

# EA150

## **Generator Automatic Voltage Regulator Operation Manual**



Self Excited Automatic Voltage Regulator  
150 Amp AVR Compatible with Carbon Brush Type Generators  
Full Wave & Half Wave Version Selectable



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**KUTAI ELECTRONICS INDUSTRY CO., LTD.**



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## SECTION 1 : SPECIFICATION

### Sensing Input

Voltage 100 to 500 Vac Single phase 2 wire  
 Frequency 50 / 60 Hz, selectable

### Power Input

Voltage 170 to 265 Vac Single phase 2 wire  
 Frequency 50 / 60 Hz, selectable

### Output (at 220 Vac Input)

Voltage Half-wave Max. 90 Vdc  
 Full-wave Max. 180 Vdc  
 Current Continuous 150A  
 Intermittent 200A for 10 sec.  
 Resistance Half-wave Min. 0.9 ohms  
 Full-wave Min. 1.8 ohms

### External Volts Adjustment

+/- 6%

### Voltage Regulation

< +/- 1% ( with 4% engine governing )

### Build Up Voltage

Residual voltage at AVR terminal > 5 Vac @ 25 Hz

### Droop Adjustment

Droop : Current Compensation Input 5A 5VA +/- 7%  
 @ PF = +/- 0.5 (Droop Adjusted)

### Analogue Input

Analog Voltage Input. Connect to an external DC  
 Signal +/- 5 Vdc 7% Adjustable (TRIM Adjusted)

### Under Frequency Protection (Factory Knee Point Setting)

50 Hz system presets knee point at 45 Hz  
 60 Hz system presets knee point at 55 Hz

### Battery Input (24V)

Power input for the Flash and Alarm

### Environment

Operation Temperature -40 – +60 °C  
 Storage Temperature -40 – +85 °C  
 Relative Humidity Max. 95%  
 Vibration 3 Gs @ 100 – 2K Hz

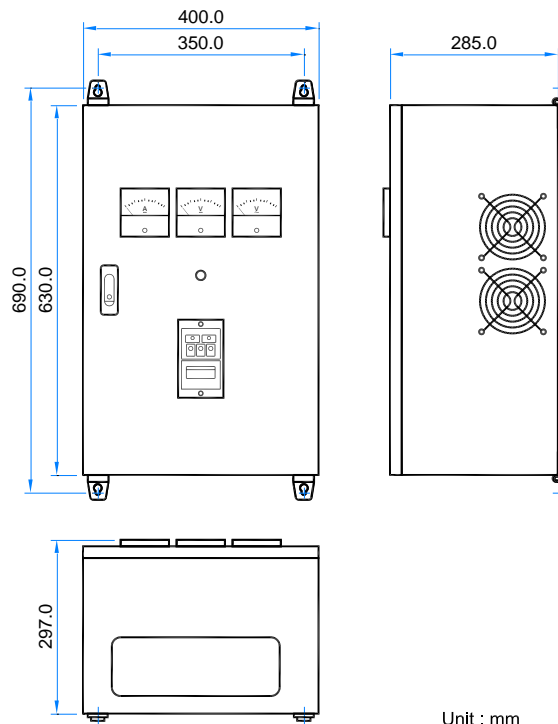
### Dimensions

630.0 (L) x 400.0 (W) x 285.0 (H) mm  
 Packaging : 780.0 (L) x 580.0 (W) x 500.0 (H) mm

### Weight

EA150A 28 Kg +/- 2% (Net Weight)

