

**AVR 400 SERIES**  
(AUTOMATIC VOLTAGE REGULATOR)

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## ***Power Drive Systems***

### **AVR 400 AUTOMATIC VOLTAGE REGULATOR**

#### **1. INTRODUCTION**

The AVR 400 is a solid state device, which is designed to give accurate and stable voltage regulation of brushless, rotating or stationary field alternators regardless of prime mover type and will replace most electronic regulators with or without separate excitation.

The AVR 400 is suitable for one and three phase machines both 50 and 60Hz and has a selectable voltage sensing range available.

The AVR has several features:

- Voltage adjustment  $\pm 10\%$  over each range
- Wide range of stability
- Underspeed adjustment which will provide voltage droop with large motor starting loads, this feature will provide excellent starting characteristics and prevent unnecessary stalling of the prime mover
- Remote voltage adjustment available
- Fuse protection
- LED indication of underspeed operation

#### **2. OPERATION**

The regulator senses the alternator output and derives excitation power from the 3 phase connections to the alternator output.

Regulation and stability is maintained provided the prime mover speed is within governor class A1 to ISO 3046, at any machine load or power factor by comparing the sensed voltage with an internal reference.

The unit constantly adjusts the field excitation level to compensate for voltage difference between the sensed voltage and reference.

Output voltage of the machine will be held to  $\pm 1.5\%$  for steady state conditions including cold to hot variations in ambient conditions of -10 deg. to +70 deg. and engine speed changes of  $\pm 4\%$  from present nominal.

#### **3. CONSTRUCTION**

The assembled PCB is solidly mounted in a folded aluminium housing which provides the necessary mechanical protection and is suitable to mount directly in the alternator terminal box or in a separate control cubicle.

All components used are selected for stable operation in ambients ranging from -10 deg to +70 deg. and severely capacity derated for high reliability. The printed circuit board is a 1.5mm reinforced fibreglass with double sided tracks and plated through holes.

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#### **4. CONTROLS**

There are four standard controls on each AVR.

##### **a. STABILITY 1 - R7**

This potentiometer adjusts the stability and response of the alternator and should initially be set in a counter clockwise position and rotate clockwise to give optimum stability and response characteristics. Once set, no further adjustment should be necessary.

Full CCW position gives maximum response, minimum stability.

Full CW position gives minimum response, maximum stability.

##### **b. STABILITY II - R12**

This potentiometer widens the range of stability and should always be normally fully anti-clockwise and only adjusted slightly clockwise to provide further stability should 'Stability I' run out of range, particularly on single phase machines.

Set stability II fully anti- clockwise for 1 phase or fully clockwise for 3 phase.

##### **c. VOLTAGE ADJUST - R10**

This potentiometer varies the reference voltage and hence the amount of excitation of the alternator which adjusts the output voltage over a range of  $\pm 10\%$ .

An external 5K potentiometer may be added to terminals P.P. for remote panel voltage adjustment. When this is used the loop on P.P. is removed and the internal pot turned to maximum.

##### **d. UNDERSPEED - R22**

This potentiometer sets the frequency at which voltage drooping with speed will occur.

For example, if set at 48Hz and a large motor is started, this temporarily overloads the prime mover on starting. Once the speed falls to 48Hz the alternator voltage will decrease and act as an automatic reduced voltage starter and greatly assist in motor starting.

#### **5. INITIAL SETTING UP**

##### **a. VOLTAGE**

The AVR sensing voltage must be first selected for the required sensing voltage.  
ie 120, 208, 240 and 415V.

**Note:**

**If replacing other electronic regulators for convenience use the same sensing connections if possible.**

##### **b. STABILITY I**

Rotate clockwise to increase stability.

To check, if after sudden load change prolonged fluctuation occurs, turn stability slightly clockwise, or if voltage is very slow to recover from load changes, then counter-clockwise.

