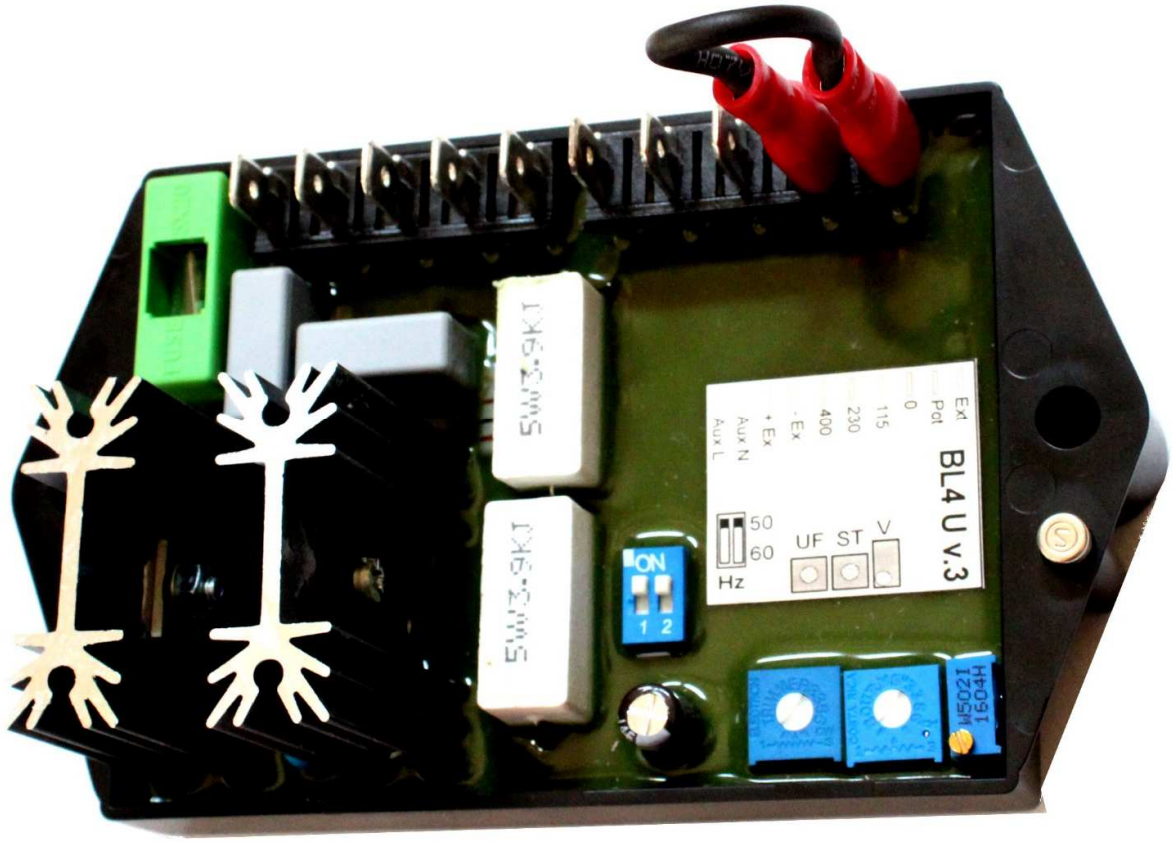
BL4-U
Analogic AVR

Automatic Voltage Regulator

OPERATION MANUAL



sincro®

REV01 07/2019

INDEX

GENERAL FEATURES

SINCRO BL4-U is a half-wave phase-controlled thyristor type Automatic Voltage Regulator (AVR) and is part of the alternator excitation system.

In addition to the regulation of the alternator voltage, BL4-U circuitry includes under-speed protection features. Excitation power is derived directly from the alternator terminals.

Positive voltage build up from residual levels is ensured by the use of efficient semiconductors in the power circuitry of AVR BL4-U.

AVR BL4-U is connected with the main stator windings and the exciter field windings to provide closed loop control of the output voltage.

In addition to being powered from the main stator, AVR BL4-U also derives a sample voltage from the output windings for voltage control purposes. In response to this sample voltage, AVR BL4-U controls the power fed to the exciter field, and hence the main field, to maintain the machine output voltage within the specified limits, compensating for load, speed, temperature and power factor of the alternator.

