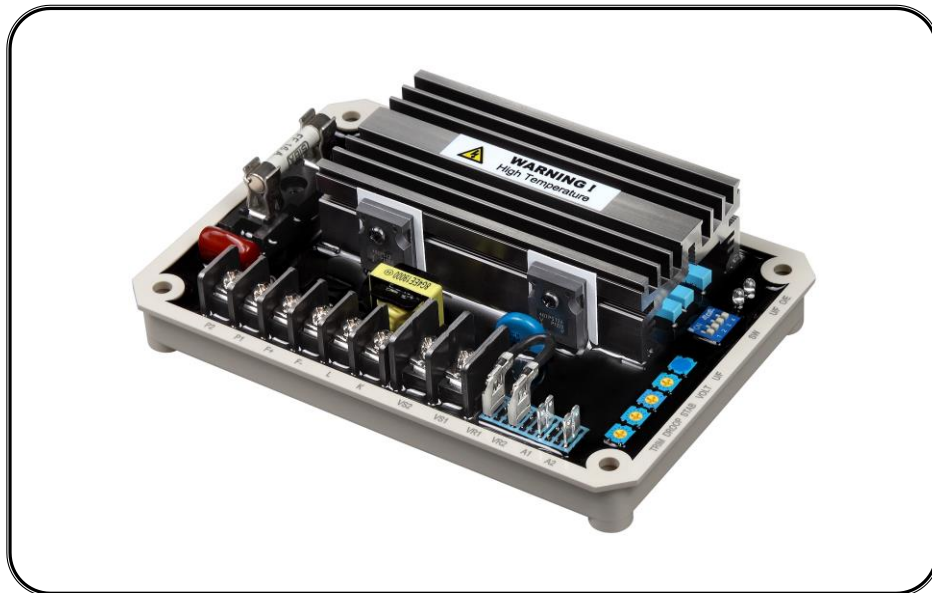


# ADVR-16

## ***Universal Hybrid Analog-Digital Voltage Regulator Operation Manual***



Self Excited 16 Amp Analog / Digital Voltage Regulator  
for use in 170 – 510 Vac brushless generators  
with paralleling compatibility



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## SECTION 1 : SUMMARY

The ADVR-16 is an advance (Hybrid Analog / Digital Voltage Regulator) design for general-purpose isochronous stand alone applications. The ADVR-16 uses an extremely reliable CPU (Central Processing Unit) in its design. This eliminates complex analogue components and circuits that are inherently over sensitive to temperature anomalies, as a result eliminating voltage instability and drift.

In addition, we added over excitation and loss of sensing shutdown protections, with matching U/F, O/E LED indicator lights. Consequently, this AVR prevents the generator from excitation overload, with its resulting exciter and regulator damage. It is easy to install and flexible for use in both shunt type and generators with auxiliary windings.

## SECTION 2 : SPECIFICATION

### Sensing Input

Voltage 170 – 510 Vac, 1 phase 2 wire  
Frequency 50/60 Hz, DIP switch setting

### Power Input

Voltage 60 – 300 Vac, 1 phase 2 wires

### Excitation Output

240V 1 phase Continuous 63 Vdc 16A  
Max. 90 Vdc 20A for 10 secs.  
Resistance Min. 5 ohms  
Fuse Spec. Slow blow 6.35 x 32mm 16A / 500V

### External Voltage Adjustment

Max. +/- 5% 2K ohms 1 watt potentiometer

### Voltage Regulation

Less than +/- 0.5% ( with 4% engine governing )

### Build Up Voltage

5 Vac residual volts at power input terminal

### Soft Start Ramp Time

2 seconds +/- 10%

### Static Power Dissipation

Max.10 watts

### Quadrature Droop Input

CT 1A or 5A greater than 5VA (DIP switch setting)  
Sensitivity +/- 7% @ PF +/- 0.5

### Analogue Voltage Input

Max. +/- 5 Vdc +/- 10% @ +/- 3 Vdc

### Under Frequency Protection (Factory Presets)

50/60 Hz, DIP switch setting

### Over Excitation Protection

Max. DCV 95% 20 secs.