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#### c. **UNDERSPEED**

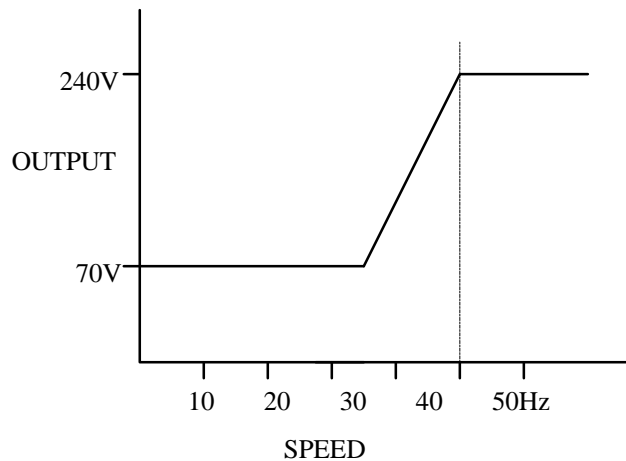
To adjust the underspeed characteristic the alternator must be running at 50Hz no load 240Hz.

Connect an AC voltmeter across the output of the alternator and slowly turn the underspeed potentiometer clockwise until the voltage just starts to fall, then turn slightly counter-clockwise approximately 30 deg.

To check apply full load if possible and voltage should not droop more than 1%.

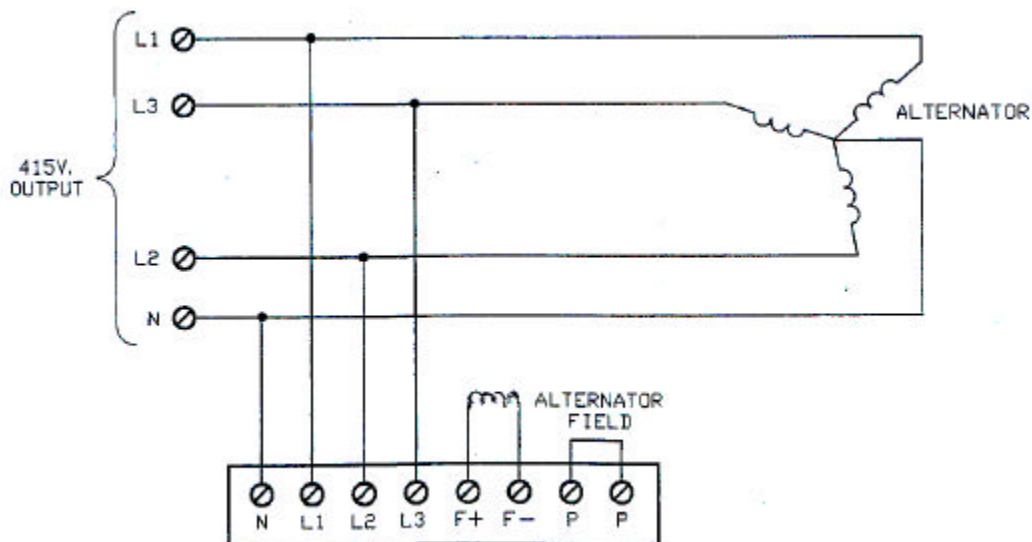
Or alternatively lower speed to 48Hz and voltage should droop.

When setting is completed return no load prime mover speed back to 52Hz (where a mechanical governor is used).