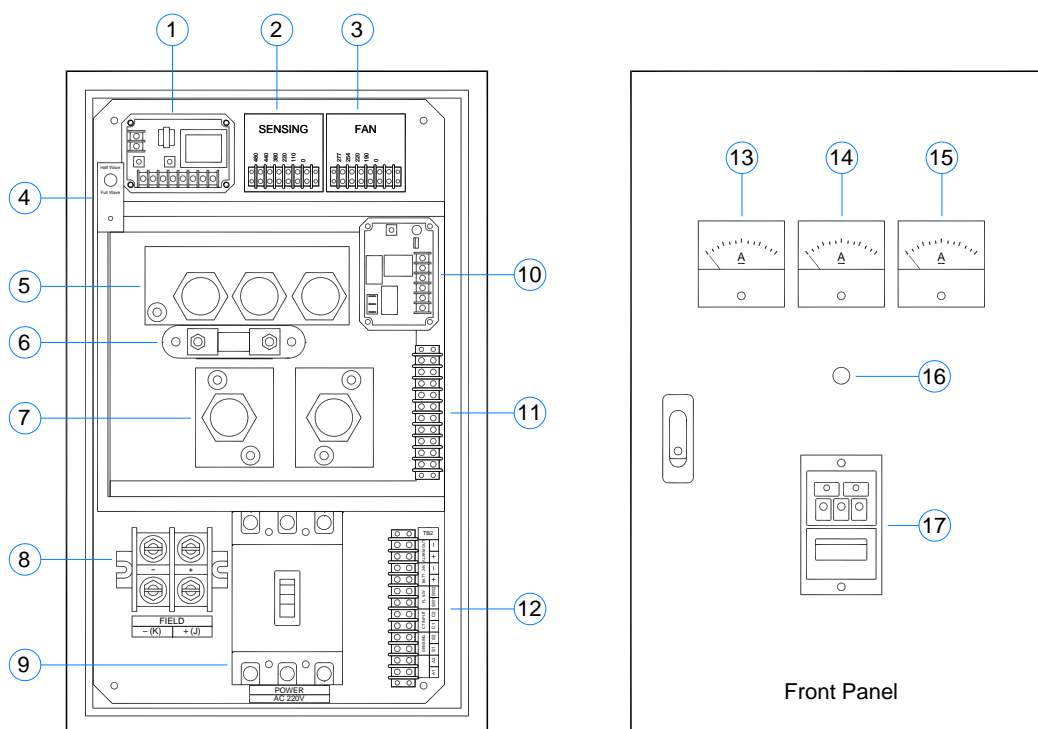
## SECTION 2 : OUTLINE / SIZE



Unit : mm

Note : Full or Half wave toggle switch selectable

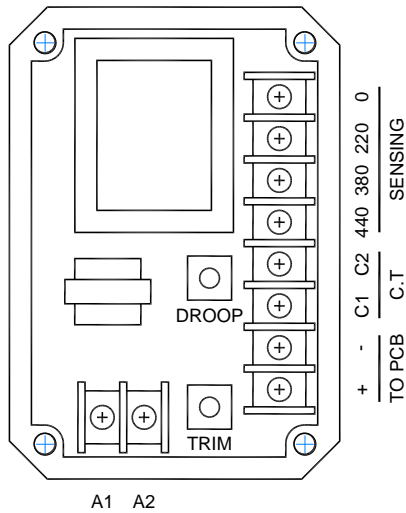
## SECTION 3 : INTERNAL SPECIFICATION



Item	Content	Application
1	EA45C	Sensing module
2	Sensing transformer	For Sensing power input
3	Fan transformer	For Fan power (220V 50/60 Hz)
4	Toggle switch	Full Wave / Half Wave selection
5	Diode	Rectifier diode
6	Shunt	For ammeter
7	SCR	Rectifier SCR
8	Field output terminal	Connected to the exciter field
9	Power input MCCB	Power input 100 – 300 Vac 50/60 Hz
10	EB500	Excitation flash module
11	Terminal TB1	I/O put terminal
12	Terminal TB2	Control terminal
13	Field current meter	
14	Field voltage meter	
15	Generator voltage meter	
16	Over heat lamp	
17	EA45AF-1	AVR control unit

Figure 1

### EA45C



EA45C	
SENSING	Sensing power input
C.T	Current Transformer input N : 5A
TO PCB	Connected to the EA45AF-1
DROOP	Droop adjustment
TRIM	Trim adjustment
A1 A2	Analog input 0 – +/- 5 Vdc

