STAMFORD

STAMFORD VITA™ 05 Digital Voltage Regulator

SPECIFICATION, CONTROLS AND ACCESSORIES

English
Original Instructions

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A072Z058 (Issue 2)

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1 Foreword

1.1 General

This document is an important guide to the intended use and operation of the product(s) detailed on the front cover. Read the information and procedures in this document. The information and procedures must be obeyed at all times. Failure to obey the information and procedures can be considered misuse and can lead to injury, loss or damage to personnel or equipment.

TABLE 1. COMPANY ADDRESSES

Company and European Authorized Representative Addresses	
Cummins Generator Technologies Fountain Court Lynch Wood Peterborough PE2 6FZ United Kingdom	Cummins Generator Technologies Bvd. Decebal 116A Craiova Dolj 200746 Romania

1.2 Legal

The STAMFORD VITA™ range of Digital Voltage Regulators are the intellectual property of Cummins Generator Technologies Ltd (also referred to as 'CGT' or 'the manufacturer' or by the brand names 'STAMFORD®' or 'AvK®' within this manual).

1.3 Component Manual

This manual contains specifications, control and accessory information for a STAMFORD VITA™ Digital Voltage Regulator, commonly known as an Automatic Voltage Regulator (AVR) or Digital Voltage Regulator (DVR).

STAMFORD VITA ™ voltage regulators are intended for use with STAMFORD® and AvK® alternators, produced by Cummins Generator Technologies Ltd (CGT).

Before installing, operating, servicing or repairing the equipment, read this manual. Make sure that all personnel who work on the equipment have access to the manual and all related documentation supplied with it. Misuse, failure to obey the instructions or use of non-approved parts may invalidate the product warranty and lead to loss, injury or damage.

This manual is an essential part of the equipment. Make sure that the manual is available to all applicable personnel throughout the life of the equipment.

The manual is written for skilled electrical and mechanical technicians and engineers, who have prior knowledge and experience of equipment of this type. If in doubt, contact your local CGT subsidiary.

NOTICE
Information in this manual was correct when published. It may be superseded due to our policy of continuous improvement. Visit www.stamford-avk.com for the latest documentation.

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2 Safety Precautions

2.1 Safety Information and Notices used in this Manual

Danger, Warning and Caution panels used in this manual describe the sources of hazards, their consequences and how to avoid injury. Notice panels emphasize important or critical instructions.

⚠ DANGER

Danger indicates a hazardous situation which, if not avoided, WILL result in death or serious injury.

⚠ WARNING

Warning indicates a hazardous situation which, if not avoided, COULD result in death or serious injury.

⚠ CAUTION

Caution indicates a hazardous situation which, if not avoided, COULD result in minor or moderate injury.

NOTICE

Notice refers to a method or practice which can result in product damage, or to draw attention to additional information or explanations.

2.2 General Guidance

- These safety precautions are for general guidance. The information is intended to supplement your own safety procedures and applicable rules, laws and regulations.

2.3 Training and Skill Requirements for Personnel

Operation, installation, service and maintenance tasks and/or procedures can only be done by personnel, who:

- Have completed related, applicable and approved training.
- Know the equipment, understand the task(s) and procedure(s) and know the related hazards / risks.
- Know and obey site / location specific emergency procedures and applicable laws and regulations.

2.4 Risk Assessment

- The installer / operator / service / maintenance company must do a risk assessment to establish all related hazards and risks.
- During operation, access to the alternator must be restricted to personnel who are trained and who know all relevant hazards and risks. Refer to: **Section 2.3 on page 3**.

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2.5 Personal Protective Equipment (PPE)

Personnel who install, operate, service or maintain the alternator must:

- Have access to the minimum recommended protective equipment (refer to the figure below). The protective equipment must be approved for the task or procedure.
- Know how to correctly use protective equipment, refer to: **Section 2.3 on page 3**
- Use protective equipment as directed by the risk assessment, refer to: **Section 2.4 on page 3**.

FIGURE 1. MINIMUM RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT (PPE)

2.6 Tools and Equipment

All personnel must know how to use tools and equipment safely, refer to: **Section 2.3 on page 3**.

All tools and equipment used, must be:

- Suitable for the task and procedure.
- Electrically insulated (not below the alternator output voltage), refer to: **Section 2.4 on page 3**.
- In a serviceable condition for safe use.
- Included within the risk assessment, refer to: **Section 2.4 on page 3** .

2.7 Safety Information Signs

Safety information signs are provided on the equipment to indicate hazards and emphasize instructions. Before operating the equipment:

- Personnel must know and understand alternator safety information signs and the associated hazards / risks.

FIGURE 2. EXAMPLE SAFETY INFORMATION SIGNS

Safety information signs vary depending on alternator specification.