#### 6. **CONNECTIONS**

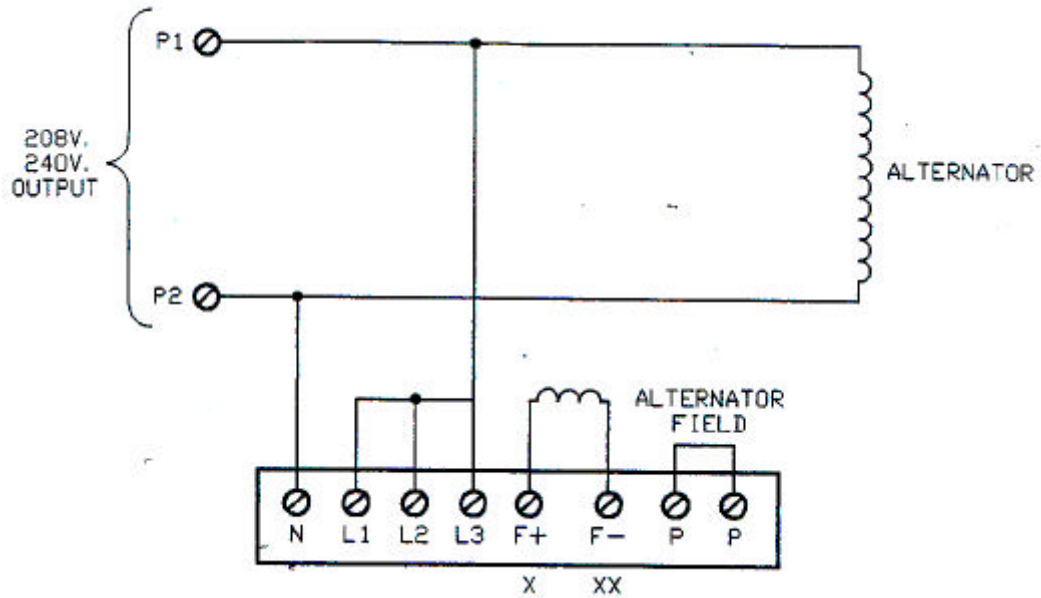
##### a. **STANDARD 3 PHASE 4 WIRE**



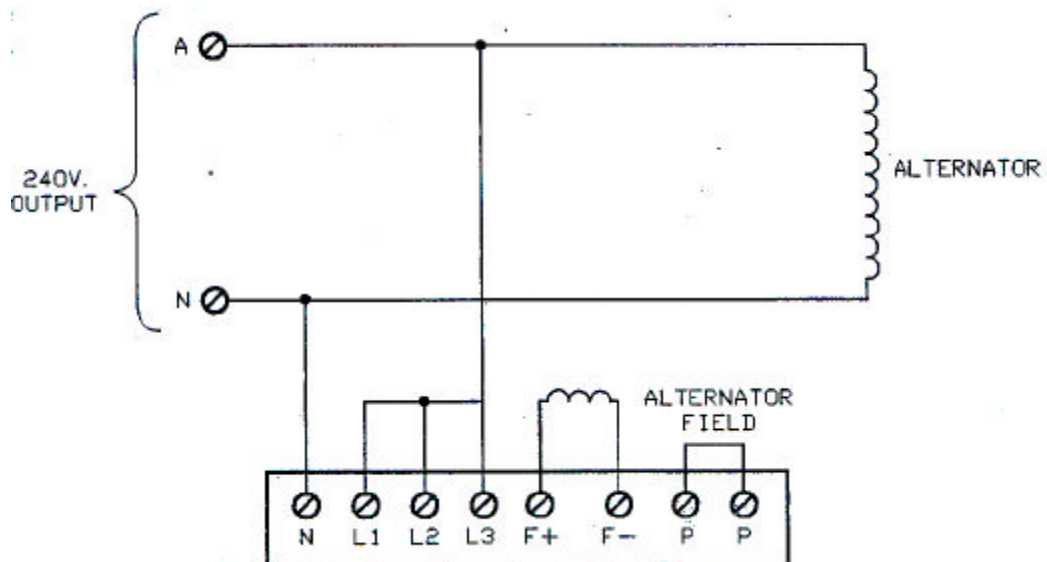
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#### b. STANDARD 1 PHASE 2 WIRE



#### c. 2 PHASE SENSING - CENTRE TAP OF 2 WINDINGS V & W 3 $\phi$ or 1 $\phi$



Alternate for Stamford replacing series 6 AVR's

#### 7. VOLTAGE RANGE SELECTION

Factory fitted link for 240 Volts sense 1  $\phi$  and 415V sense 3  $\phi$

For voltage range 120 Volts 1  $\phi$  and 208 Volts 3  $\phi$  remove link

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### AVR 400 AUTOMATIC VOLTAGE REGULATOR

