage by adjusting the excitation current.

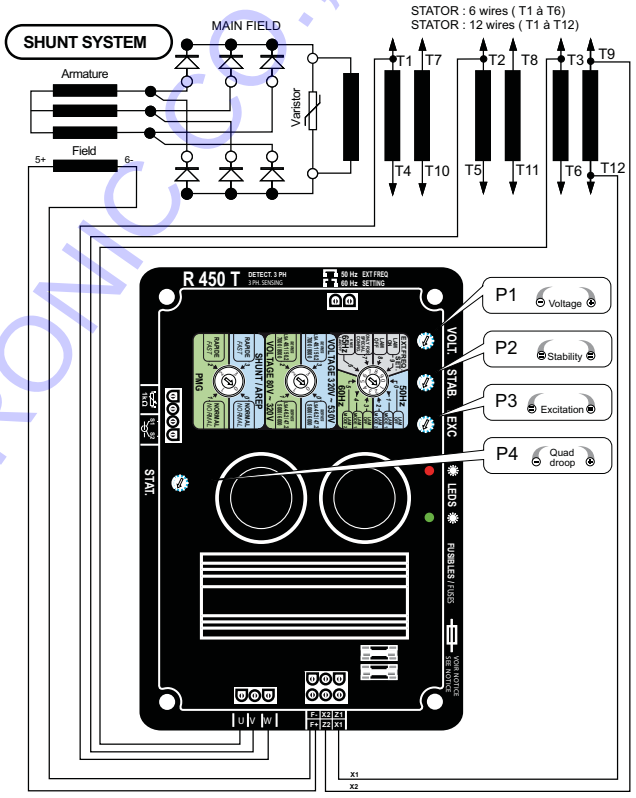
The rotating switch should be in the PMG position (see 3.2.3).

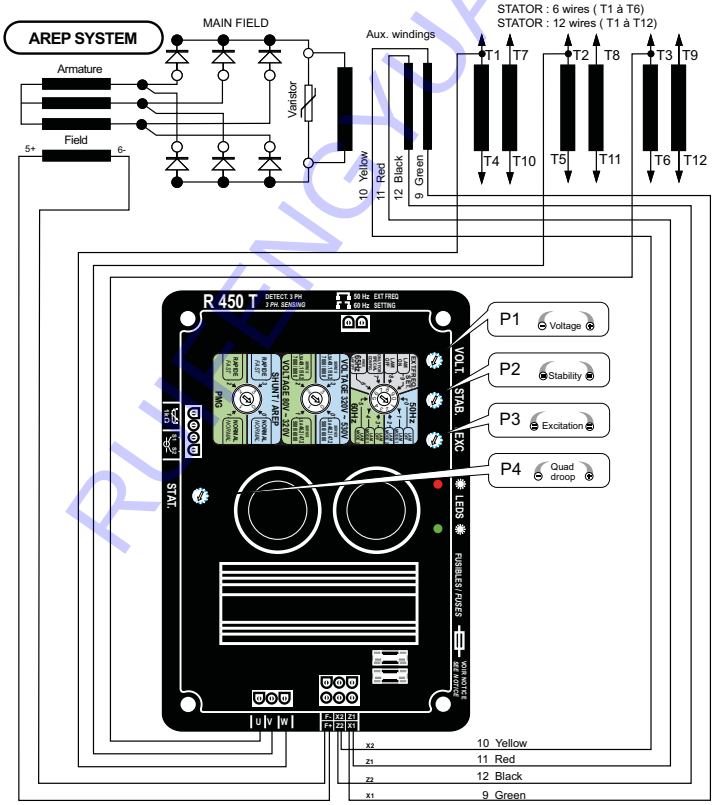
2.3 - SHUNT or separate excitation system