A frequency measuring circuit continually monitors the alternator output and provides output under-speed protection of the excitation system, by reducing the output voltage proportionally with speed below a pre-settable threshold. A manual adjustment is provided for factory setting of the under frequency roll off point, (UF). This can easily be changed to 50 or 60 Hz with two dip switches.

Provision is made for the connection of a remote voltage potentiometer, allowing the user fine control of the alternator's output.

ELECTRICAL SPECIFICATIONS

BL4-U AVR includes:

- A terminal strip (10 terminals)
- A voltage trimmer
- A stability trimmer
- An under frequency trimmer
- A frequency selection DIP switches
- Electric protection with fuse.

The electronic is sealed with resin (it is a perfect protection against vibrations and humidity).

ADJUSTMENTS

Adjusting elements of AVR BL4-U are described as the figure below.

FREQUENCY SELECTION

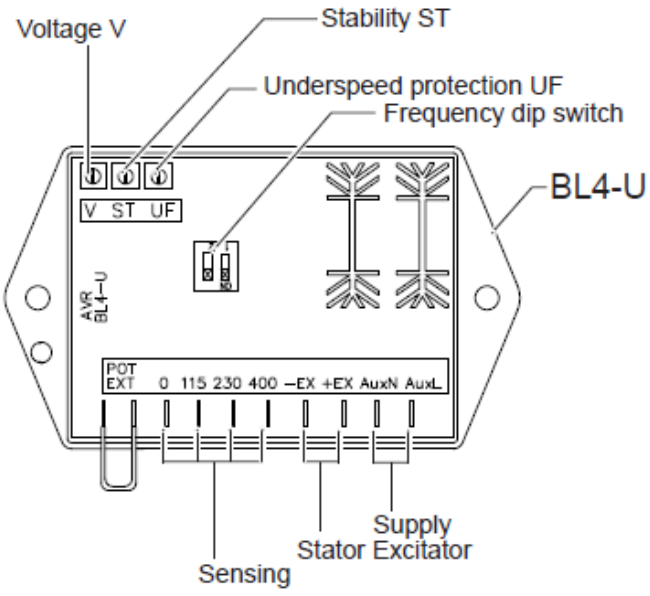
The frequency selection is done using two DIP-Switches. Set both switches to “ON” for 50 Hz, to “OFF” for 60 Hz.

VOLTAGE ADJUSTMENT

The alternator output voltage is set at the factory, but it can be altered by adjustment of the V potentiometer on the AVR BL4-U board, or by the external hand potentiometer.
External hand potentiometer (5 kohm/0.5 W) has to be fitted at the terminals Ext and Pot instead of shorting link.
If no hand potentiometer is required terminals Ext and Pot will be fitted with a shorting link.

STABILITY ADJUSTMENT

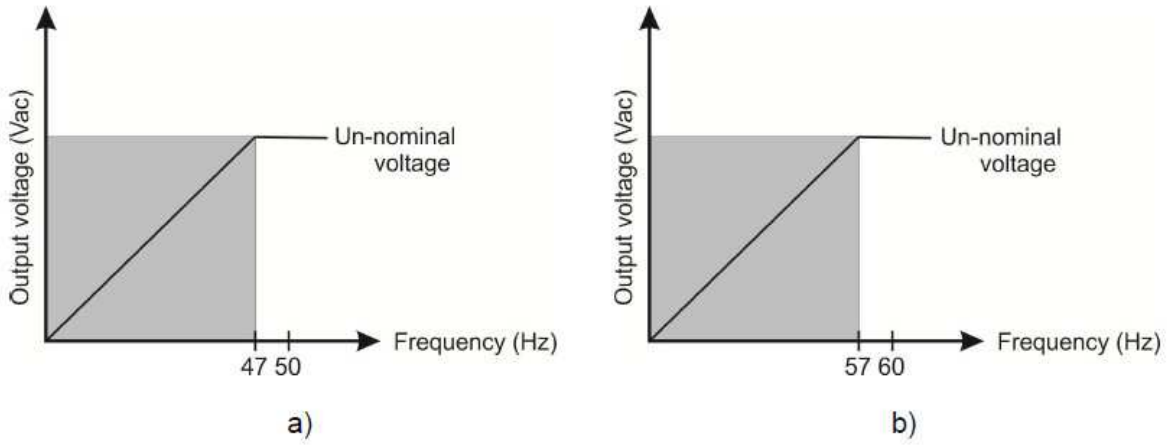
The AVR BL4-U includes stability or damping circuit to provide good steady state and transient performance of the alternator.
The correct setting can be found by running the alternator at no load and slowly turning the stability ST clockwise until the alternator voltage starts to become unstable.
The optimum or critically damped position is slightly anti-clockwise from this point (i.e. where the machine volts are stable but close to the unstable region).