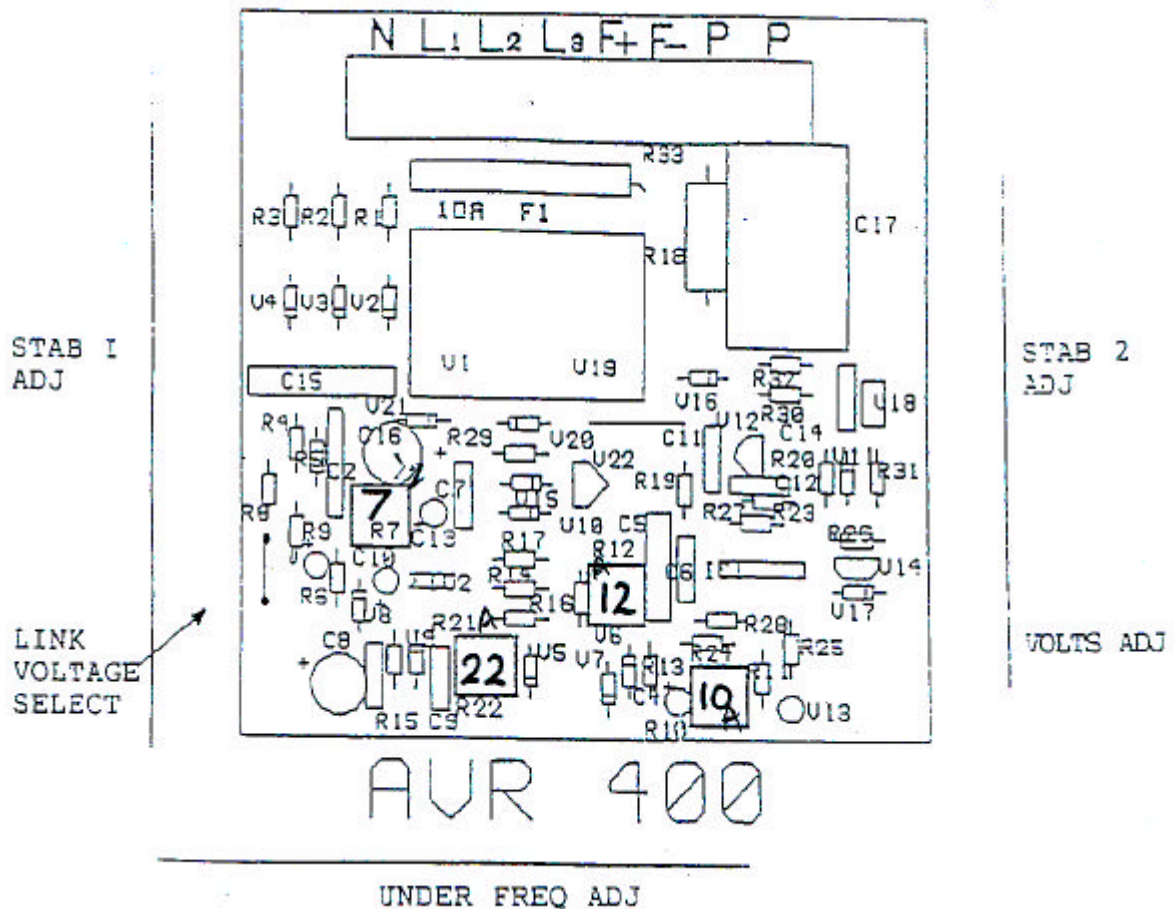
#### 8. RADIO INTERFERENCE

Additional RFI suppression can be achieved by connecting a 0.47MFD capacitor, rated at 250 volt AC between terminals N & L3.