### EA45AF-1

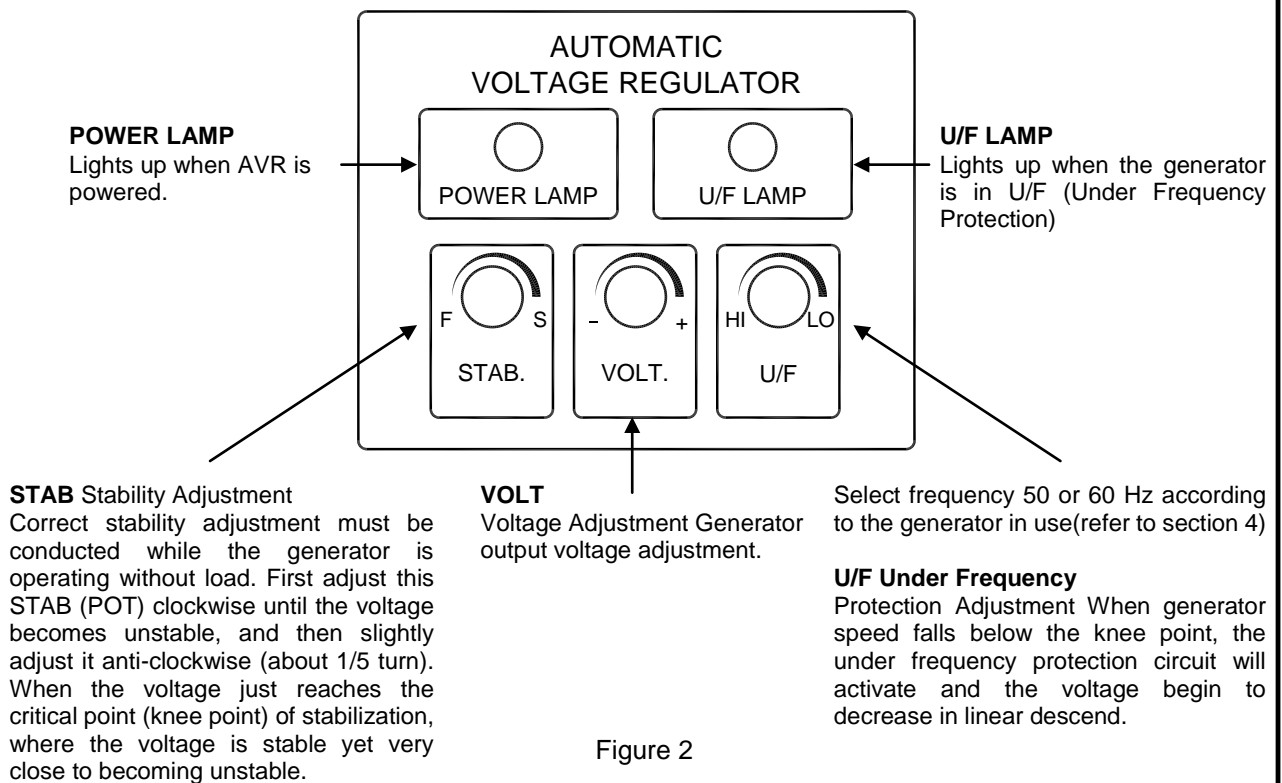


Figure 2

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## SECTION 4 : ATTENTION

### 4.1 When Installing

- 4.1.1 Let only experienced professional installer carry out the installation.
- 4.1.2 Avoid Installing AVR near high temperature, moisture, or location where AVR can be easily reached.

### 4.2 When Generator Is Operating

The surface temperature of AVR may reach over 60 °C.

### 4.3 Start Procedure

#### 4.3.1 Setting

- Check wiring connection and voltage setting (Input Voltage and Fan Voltage).
- Set volt trimmer to the minimum position.
- Set external trimmer to midway position if fitted.
- Set stability trimmer to maximum position.
- Connect a voltmeter to field F+, F- terminals.
- Connect a 300 Vac voltmeter to generator output voltage terminals.

#### 4.3.2 Start the generator

- Start up generator with no load. Adjust to the correct engine speed. Voltage should build up at the lowest voltage level. If the voltage does not build up, please refer to **SECTION 7. FIELD FLASHING** or contact generator supplier.
- Slowly adjust volt trimmer clockwise until rated voltage is reached.
- Adjust stability trimmer anticlockwise until the output voltage starts to fluctuate, then carefully adjust stability trimmer clockwise until rated stable voltage is achieved.

## SECTION 5 : ADJUSTMENT

### 5.1 Under Frequency Adjustment

Open the enclosure panel. On the back of EA45AF-1 carefully select the frequency setting.

- Please refer to Figure 2 “EA45AF-1”
- EA45AF-1 (Front panel) terminals 1 & 2 Open For 50 Hz. Factory preset at 45 Hz.
- EA45AF-1 (Front panel) terminals 1 & 2 Close For 60 Hz. Factory preset at 55 Hz.

### 5.2 Voltage Adjustment

5.2.1 Please refer to Figure 2 “EA45AF-1”

5.2.2 Carefully turn volt trimmer until rated voltage is reached. (Clockwise = Increase)

5.2.3 For external voltage adjustment : Connect a 1K ohms 1W voltage rheostat to the EA45AF-1 (Front panel) terminal 3 & 4.

5.2.4 For long range external voltage adjustment, please refer to Figure 6. Use twisted wire for connection, and if distance exceeds 100 meters, please use isolated twisted only.

The TRIM on the EA45C module must be adjusted to maximum (Clockwise).

### 5.3 Stability Adjustment

5.3.1 Please refer to Figure 2 “EA45AF-1”

5.3.2 By adjusting STAB trimmer will provide the system with stable voltage output. But if it is over adjusted, then the voltage will oscillate (hunt) when heavy load is applied.

5.3.3 It is suggested to use a multi-meter DCV to adjust “stability”. When adjusting, try to make the multi-meter waving to the minimum. This will improve the full load’s voltage drift rate.

## SECTION 6 : PARALLELING

If generator is not paralleled, please ignore this section and continue to next section.

### 6.1 TRIM (EA45C)

- Please refer to Figure 2 “EA45AF-1”

TRIM works together with a bias voltage applied to terminals A1 and A2. Use the TRIM potentiometer to adjust the DC voltage input that controls the level of the generator’s output voltage. When set anticlockwise 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 (+,-).