Elements for adjustment on AVR BL4-U pcb

UNDER FREQUENCY KNEE ADJUSTMENT

AVR BL4-U incorporates an underspeed protection circuit (UF) which gives a volts/Hz characteristic when the alternator speed falls below a presettable threshold known as the "knee" point.
The UF knee adjustment is preset at factory at the 47Hz on a 50Hz system or 57Hz on a 60Hz system. Selection of 50 / 60Hz can be made using the DIP-Switches.
The figures below show the curves for voltage variation as a function of frequency variation.
For nominal frequency operation, UF is disabled. When rotation decreases (e.g. when shutting down), excitation decreases, reducing the output voltage of the alternator.
The pre-set "knee" point can be altered, by UF trimmer, according to the needs of each application.



Under frequency "knee": a) 50 Hz system, b) 60 Hz system

PROTECTION FUSE

The fuse is used to limit the input supply current in order to protect the alternator field.
The fuse must be: Fast action, 5x20 mm, 3,15A/250V.

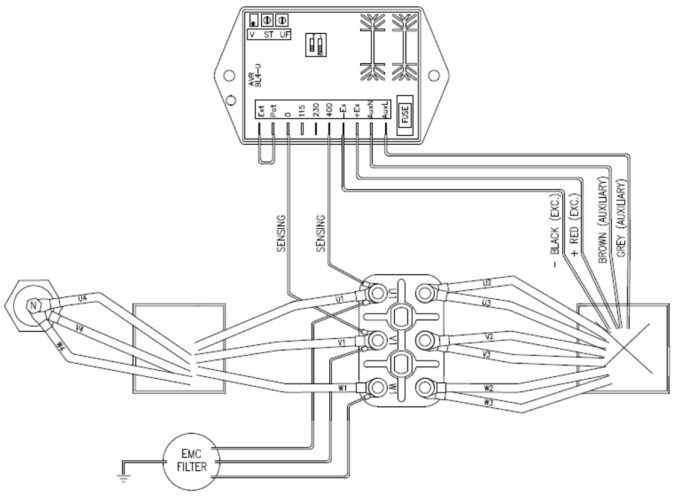
TRIMMERS

Trimmer functions:
V = Voltage adjustments;
ST = Stability adjustments;
UF = UF "knee" adjustments.
Trimmer adjustments:
V = Turning clockwise, increases voltage;
ST = Turning clockwise, speeds up response;
UF = Turning clockwise, increases the UF protection limit.

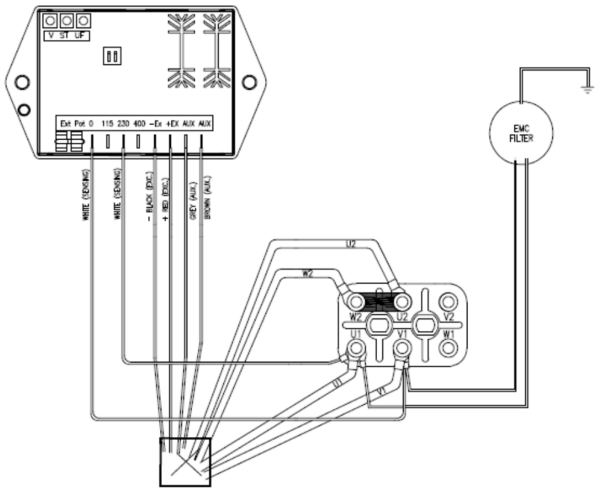
CONNECTION

CONNECTION DIAGRAMS

The figures below show the connection for an alternator with a nominal line voltage of 1Ph 230 Vac and 3Ph 400Vac. The sensing will be accomplished using the line voltage at input contacts named 400, 230, 115 and 0.