### Voltage Thermal Drift

Less than 3% at temperature range -40 to +70 °C

### Environment

Operating Temperature -40 to +60 °C  
Storage Temperature -40 to +85 °C  
Relative Humidity Max. 95%  
Vibration 3.3 Gs @ 100 – 2K Hz

### Dimensions

162.0 (L) x 112.0 (W) x 43.0 (H) mm

### Weight

535 g +/- 2%

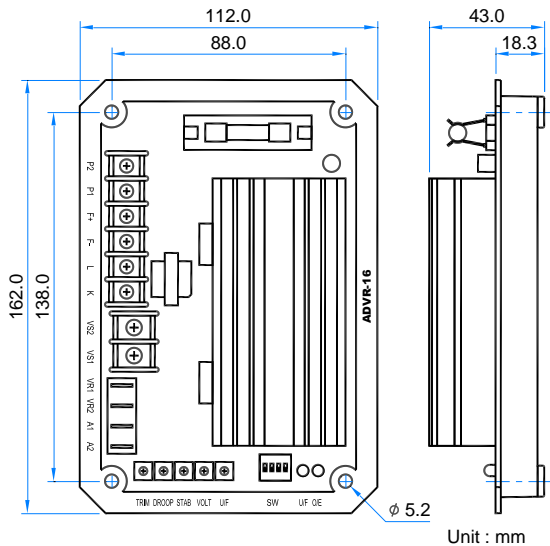


Figure 1 Outline Drawing

### ATTENTION

1. AVR can be mounted directly on the engine, genset, switchgear, control panel, or any position that will not affect operation. For dimension reference, please see Figure 1.
2. All voltage readings are to be taken with an average-reading voltmeter Meggers and high-potential test equipment must not be used. Use of such equipment could damage the AVR.
3. Secure all wiring connection. Do not install AVR at a place with high vibrations to prevent loose connections. For safety do not touch the heat sink while in operation.
4. Terminal : "Fast-On" terminals 6.35mm (1/4 inch) & With 4mm crimping terminal.
5. Improper setting of under-frequency protection could cause the output voltage of the unit to drop or become unstable under with changes in load. Avoid making any changes to the U/F setting unless necessary.
6. Turn off O/E in AVR when paralleling.

## SECTION 3 : CONNECTION TERMINAL

- 3.1 P1, P2 : Power Input Terminals from 60 to 300 Vac 50/60 Hz -16A rated.
- 3.2 F+, F- : Maximum Output current 16A.
- 3.3 VS1, VS2 : Voltage sensing input terminals, Volts selected using DIP SW1 for 220V or 440V.
- 3.4 K, L : Load Current Compensation (Droop), CT secondary current input selected by using DIP SW 1A or 5A (If droop not used leave terminals open).
- 3.5 VR1, VR2 : External Voltage trim use, 2K ohms 1 watt trimmer for +/- 5% voltage adjustment. Keep terminals shorted when not in use.
- 3.6 A1, A2 : Analogue Voltage Input terminals used for Power Factor correction from a external PLC- The PLC controls provides a DC voltage signal to adjust the generator voltage. Max. Adjustment range is +/- 5 Vdc. Keep terminals open when not used.
- 3.7 DIP Switch
  - SW1 : OFF 220 Vac (170 to 260 Vac)  
ON 440 Vac (340 to 510 Vac)
  - SW2 : OFF CT Secondary Input 1A  
ON CT Secondary Input 5A
  - SW3 : OFF Generator Frequency 60 Hz,  
52 – 61 Hz Adjustment  
ON Generator Frequency 50 Hz,  
42 – 51 Hz Adjustment
  - SW4 : OFF Over excitation protection enabled  
ON Over excitation protection disabled

- 3.8 LED Indicator
  - U/F : Under Frequency Indicator
  - O/E : Over Excitation Indicator

## SECTION 4 : ADJUSTMENT AND SETTING

- 4.1 TRIM works together with a bias voltage applied to terminals A1 and A2. This signal is supplies by an external Power Factor Paralleling PLC. Use the TRIM potentiometer to adjust the DC voltage input that controls the level of the generator's output voltage. When set counter-clockwise the control level is zero, and if moved clockwise the maximum control range is 10%. The signal connected to A1 and A2 can be unipolar (0,+ ) or bipolar (+,-). Check with the manufacture of the Paralleling control PLC.
- 4.2 DROOP : Select switch K or L pending on the secondary current of the CT that you are using. Voltage droop works when the CT and the AVR senses that the output of the generator voltage and current waveforms are out of synch and the AVR droops the output voltage of the generator to correct it.
- 4.3 STAB : If the generator output voltage oscillate, adjusting the STAB potentiometer will stabilize the output voltage, over adjustment will result in high voltage variation when load is applied. Use an analog type multimeter when making this adjustment. Connect the meter to terminals F+ and F- and slowly adjust STAB potentiometer to the point when the pointer stops moving.
- 4.4 VOLT : Move to set the generator output voltage. Set DIP Switch 1 to the generator working voltage.
  - Set SW1 to OFF (220V) for use from 170 to 260 Vac
  - Set SW1 to ON (440V) for use from 340 to 510 Vac

When using an external VR set it to the central position and adjust the AVR VOLT trim to the rated voltage.