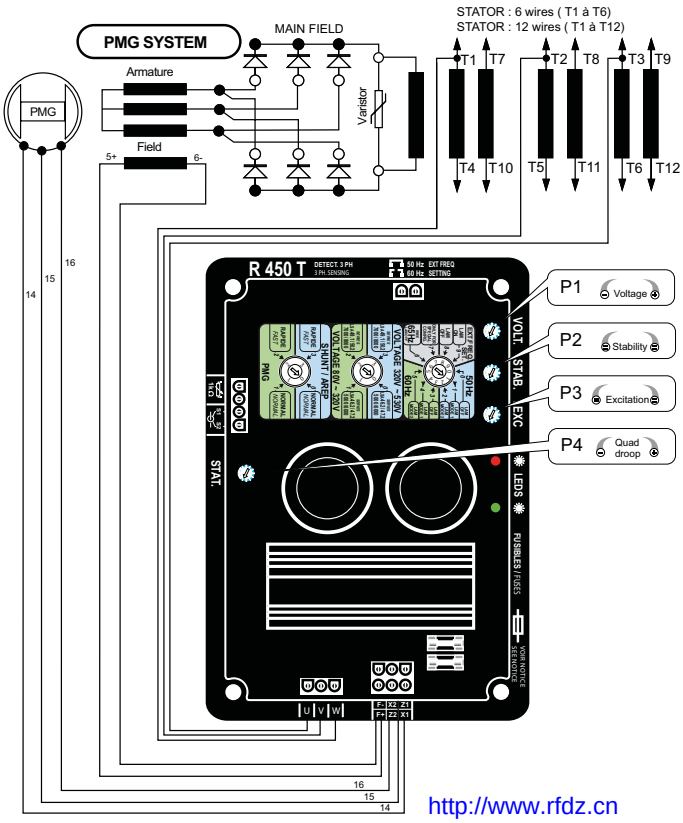
With SHUNT excitation, the AVR is powered by the main winding (100V to 140V - 50/60 Hz) by using X1, X2 on the AVR.

The rotating switch should be in the AREP position (see 3.2.3).









3 - TECHNICAL CHARACTERISTICS

3.1 - Electrical characteristics

- maximum power supply: 150V - 50/60 Hz
- Rated overload current: 10 A - 10 s
- Electronic protection:
  - In the case of a short-circuit, the excitation current is reduced to a value less than 1A after 10 s
  - In the event of loss of voltage reference, the excitation current is reduced to a value less than 1A after 1s for AREP/SHUNT, 10 s for PMG.
  - In the event of overexcitation, the current is reduced as indicated in the next diagram (see 3.2.1.4).
- Fuses: F1 on X1 and F2 on Z2 10A, 250V.
- Voltage sensing

R450 : single-phase connection

- 0-110 V terminals = 95 to 140 V
- 0-220 V terminals = 170 to 260 V
- 0-380 V terminals = 340 to 528 V

R 450 M: single-phase connection to V and W. Rotating switch set to 'Voltage 80V - 320V'

R 450 T: three-phase connection to U, V and W. Rotating switch set to 'Voltage 320V - 530V'

For other voltages, a transformer should be used.

- Voltage regulation:± 0.5%.
- Current sensing: (parallel operation): input S1, S2 intended for 1 C.T. < 2.5 VA cl1, secondary 1 A or 5 A.

3.2 - Configurations:

3.2.1 - Settings

3.2.1.1 - Voltage

Voltage adjustment via potentiometer **P1** in the ranges described in the table below:

For 50 and 60 Hz	Max.
High range	Un ≤ 530 V
Medium range	Un ≤ 252 V

WARNING

The allowed adjustment range is ±5%; when the setting exceeds these limits, please check that it is conform with the power table.

3.2.1.2 - Quadrature droop:

Quadrature droop adjustment via potentiometer **P4** within a range :

- from 0 to 8% with a PF=0.8 for 400V applications.
- From 0 to 14% with a PF=0.8 for 240V applications.
- From 0 to 8% for 110V applications with a step-up transformer (ratio of 4) placed on the voltage reference.

The potentiometer P4 has a non linear response. Then, when a 1A secondary CT is connected the effective range starts from the the second 1/3 of P4 range and in the case of a 5A secondary CT the effective range starts from the first 1/3.

When a 5A CT is used, the adjustment range is higher, so P4 must be set to the first 1/4 (anti-clockwise) and then progressively increase it.

WARNING

The CT must be connected.

3.2.1.3 - Stability:

Stability adjustment via potentiometer **P2.** Selection of rotating switch according to the machine type and the response time as indicated in paragraph 3.2.3.

