INSTALLATION AND SET-UP MANUAL FOR THE NEW:

AVR-08

A *CONTROLPAK* AVR
Automatic Voltage Regulator for three-phase and single-phase alternators

This is a premium quality product at a reasonable price, and offers unsurpassed reliability and operating features. The following is a summary of features and capabilities:

- ❑ Genuine 30A DC output rating
- ❑ Output voltage to field: 100V DC max. @ 240V AC input
- ❑ Integral automatic build-up circuit works with only 1.5V AC residual
- ❑ Adjustable Excitation voltage limit prevents alternator damage
- ❑ Three-phase or single-phase application
- ❑ Single-phase operating range: 180V to 280V 50/60Hz
- ❑ Three-phase operating range: 180V to 480V 50/60Hz
- ❑ Three-phase sensing circuit
- ❑ Very low temperature drift of voltage setpoint
- ❑ Totally solid-state construction (no relays)
- ❑ Premium quality components only are used
- ❑ Extremely rugged design
- ❑ Simplified adjustment of stability for even the slowest of alternators
- ❑ High energy spike protection built-in
- ❑ Ambient air temperature rating of 50 C
- ❑ Generous heatsink for good operating margin at 50 C ambient
- ❑ Solid, easy to use terminals
- ❑ Compact size: 135mm x 135mm x 115mm

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1. APPLICATIONS

This AVR can be used in a number of applications and is designed for maximum flexibility. Alternators of brushless configuration, or with separate exciters are the normal area of application. Slip-ring machines (without exciters) can also be driven provided the current and voltage requirement does not exceed that of the AVR.
The maximum voltage output of the AVR is 100V DC with a 240V AC voltage available from the machine, but will automatically deliver any voltage between zero and this figure that the machine requires at any given time. The actual current which the AVR delivers is of course dependent on the machine requirements.
A feature of this unit is that an Excitation Voltage limit is presettable on the AVR to allow a limit to be set from 25V DC up to 100V DC. This Excitation Voltage limit function provides underspeed protection as well as protection in the event of other machine faults.
The maximum rating of 30A DC with a field resistance of 2 Ohms would imply a voltage of 60V, which is quite OK. In summary, the AVR can be used in applications where the alternator excitation requirement is less than 100V, and a current of less than 30A. The following circumstances will require special solutions which should be obtained from the supplier:

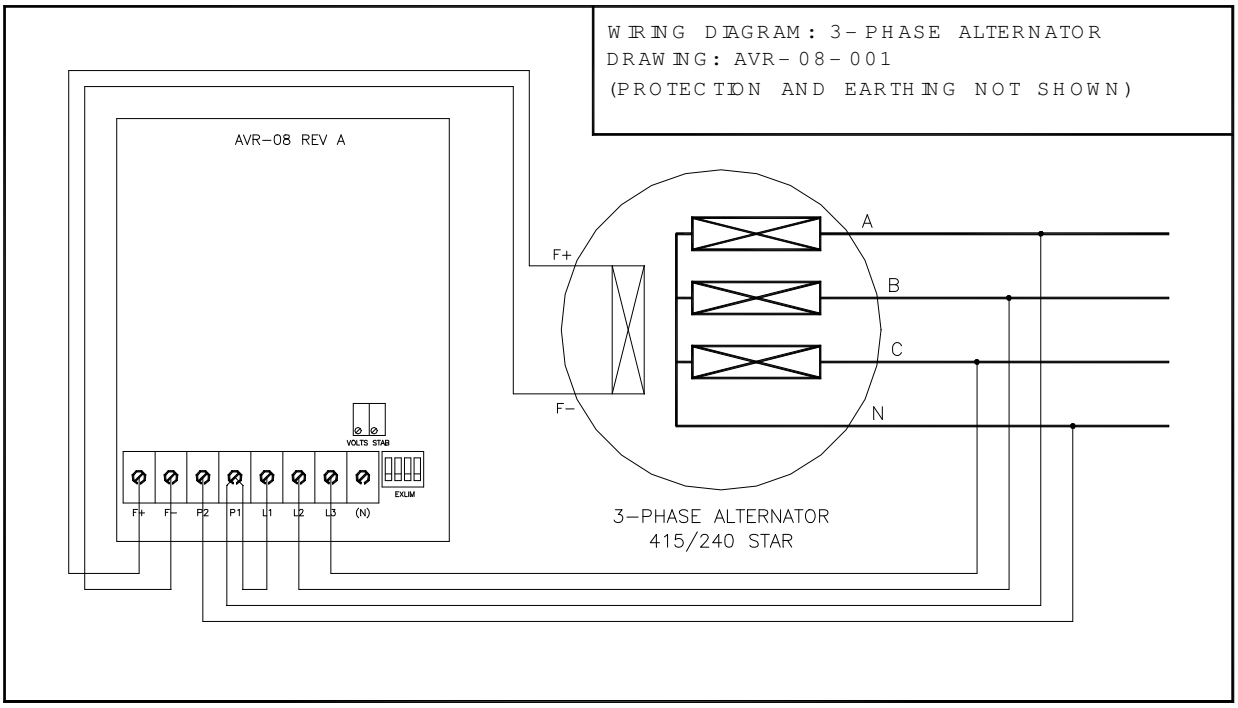
a) The field resistance (cold) is less than 2 Ohms.
b) The machine output frequency is not 50 or 60Hz.
c) The required DC excitation voltage exceeds one third of the AC voltage available to the AVR (e.g. 80V DC on a 240V L-N machine). If this is the case, machine output collapse may occur under sudden overload conditions.
d) The required DC excitation voltage is less than 10V.
e) The machine has a compound wound DC exciter with subtractive field control (very rare).