**NOTE**

**If the external VR is not used, short terminal VR1 and VR2.**

- 4.5 U/F : Under Frequency protection setting.  
At 50 Hz U/F factory set at 45 Hz  
At 60 Hz U/F factory set at 55 Hz

To adjust the U/F setting, select the correct system frequency, start engine and adjust engine speed to the required U/F frequency (for example 55 Hz or 45 Hz), slow adjust U/F potentiometer until the U/F red LED turn ON, returning the engine speed to normal turn the LED off.

**Function of the Under Frequency trim pot :**

- 4.5.1 During start up or shutdown, the engine speed changes going over or under its rated RPM (Hz). This AVR has an Under Frequency circuit to protect the AVR and exciter; you do not need to disconnect the AVR when idling the engine.
- 4.5.2 If load is higher than the generator's capacity, the Under Frequency activates, reducing the generator's voltage preventing generator overload.


**4.6 Over Excitation Protection :**

- 4.6.1 This AVR has over Excitation Protection preventing the generator from working under unusually high excitation. Excitation Protection includes generator overload, accident removal of sensing wires, and incorrect voltage setting. When problems occur, the AVR will gradually shutdown the excitation voltage to the minimum residual voltage. If the O/E LED turn ON and stays ON, you need to reset the AVR by shutting the engine for 10 seconds. When working the generator in parallel this protection is not required, the user can disable this function by switching DIP switch SW4 to ON position, vice versa.

**SECTION 5 : NOTICE OF USE**

- 5.1 Installation Notice : (Refer to Figure 2 and 4).
  - 5.1.1 Only, a trained professional can Installation, calibrate and inspections this AVR.
  - 5.1.2 Install this AVR inside the generator enclosure away from moisture, corrosion and from any easy to reach area.
- 5.2 Generator Operation Notice :
  - 5.2.1 During operation, the temperature on the surface of the AVR can reach higher the 60 °C / 140 °F.

- 5.2.2 "DANGER" When the AVR is working never touch or ground the heat sink on the AVR. The AVR heat sink is an electrically live terminal.

A warning sticker is in place on top of the heat sink. 

**SECTION 6 : FIELD FLASHING**

When the regulator is installed correctly but the generator is failed to generate power. Besides carbon brushes were worn out, here are two possible causes below.

- 6.1 **The polarity of field is reversed**  
Solution : Exchange the connection of F+ and F-.
- 6.2 **The residual voltage is less than 5 Vac,**  
**Solution 1 :**

- 6.2.1 Shut down generator, disconnect the wiring between AVR and generator then flash the field. Flashing duration = 3 seconds. (See wiring in Figure 2)  
Resistor 3 – 5 ohms for full wave AVR  
Resistor 5 – 10 ohms for half wave AVR

**Warning!! Over field flashing may damage the field winding of generator.**

- 6.2.2 Restart generator and measure the residual voltage by AC Voltmeter, if it is still less than 5 Vac, repeat the previous process, after several times, the residual voltage still cannot be built, Kutai EB500 is strongly recommended, see Figure 2.

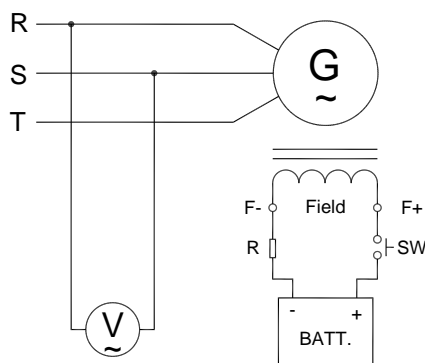


Figure 2 Manual Field Flash

**WARNING**

**Overly field flashing may damage the AVR or generator excitation winding.**

**Please make sure you have read and understand the contents of the instruction manual prior to installation. Incorrect wiring connection may result in irreversible damage to the product and other equipments.**