### 6.2 DROOP (EA45C)

- Please refer to Figure 2 “EA45AF-1”

DROOP is the adjustment of influence from CT 1, CT 2 current compensation input value to the generator output voltage decrease ratio. 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. This adjustment is required when generators are paralleled. For paralleling connection, please refer to Figure 7. The CT capacity must be greater than 5VA with 5 amperes secondary current.

## SECTION 7 : 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.

### 7.1 The Polarity Of Field Is Inverse

Solution : Exchange the connection of F+ and F-.

### 7.2 The Residual Voltage Is less Than 5 Vac, Solution 1 :

7.2.1 Shut down generator, disconnect the wiring between AVR and generator then flash the field. Flashing duration = 3 seconds. (See wiring in Figure 6)

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.**

7.2.2 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 (automatic flash module) is strongly recommended. For more information about EB500, please refer to **SECTION 10. APPENDIX**

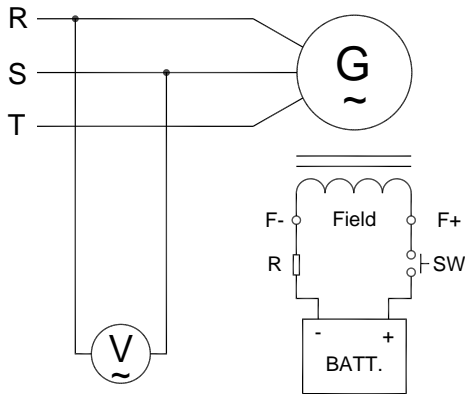


Figure 3 Manual Field Flash

### ATTENTION

1. AVR installation should only be performed by a qualified technician.
2. Install AVR inside the generator control panel to avoid high temperature, moisture, and location where AVR cannot be easily reached.
3. AVR heat sink may reach a high temperature (above 60 °C) when AVR is powered, do not touch or ground AVR heat sink.
4. 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.

### WARNING

This Automatic Voltage Regulator is not equipped with loss-Sensing Protection function / Over Excitation Protection. An additional Over-Voltage Protection device for load may be required to avoid possible damage to the equipment or severe personal injury or death.