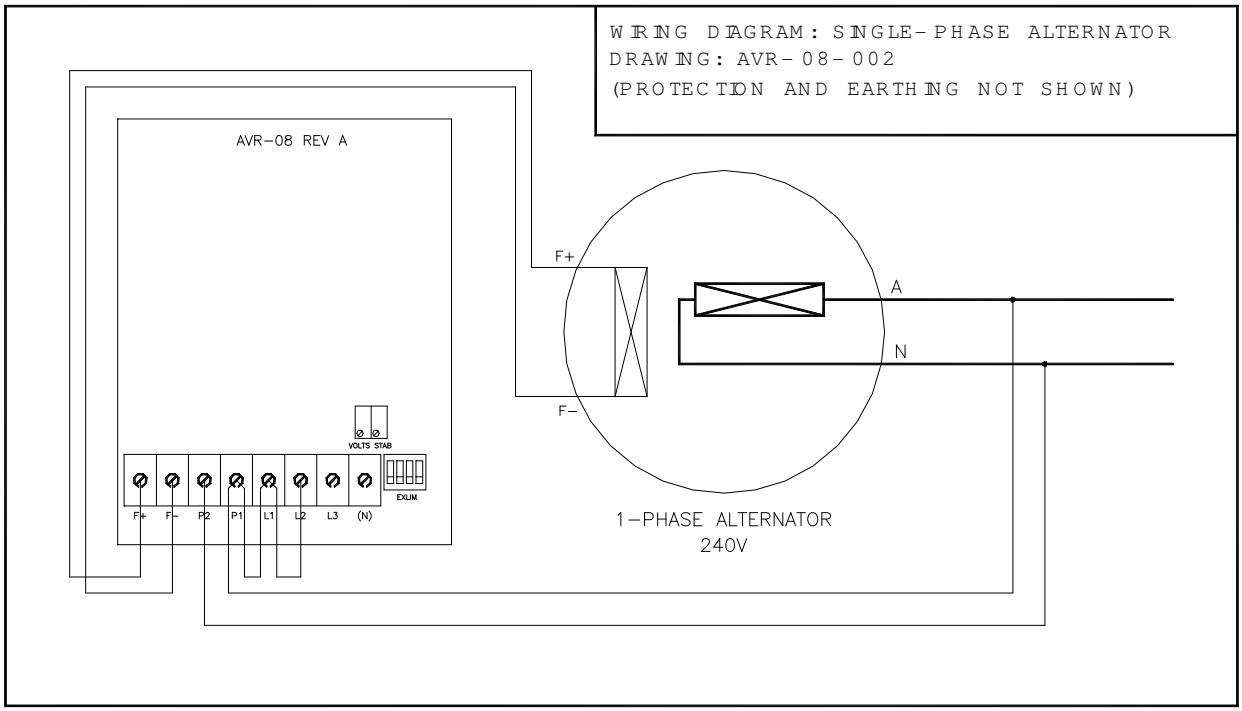
2. LOCATION AND MOUNTING

Although rugged, it is always advisable to choose the best possible position for mounting the AVR. The following guidelines should be kept in mind:
a) The AVR must be mounted on a vertical surface with the cooling fins vertical and the terminal block at the bottom.
b) If possible, avoid locations which will expose the AVR to high levels of vibration and/or grease and oil.
c) Although generously sized, the heatsink must not be enclosed in such a way as to restrict or contain the surrounding air, especially if the field current requirement is high. The ambient air temperature around the AVR must not exceed 50C.
d) Use the mounting channels extruded into the heatsink base for fixing. These are designed for M5 Hex hardware.

3. EXTERNAL WIRING

Follow the wiring diagrams supplied:
Standard three - phase; Use drawing **AVR-08-001**
Standard single - phase; Use drawing **AVR-08-002**





CAUTION: It is essential for safety reasons that the sensing leads coming from L1, L2, and L3 come directly from the machine output, rather than downstream of switching and protection devices. Partial loss of sensing voltage may cause abnormal drive to the exciter if the power source for the AVR remains intact. If fuses are used in the sensing wires from from L1, L2, and L3, they must be extremely reliable, and not be feeding any other equipment (not even a voltmeter).

a) The power source for the AVR is fed to **P1**.
b) Always ensure that the neutral goes to **P2** of the AVR.
c) For three-phase machines, the sensing terminals **L1, L2,** and **L3** need to be connected to the corresponding 3 lines from the machine.
d) For single-phase machines, BOTH of the sensing terminals **L1** and **L2** need to be connected to the 240V line from the machine (**L3** MUST be left open).
e) The last terminal (N) is also connected to P2 within the AVR.