#### 9. SPECIFICATIONS

1, 2 and 3 phase sensing  
Voltage sensing range 120, 208, 240, and 415V  
Adjustment  $\pm 10\%$  on each range  
Maximum field current 10 amps  
SCR rated at 50 amps, 1600 volts  
Suitable for single and three phase alternators  
Regulation  $\pm 1\%$  (Assuming class A1 governor ISO3046)  
Temperature range -10 deg. to 60 deg.  
Reliable excitation 3-5 volts residual  
Minimum field resistance 3-5 ohms  
Field voltage 50% of input sensing voltage selected

#### 10. COMPONENT LAYOUT



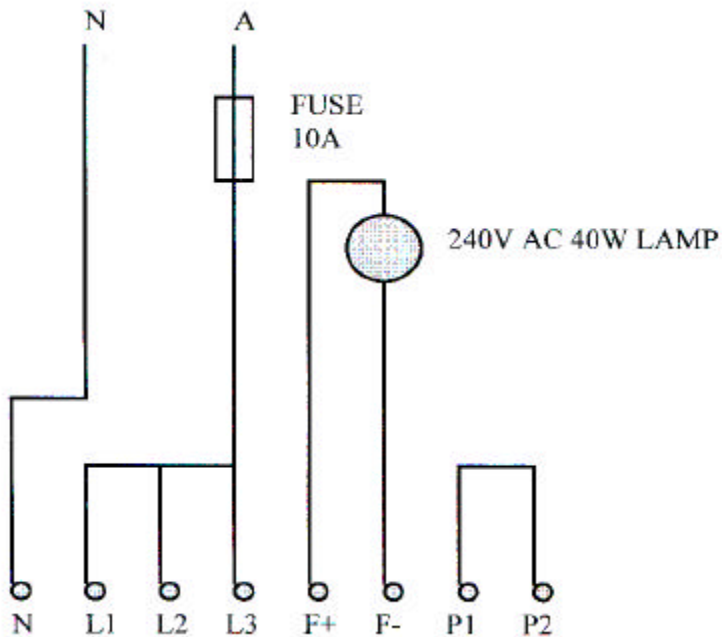
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#### 11. BENCH TEST

The AVR can be bench tested as follows

##### a. TEST CIRCUIT



##### b. AVR TEST SET UP SELECTIONS

240V Sense

##### c. TEST EQUIPMENT REQUIRED

A 240 Volt 40 Watt globe, complete with holder and wire.

3 pin 240 Volts mains plug and lead.

Mains supply

##### d. PROCEDURE

1. Remove AVR from generator
2. Connect as above and select 240 Volt position (note the original sensing voltage position)
3. Mark position of voltage adjusting potentiometer with biro or pencil (this enables the potentiometer to be returned to its original position)
4. Turn voltage adjusting potentiometer fully clockwise
5. Turn on the 240 Volt supply
6. 240 Volt globe should illuminate
7. Turn 240 volt supply off
8. Turn the voltage potentiometer fully anti-clockwise
9. Turn 240 volt supply on
10. 240 volts globe should just flash and then remain off immediately

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**WARRANTY CLAIM PROCEDURE**

On identifying a possible component fault advise the company in writing the model and serial number of the component and major assembly it is part of as well as fault details.

Remove and return the faulty component to the company following any tests or checks requested by the company.

**BASIC WARRANTY CONDITIONS**

The warranty is a 12 month back to base warranty where the customer is liable for the re delivery costs.

Items modified without the companies knowledge or approval may not be warrantable.

If the company is required to inspect / remove or reinstall any part of the goods, the customer will be liable for any out of pocket expenses.

Major third party items such as engines and alternators are subject to the original manufacturers warranty only.

The warranty does not cover inter alias, loss of damage due to accident misuse or fair wear and tear.

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**WARRANTY REGISTRATION**

**CUSTOMER NAME:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_

**TELEPHONE No:** \_\_\_\_\_ **FAX No:** \_\_\_\_\_

**ITEM MODEL No:** \_\_\_\_\_ **SERIAL No:** \_\_\_\_\_

**SUPPLIER NAME:** \_\_\_\_\_

**DATE PURCHASED:** \_\_\_\_\_