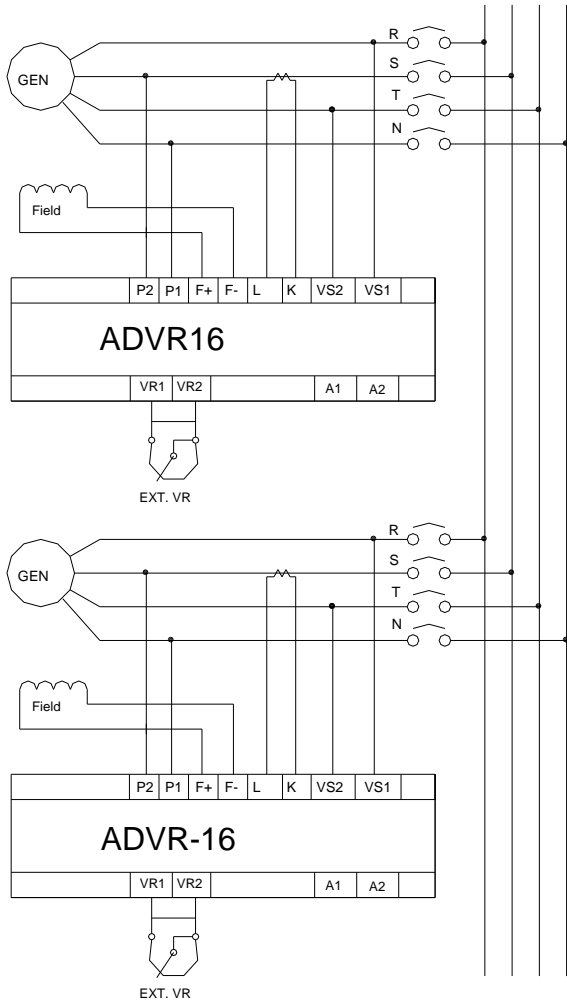


Figure 3 Paralleling Connection

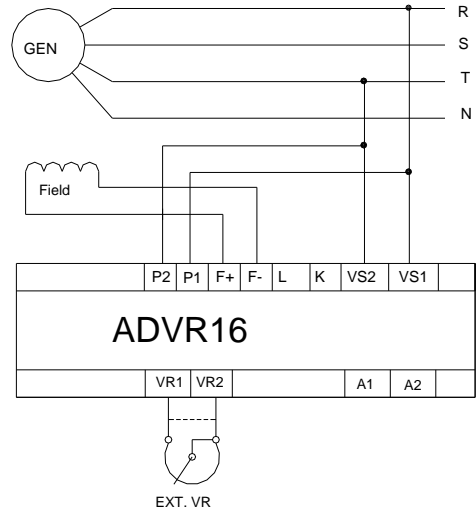


Figure 4 220V Connection

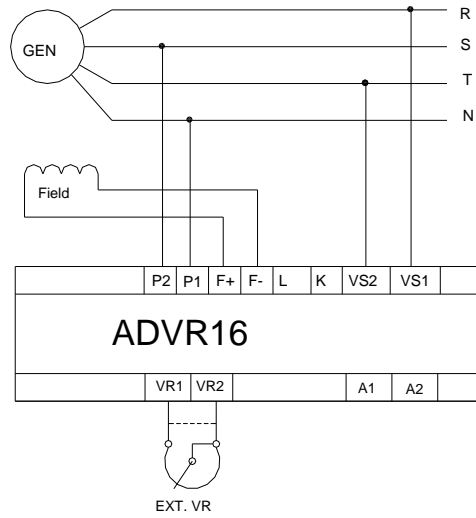


Figure 5 380 / 480V Connection

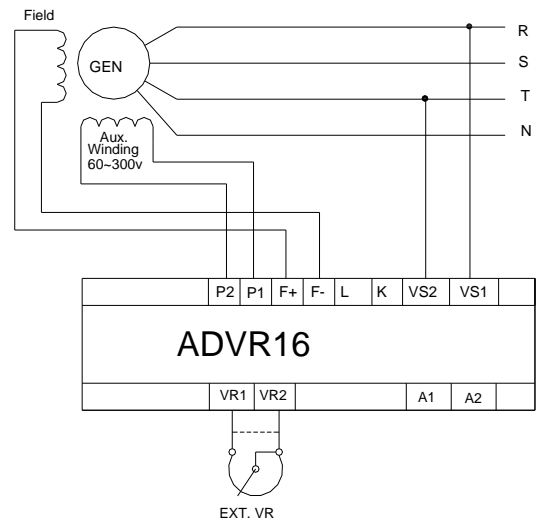


Figure 6 Auxiliary Winding

## SECTION 7 : TROUBLE SHOOTING

SYMPTOM	POSSIBLE CAUSES	SOLUTIONS
Voltage does not build up	Residual voltage below 5 Vac	Reference from section 6. Field Flashing
	F+, F- polarity reversed	F+ and F- reverse the connection
	F+, F-, P1, P2, VS1, VS2 not connected	Reference from Figure 4 and 5 connection
	Burnt fuse	Change fuse 16A 500V
	Ext. Switch (Breaker) not turned on	Switch on (ON)
	Engine RPM under speed	Increase engine speed / frequency above 25 Hz
Low output voltage	Poor adjustment is made	Read start procedure carefully and adjust again
	U/F protection activated	Increase generator speed
	U/F activated / Incorrect voltage selection	Read user's manual to select correct voltage
Over output voltage	Poor adjustment is made	Read start procedure carefully and adjust again
	Incorrect voltage selection	Read user's manual to select correct voltage
Output voltage unstable (Hunting)	Poor adjustment is made	Read start procedure carefully and adjust again
	Field voltage requirement lower the rang of regulator	Connect appropriate resistors in series to increase total impedance

- ※ Use only the replacement fuses specified in this user manual.
- ※ Appearance and specifications of products are subject to change for improvement without prior notice.