3.2.1.4 - Excitation limitation:

Excitation limitation adjustment via potentiometer **P3** as described below.

The excitation current limitation threshold in steady state is set by a potentiometer at 110% of the rated value. The adjustment is made by the operator during the on-load test at rated power by tuning the potentiometer.

When the excitation current exceeds this value, a counter is activated at the speed of one record per second for 90 s. When this time is elapsed, the current is reduced to the value of the rated excitation current. If in the meantime the excitation current drops below the threshold value, the counter counts down at the same speed.

WARNING

The limitation threshold must be adjustable between 1 and 5.5 A. The genset breaker must be open during the short circuit. If the genset is restarted in short circuit, there is a excitation build up during 10s again at the maximum value.

Operation between 3 and 6 In when short-circuited:

The excitation current ceiling during a short-circuit equals 2.9 times the fixed threshold when setting the permitted excitation ceiling in continuous operation. When the threshold is exceeded for a period = 10 s the current is reduced to a value between 0.5 and 0.7 A (shutdown).

NB: Even if the AVR is limiting the exciter field current to a value less than 1A, the generator will continue to supply the fault current. In all operating conditions the maximum excitation current is clamped to 9.5 A ± 0.5 A.

Overrun indications:

One green LED:

- Lights up when the excitation current is below the continuous operation threshold It signals the AVR normal operation.
- Turns off when the excitation current ceiling used to obtain short-circuit operation is reached and when the excitation current is reduced to the shutdown value.
- Flashes when the over excitation timer is decrementing.

NB: After the short circuit is cleared, the output voltage is limited to about 70% of the rated voltage. This avoids no load overvoltage for machine which no load exciter current is less than the shutdown current (only in AREP).

Red LED:

- Lights up simultaneously with the green led when the continuous operation threshold is reached for more than 90 s and the excitation current is reduced to the continuous operation threshold. It is used to set the excitation current ceiling
- Turns off when the excitation current is less than the setting value
- Flashes when the excitation current is above the continuous operation threshold during less than 90 s.

When the green led is off :

-flashes in a case of loss of voltage sensing <1s or 10s for PMG excitation.

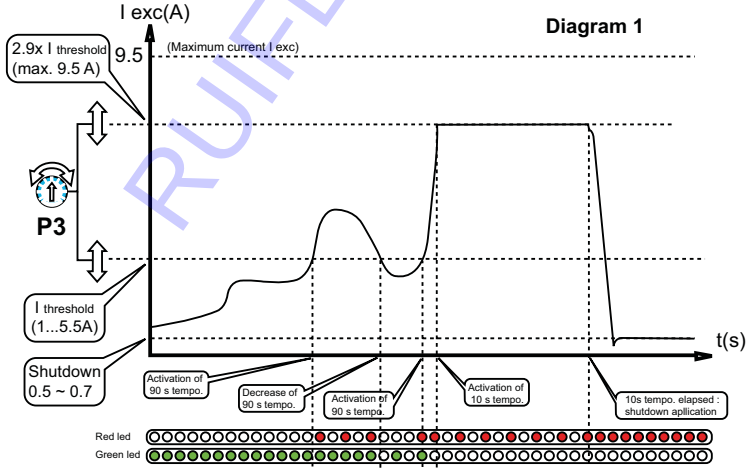
-turns on if Iex= Ishutdown.

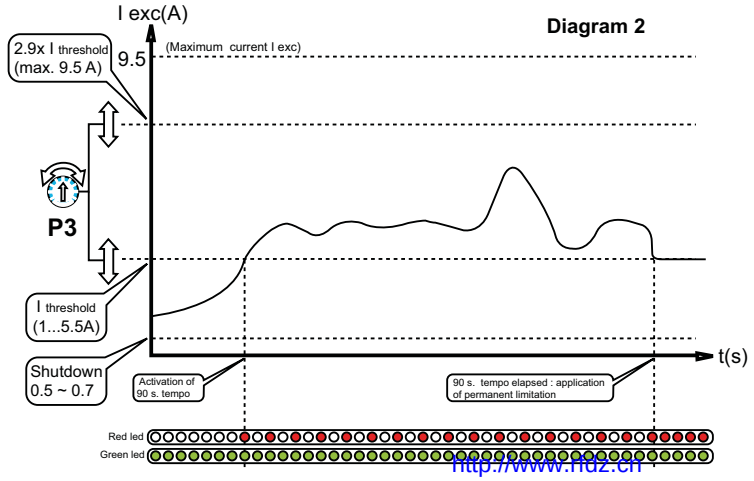
WARNING

In the case of overload protection activation, a voltage drop will appear with a value sometimes higher than 10% of the reference voltage.