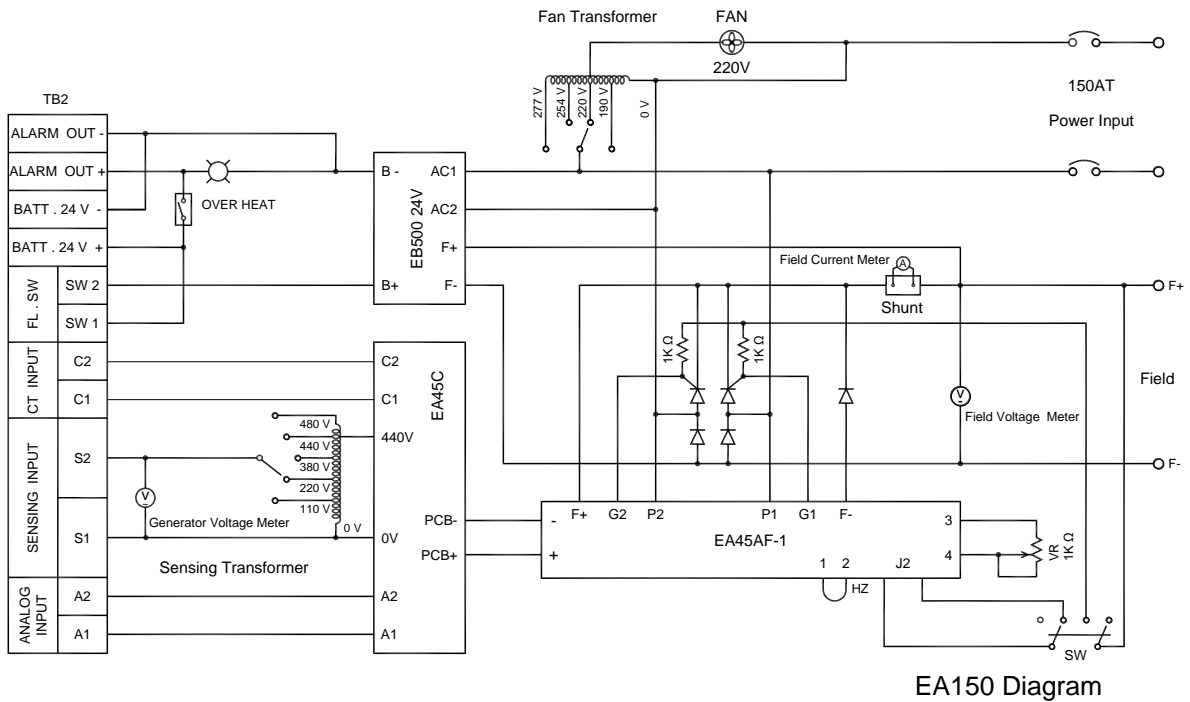


Figure 5

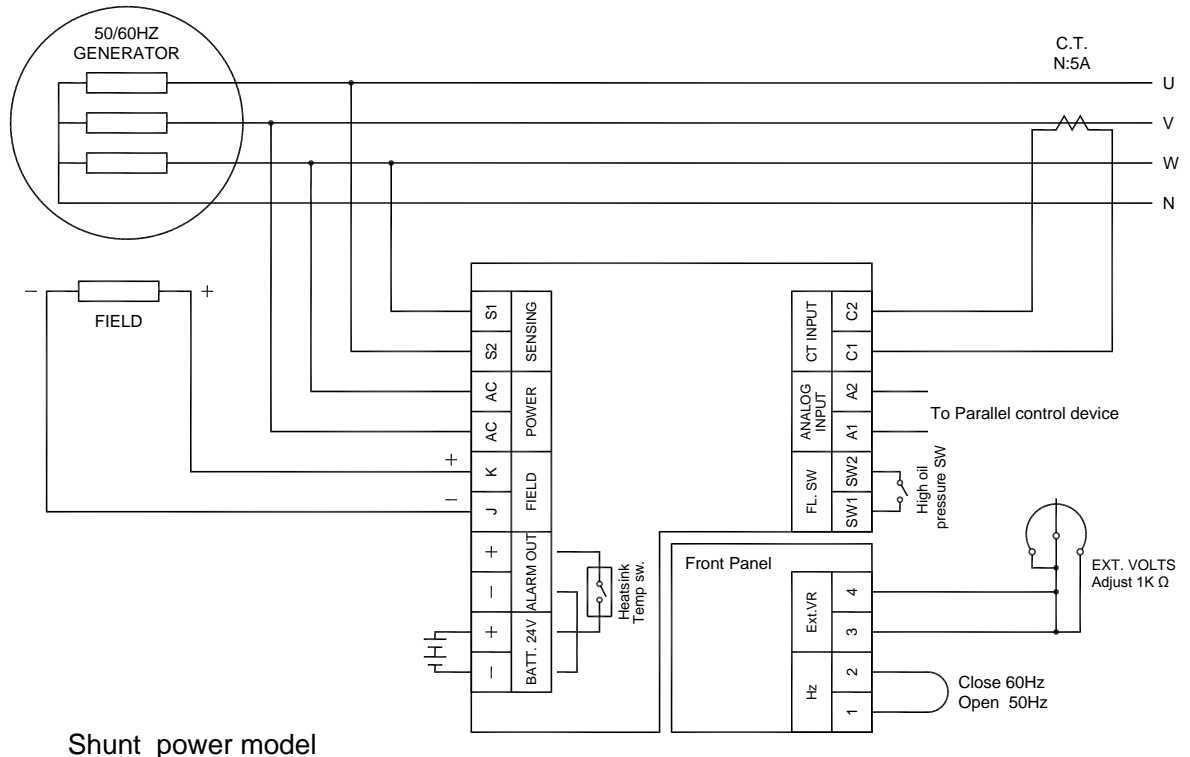