AVR BL4-U Connection diagram: 3Ph - sensing 400 V



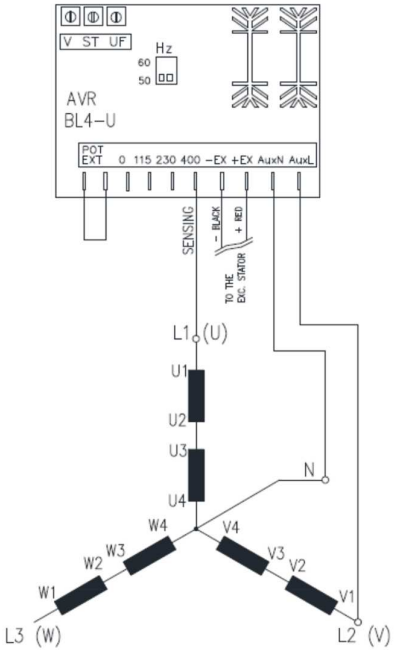
AVR BL4-U Connection diagram: 1Ph - sensing 230V

CONNECTION TERMINALS

Sensing voltage:
400, 0 = 400 Vac
230, 0 = 230 Vac
115, 0 = 115 Vac
Supply voltage:
AuxL, AuxN
Alternator field:
+Ex, -Ex
External adjustment potentiometer:
Ext, Pot

CONNECTION DIAGRAMS WITHOUT AUXILIARY WINDING

The figure below shows the connection for an 12-wires alternator without the auxiliary winding.
The nominal line voltage is 400Vac. The sensing will be accomplished using the line voltage at input contacts. See the figure below.
The power supply is 230V. For the machine 3Ph 400V connect the line U and the neutral N to the terminals AuxL and AuxN.



AVR BL4-U Connection diagrams without auxiliary winding: 3Ph - sensing 400 V

STARTING UP

If a replacement AVR has been fitted, or the re-setting of the voltage adjustment is required, please proceed as follows:

1. Connect the wires coming from the alternator according to the description in the CONNECTION DIAGRAM and the type of alternator to be used.
2. Check that the DIP switches and the connections are consistent with the characteristics of the machine (voltage, frequency, remote control)
3. Before running alternator, turn the volts trimmer “V” anti-clockwise
4. Turn stability trimmer “ST” to midway position
5. Start alternator set, and run on no load at nominal frequency e.g. 50-53 Hz or 60-63 Hz
6. Carefully turn volts trimmer “V” (or external pot, if fitted) clockwise until rated voltage is reached
7. If instability is present at rated voltage, refer to stability adjustment, and then re-adjust voltage if necessary