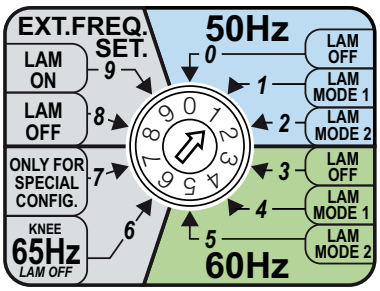
The UnderVoltage protection is not achieved by the AVR. Customer must ensure that his installation load is correctlyprotectedagainstundervoltage.

During load rejection, the overvoltage is observed and takes a few seconds to be cleared.





3.2.2 - Rotating switch selection: LAM and U/F

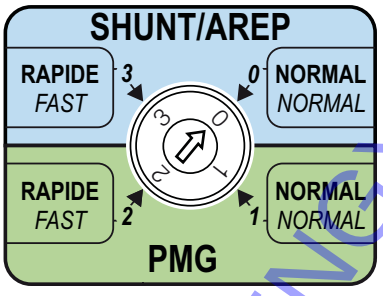


- Pos 0: Change in the voltage according to the U/F ratio, knee-point position at 48 Hz.
- Pos 1: Change in the voltage according to the 2U/F, knee-point position at 48 Hz.
- Pos 2: Change in the voltage according to the self auto-adaptive LAM combined with 2U/F, knee-point position at 48 Hz.
- Pos 3: Change in the voltage according to the U/F ratio, knee-point position at 58 Hz
- Pos 4: Change in the voltage according to the 2U/F, knee-point position at 58 Hz.
- Pos 5: Change in the voltage according to the self auto-adaptive LAM combined with 2U/F, knee-point position at 58 Hz.
- Pos 6: Change in the voltage according to the U/F ratio, knee-point position at 65 Hz (Tractelec application and variable speed above 1800 rpm).
- Pos 7: Special (not used).
- Pos 8: Change in the voltage according to the U/F ratio, knee-point position at 48 Hz or 58 Hz according to selection of the frequency by an external contact.
- Pos 9: Change in the voltage according to LAM 1, knee-point position at 48 Hz or 58 Hz according to selection of the frequency by an external contact

WARNING

For Pavers and hydraulic applications, select positions 0 (50 Hz) or 3 (60 Hz).

3.2.3 Rotating switch: excitation type and time response



0: AREP excitation and normal time response.

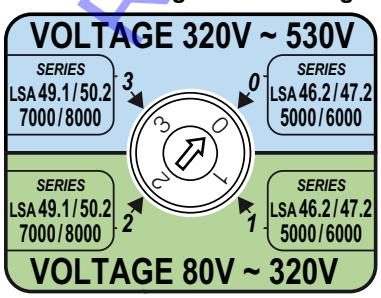
3: AREP excitation and fast time response.

1: PMG excitation and normal time response.

2: PMG excitation and fast time response.

For SHUNT applications, AREP excitation must be selected.

R450M &T Rotating switch : voltage sensing



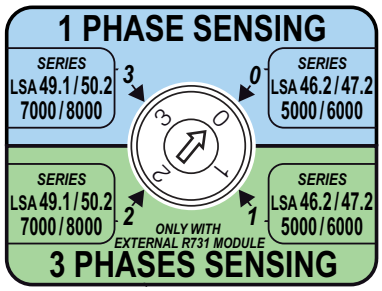
0: Voltage from 320 to 530V
- LSA 46.2/47.2 - 5000 / 6000 series.

3: Voltage from 320 to 530V
- LSA 49.1/50.2 - 7000 / 8000 series.