Figure 6

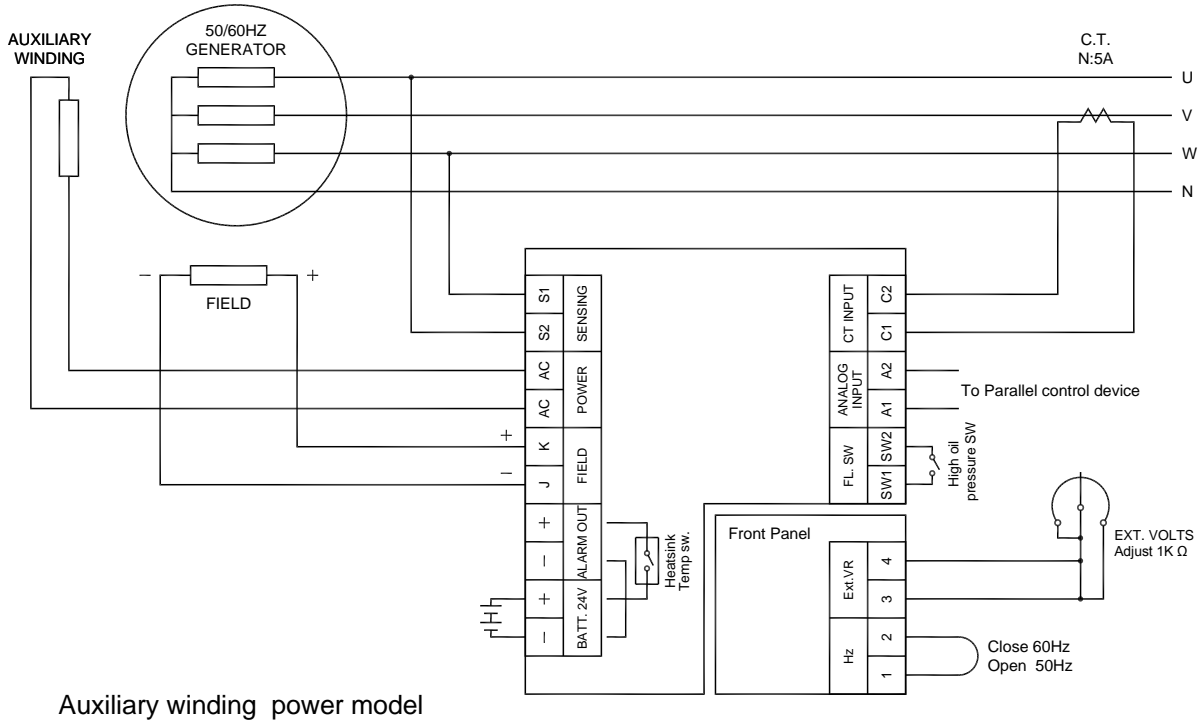


Figure 7

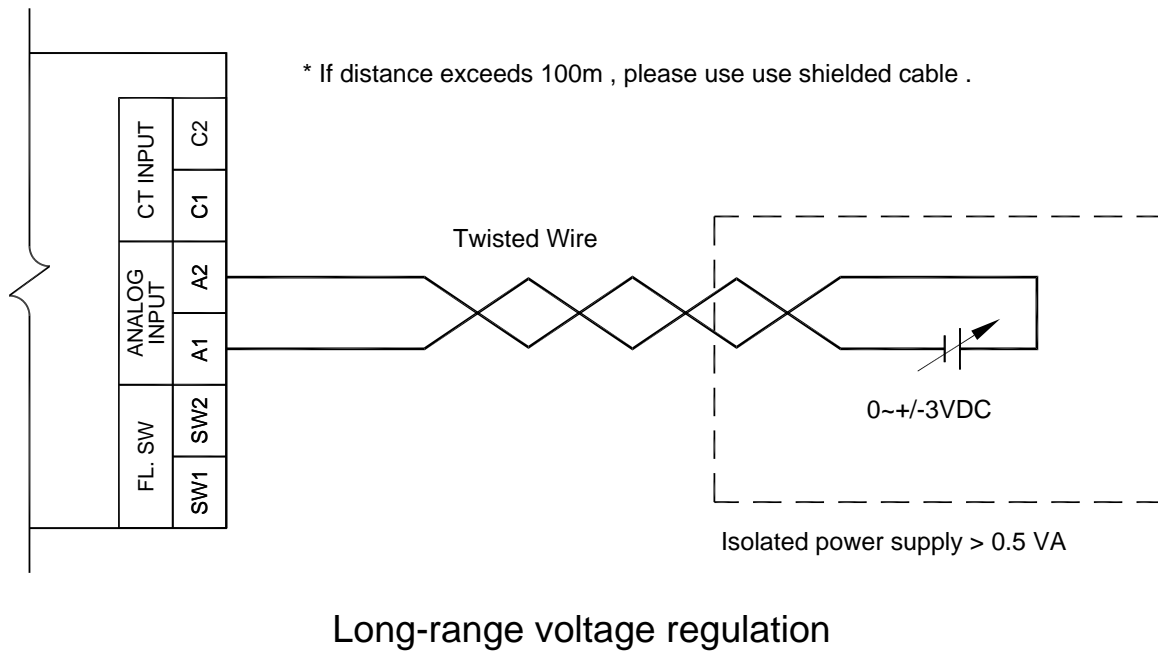