4. OPERATIONAL BEHAVIOUR

Although completely solid state (no relays), the AVR has its own build-up circuit and control. A voltage of 1.5 VAC or more is required between P1 and P2, for the build-up circuit to function.
Once the build-up begins (and it may occur at any speed), an Excitation limiting circuit prevents over excitation of the machine.
This is AVR “build-up mode”.
Once the output frequency reaches a sufficient value, the normal regulation part of the AVR, regulates the machine output voltage without the Excitation limiting circuit coming into play.

CAUTION: In build-up mode, the machine output voltage will be lower than normal, and possibly fluctuating due to AVR limiting action. It is important that load devices are not connected to the machine under these circumstances, as they will malfunction due to low voltage and frequency. This is normally standard practice, and dependent on the output control cubicle that the generating set should be fitted with, and is a consideration when using ANY type of AVR. Connection of the load should only be enabled when the alternator output is stable and within limits.

5. SET-UP

a) 4-WAY DIP SWITCH

It is **ESSENTIAL** that this switch be configured correctly for successful application of this AVR. A correct setting not only ensures proper operation, but also provides additional equipment protection.

i) In deciding what Excitation Voltage limit to set, refer to the nameplate of the alternator. Set an excitation limit value which is just above the nameplate value.

ii) In the *absence* of a nameplate value, run the machine with all switches set to OFF, and measure the no-load Excitation voltage (DC). A DIP switch setting of 3 times this no-load value should be ample to drive the machine to full output. If the means are available (load bank), the actual excitation under rated load can be measured, and the setting further adjusted.

iii) Note that an Excitation Voltage limit setting set too low can result in the alternator failing to deliver rated output. If the AVR starts to limit during normal machine operation, the alternator output voltage will fall below normal, and begin to fluctuate.

iv) Note that an Excitation Voltage limit setting set too high compromises machine

protection in the event of underspeed or external faults.
v) Familiarise yourself as to which way is "ON" for the 4 switches in the bank.
vi) The Excitation Voltage is limited to its LOWEST possible value with all switches OFF. This minimum value is 25V. The value set by the four switches is then added to the base figure of 25 as follows:

SWITCH STAGE	**1**	**2**	**3**	**4**
ASSOCIATED VALUE WHEN ON	5V	10V	20V	40V

The table below provides a quick means of determining which switch to set for a particular desired Excitation Voltage limit setting:

EXCITATION LIMIT	**STAGE 1**	**STAGE 2**	**STAGE 3**	**STAGE 4**
25V	OFF	OFF	OFF	OFF
30V	**ON**	OFF	OFF	OFF
35V	OFF	**ON**	OFF	OFF
40V	**ON**	**ON**	OFF	OFF
45V	OFF	OFF	**ON**	OFF
50V	**ON**	OFF	**ON**	OFF
55V	OFF	**ON**	**ON**	OFF
60V	**ON**	**ON**	**ON**	OFF
65V	OFF	OFF	OFF	**ON**
70V	**ON**	OFF	OFF	**ON**
75V	OFF	**ON**	OFF	**ON**
80V	**ON**	**ON**	OFF	**ON**
85V	OFF	OFF	**ON**	**ON**
90V	**ON**	OFF	**ON**	**ON**
95V	OFF	**ON**	**ON**	**ON**
100V	**ON**	**ON**	**ON**	**ON**

b) VOLTS TRIMPOT

The trimpot marked "VOLTS" (left hand one of pair), has about 30 turns adjustment from full anti-clockwise to full clockwise. This trimpot is normally preset for 240V Line to Neutral during manufacture.
Note that if your application is wired for 3-phase paralleling (sensing terminal L2 left open), it will be necessary to turn this VOLTS trimpot fully anti-clockwise before starting the machine (much lower settings apply for this paralleling AVR connection).

c) STABILITY TRIMPOT

The trimpot marked "STAB" (next to the "VOLTS" trimpot), has about 30 turns adjustment from full anti-clockwise to full clockwise. This trimpot is normally preset to 15 turns clockwise during manufacture (about midway). However, it may well be necessary (and desirable) to adjust this to a more optimum value, depending on the AVR application.
FULL CLOCKWISE on this trimpot corresponds to maximum stability (slowest response).
FULL ANTI-CLOCKWISE on this trimpot corresponds to minimum stability (fastest response).
More clockwise settings will be required to stabilise alternators that are particularly

sensitive, and/or of sluggish response characteristic.
Conversely, more anti-clockwise settings will be required to get response times short enough (for motor starting etc), for alternators that are less sensitive, and/or capable of quicker response performance.
The best set-up requires an oscilloscope, however an analogue meter or better still an incandescent globe, give a good indication of response speed and settling time.
NOTE: The most critical circumstance to be monitored is UNLOADING (perhaps using the output breaker or similar to drop say 30% of the rated load). If stability problems exist, they will normally occur when the load is removed.

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