1: Voltage from 80 to 320V
- LSA 46.2/47.2 - 5000 / 6000 series.

2: Voltage from 80 to 320V
- LSA 49.1/50.2 - 7000 / 8000 series.

R450 Rotating switch: voltage sensing



0: Single phase sensing
- LSA46.2/47.2 series.

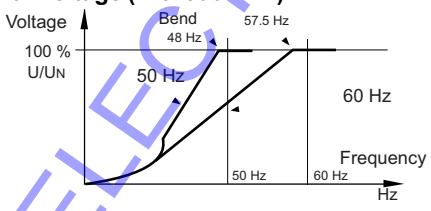
3: Single phase sensing
- LSA49.1/50.2 series.

1: Three-phase sensing with optional module R731
- LSA46.2/47.2 series.

2: Three-phase sensing with optional module R731
- LSA49.1/50.2 series.

3.3 - U/F and LAM function

3.3.1 - Frequency variation compared with voltage (without LAM)



3.3.2 - LAM (Load Acceptance Module) characteristics

3.3.2.1 - Voltage drop

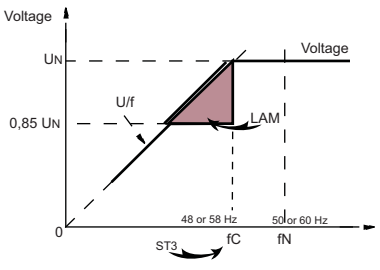
The LAM system is integrated in the AVR. As standard it is active.

Role of the LAM:

On application of a load, the genset rotation speed decreases. When it falls below the preset frequency threshold, the LAM causes the voltage to drop proportionately to the frequency (LAM1) or to the active power (LAM2) depending the the rotating switch position. This reduces the active load scale applied until the speed returns to its rated value.

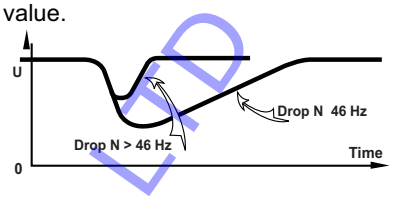
Hence the LAM can be used either to reduce the speed variation (frequency) and its duration for a given applied load, or to increase the applied load possible for one speed variation (turbo-charged engine).

To avoid voltage oscillations, the trip threshold for the LAM function should be set approximately 2 Hz below the rated frequency.



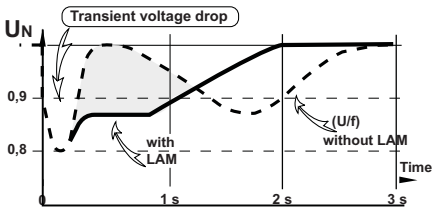
3.3.2.2 - Soft voltage recovery function

During load impacts, the function helps the genset to return to its rated speed faster with a gradual increase in voltage according to the principle:
- If the speed drops between 46 and 50 Hz (in 50Hz operation), the rated voltage is recovered by following a fast gradient.
- 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.

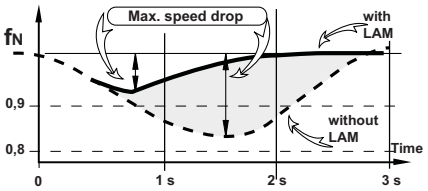


3.4 - Typical effects of the LAM with a diesel engine with or without a LAM (U/F only)

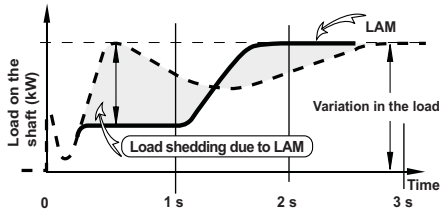
3.4.1 - Voltage



3.4.2 - Frequency



3.4.3 - Power



3.5 - AVR options

- Current transformer for parallel operation of...../1 A or 5 A according to the potentiometer P4 position.

- Voltage transformer
(adaptation)

- Remote voltage adjustment potentiometer.
For a range of variation:
± 5% : 470 Ω
± 10% : 1 kΩ
the power of the potentiometer can be 0.5 W, 2 W or 3 W.

The potentiometer input must be isolated. Do not connect it to the ground.