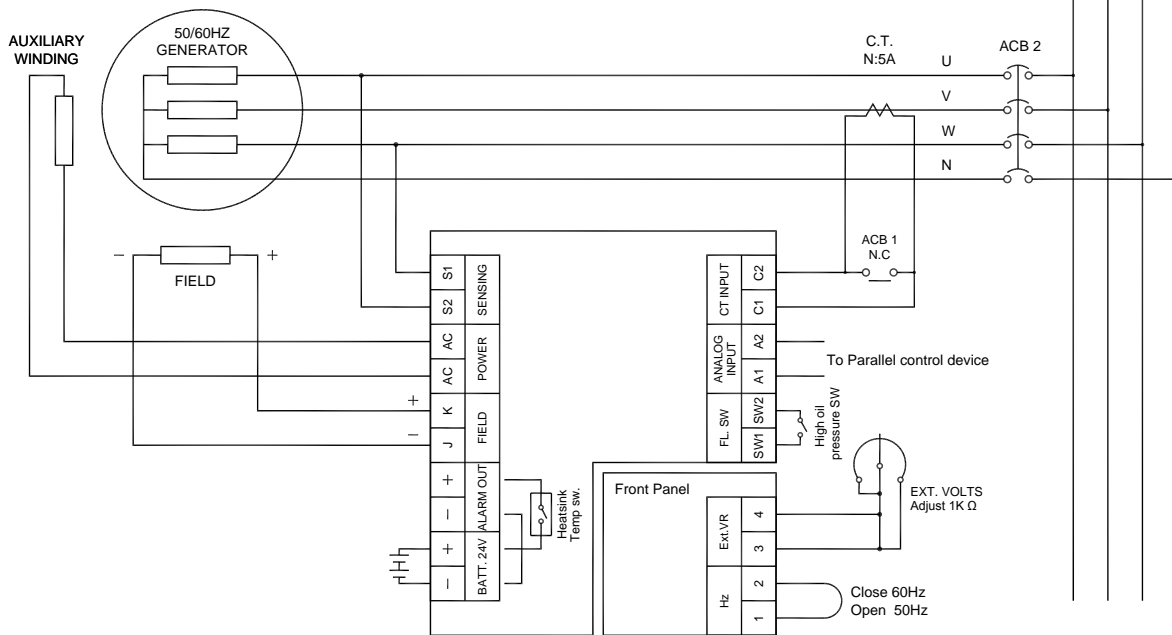
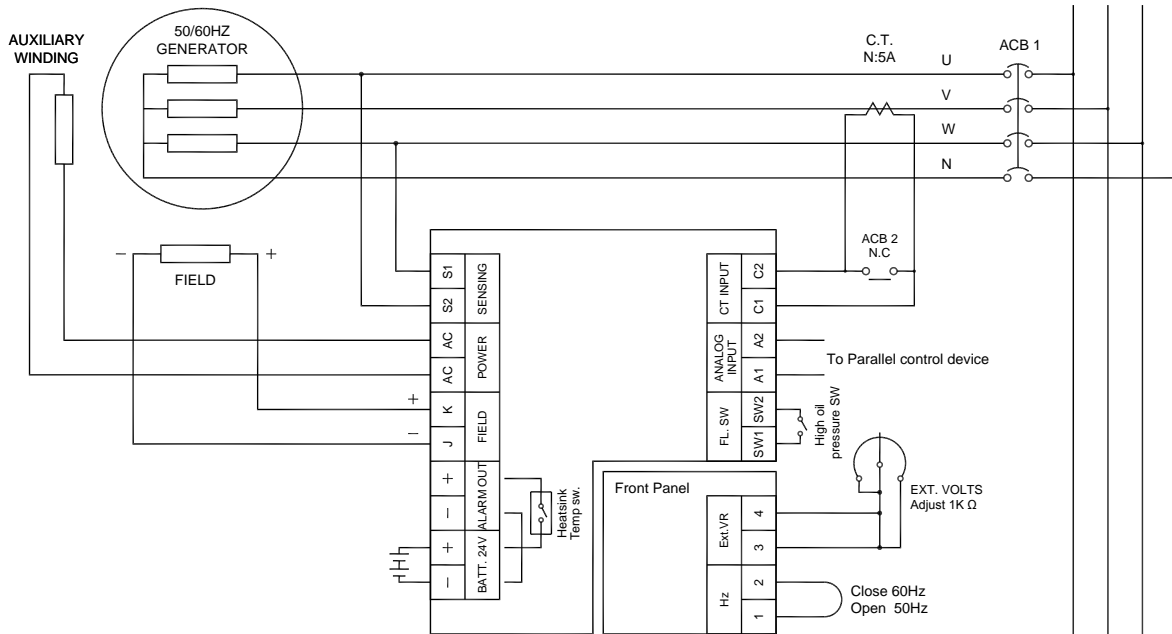