MAINTENANCE AND TROUBLE-SHOOTING

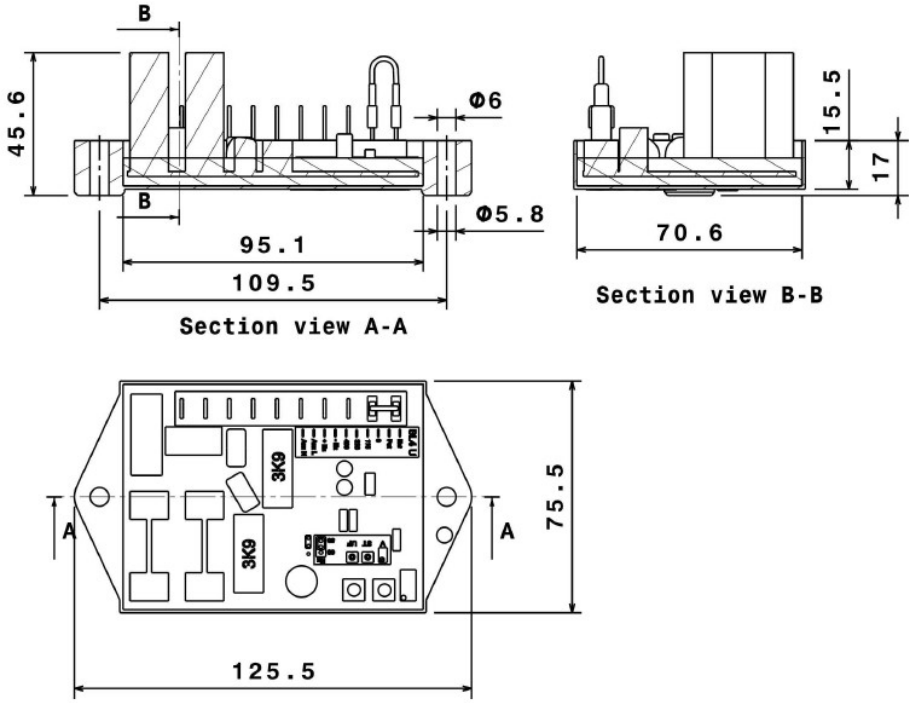
PREVENTIVE MAINTENANCE

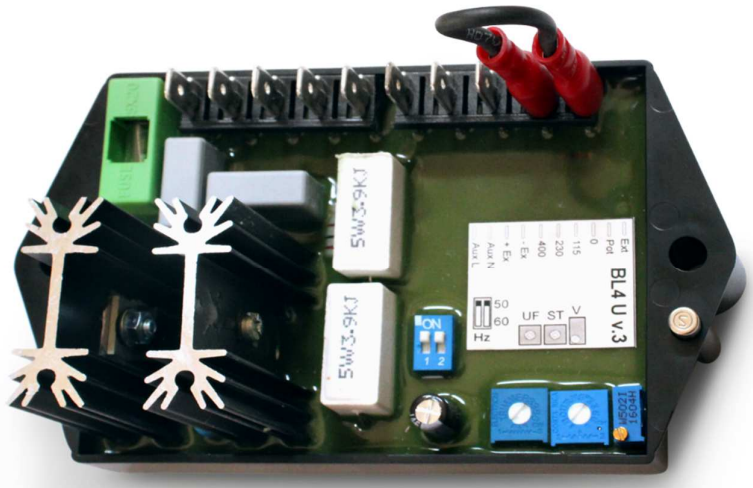
Periodical inspections of the equipment are required to ensure they are clean, dust and moisture free. It is essential that all terminals and connections are kept free from corrosion.

TROUBLE-SHOOTING

Trouble	Possible causes	Solutions
NO OUTPUT VOLTAGE	- Demagnetized machine	- Connect (for a while) an external battery (12Vdc) to the exciter (respecting the polarities)
	- Wrong connection of the AVR	- Check as per wiring diagram
	- Loose terminals/connections	- Check if all terminals/connections are well tightened
	- External potentiometer terminals (Ext, Pot) not short circuited or potentiometer is open (if present)	- Short circuit (Ext, Pot) or change external potentiometer (if present)
	- Burnt fuse	- Check and replace
	- Faulty AVR	- Replace the AVR
LOW OUTPUT VOLTAGE	- Voltage potentiometer wrongly adjusted	- Check and adjust
	- Sensing wrongly connected	- Check the sensing connections
	- Dip-switch wrongly positioned	- Check and fix
	- Low frequency (under the UF limit)	- Increase the engine speed
	- Under-Frequency protection is not properly adjusted	- Check and adjust
	- Faulty AVR	- Replace the AVR
HIGH OUTPUT VOLTAGE	- Voltage potentiometer wrongly adjusted	- Check and adjust
	- Sensing wrongly connected	- Check the sensing connections
	- Dip-switch wrongly positioned	- Check and fix
	- Missing sensing	- Check if sensing is interrupted
	- Faulty AVR	- Replace the AVR
UNSTABLE VOLTAGE	- Stability response incorrectly adjusted	- Adjust trimmer “ST”
	- Unstable engine speed	- Check the frequency/engine speed
	- Loose terminals/connections	- Check if all terminals/connections are well tightened
	- Faulty AVR	- Replace the AVR
FUSE BLOWS CONTINUOUSLY	- UF protection adjusted for a very low frequency (so the fuse burn during the turn-off procedure)	- Adjust UF limit to a value close to the nominal frequency
	- Faulty AVR	- Replace the AVR

DIMENSIONS


B
45.6
Φ6
B
Φ5.8
95.1
109.5
Section view A-A
15.5
17
70.6
Section view B-B
3K9
3K9
A
A
75.5
125.5


5W3.9KJ
5W3.9KJ
BL4 U v.3
ON
50
60
Hz
UF
ST
V

SINCRO has been manufacturing trustable alternators for over 30 years.
At the core of your best energy up to 2.6 MVA. Standard and custom.
Proudly 100% Made in Europe.

soga energyteam

WE MAKE INNOVATION

ITALIAN GROUP, ITALIAN QUALITY
www.sogaenergyteam.com

sincro®