Figure 8



Parallel wiring diagram

Figure 9

## SECTION 9 : TROUBLE SHOOTING

SYMPTOM	POSSIBLE CAUSES	SOLUTIONS
Voltage does not build up	Residual voltage below 5 Vac	Field flash is required. Please refer to Section 7. FIELD FLASHING
	Incorrect wiring	Check wiring diagram for proper connection
	Engine under speed	Increase engine speed to above 25 Hz
	Carbon brushes were worn out	Replace with new carbon brushes
Low output voltage	Voltage set point is not properly adjusted	Adjust VOLT POT clockwise to reach desired voltage
	External voltage adjusted too low	Turn the external VR to reach desired voltage
	Under Frequency Protection is activated	Please refer to Section 5.1 Under frequency adjustment
Over output voltage	Voltage set point is not properly adjusted	Adjust VOLT POT anti-clockwise to reach rated voltage
Output voltage unstable (Hunting)	Stability range is not set properly	Please refer to 5.3 Stability adjustment
	Field voltage or field resistance is too low	Connect suitable resistor in series to increase total resistance

※ Appearance and specifications of products are subject to change for improvement without prior notice.

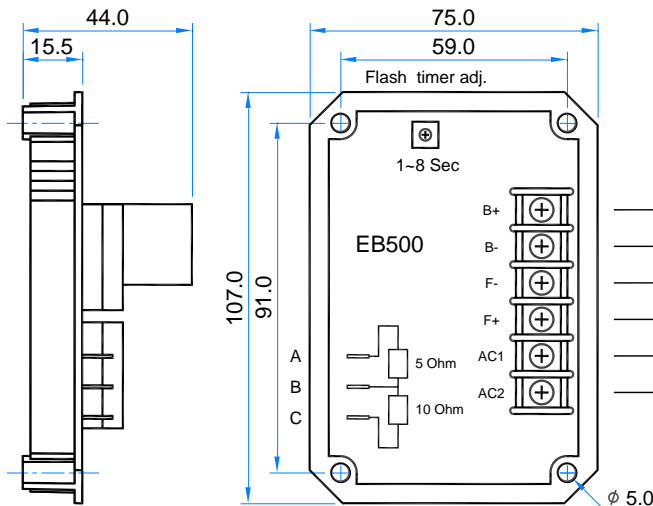
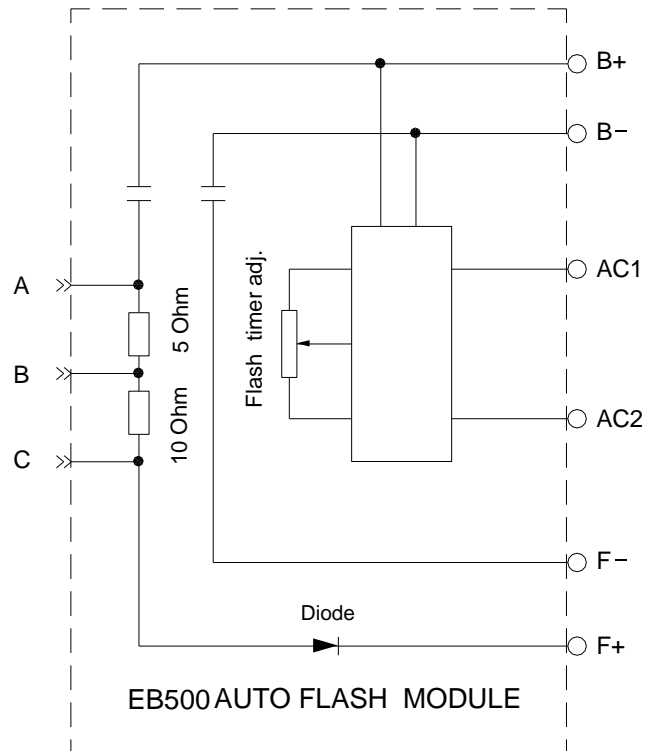
**SECTION 10 : APPENDIX**

**EB500 12 / 24 Vdc**

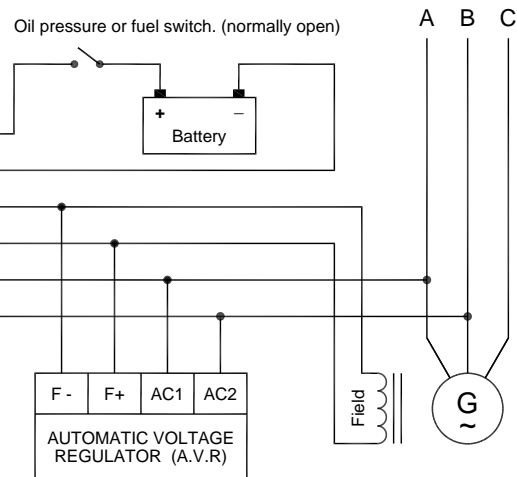
1 Shot Auto Flash Module  
Generator Voltage Build Up Latching Relay



- Input Voltage : DC 10 – 30 Vdc
- Sensing Voltage : AC 120 / 240 Vac
- Flashing Time : 1 – 8 sec. (Adjustable)
- Trigger Contact : Oil Pressure (Normally Open)
- Excitation Current : 12V 0.8 / 1.2 / 2.4A DC  
24V 1.6 / 2.4 / 4.8A DC
- Dimensions : 107.0 (L) x 75.0 (W) x 44.0 (H) mm
- Weight : 210 g +/- 2%



NOTE :  
 ALL OPEN FOR 15 Ohm  
 JUMP A-B FOR 10 Ohm  
 JUMP B-C FOR 5 Ohm  
 JUMP A-C FOR 0 Ohm  
 Unit : mm



**Flash Current Selection**

A, B, C (Open)	12V = 0.8A	24V = 1.6A
A – B (Short)	12V = 1.2A	24V = 2.4A
B – C (Short)	12V = 2.4A	24V = 4.8A