2.8 AVR Danger, Warning and Caution Notices

⚠ DANGER

Live Electrical Conductors

Live electrical conductors can cause serious injury or death by electric shock and burns. To prevent injury and before working on live conductors:

- ***Shut down and isolate the alternator from all energy sources.***
- ***Remove or isolate stored energy.***
- ***Test isolated parts for electrical isolation using a suitable voltage tester.***
- ***Use lock out/tag out safety procedures.***

⚠ DANGER

Live Electrical Conductors

Output, AVR, AVR accessory terminals, and AVR heat sink can cause serious injury or death by electric shock and burns. To prevent injury:

- ***Use applicable precautions to prevent contact with live conductors, such as: insulation, barriers, insulated tools and personal protective equipment, refer to: Safety Precautions Chapter.***

⚠ WARNING

Strong Magnetic Field

The strong magnetic field from a Permanent Magnet Generator (PMG) or Excitation Boost System (EBS), can cause serious injury or death by interference with implanted medical devices. To prevent injury or death:

- ***Do not work near a Permanent Magnet Generator (PMG) or Excitation Boost System (EBS) if you have an implanted medical device.***

⚠ WARNING

Installing Automatic Voltage Regulator (AVR)

An incorrectly configured AVR can result in equipment malfunction or damage which can cause injury or death. Prior to installing, operating / adjusting or replacing an automatic voltage regulator, all personnel must:

- ***Read and obey all instructions within this manual.***
- ***Read and obey all instructions within the original operator manual for the alternator that work is being undertaken on.***
- ***Know the equipment, understand the task(s) and procedure(s).***
- ***Know all related hazards and risks.***
- ***Know and understand all location specific emergency procedures and locally applicable laws and regulations.***

NOTICE

Refer to alternator wiring diagram for connection details.

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3 Description

3.1 General Description

VITA™ 05 is a three-phase sensed Automatic Voltage Regulator (AVR) and forms part of the excitation system for a brush-less alternator. Excitation power is derived from a three-phase Permanent Magnet Generator (PMG), to isolate the AVR control circuits from the effects of non-linear loads and to reduce radio frequency interference on the alternator terminals.

Sustained alternator short circuit current is an additional feature of the PMG system.

3.2 Separately-Excited AVR Controlled Alternators

A separately-excited AVR receives power from a separate Permanent Magnet Generator (PMG), mounted on the main alternator shaft. The AVR controls the alternator output voltage by automatic adjustment of the exciter stator field strength. The AVR excitation remains at full capability when sudden loads are applied to the alternator, giving superior motor starting, short circuit and EMC performance.

3.2.1 Permanent Magnet Generator (PMG) Excited - AVR Controlled Alternators

⚠ WARNING

Strong Magnetic Field

The strong magnetic field from a Permanent Magnet Generator (PMG) or Excitation Boost System (EBS), can cause serious injury or death by interference with implanted medical devices. To prevent injury or death:

- ***Do not work near a Permanent Magnet Generator (PMG) or Excitation Boost System (EBS) if you have an implanted medical device.***

The AVR provides closed loop control by sensing the alternator output voltage at the main stator windings and adjusting the exciter stator field strength. Voltage induced in the exciter rotor, rectified by the rotating diodes, magnetizes the rotating main field which induces voltage in the main stator windings. A separately-excited AVR is independently powered from a separate Permanent Magnet Generator (PMG), mounted on the main alternator rotor shaft. Voltage is induced in the stator of the PMG by a rotor of permanent magnets.

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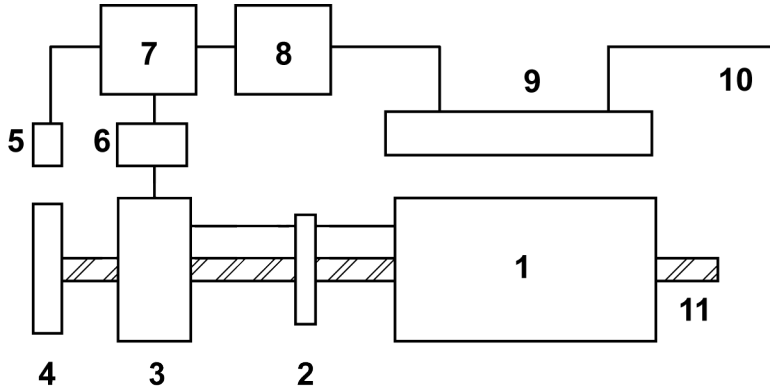
TABLE 2. PMG EXCITED AVR



No.	Description	No.	Description	No.	Description
1	Main field (rotor)	5	PMG armature (stator)	9	Main armature (stator)
2	Rotating diodes	6	Exciter field (stator)	10	Output
3	Exciter armature (rotor)	7	AVR	11	Rotor shaft
4	PMG field (rotor)	8	Isolating transformer (if fitted)		

4 Specification

4.1 STAMFORD VITA™ 05 Technical Specification

• Sensing Input

- Voltage: 99 VAC to 133 VAC maximum 2 phase[1]
  : 171 VAC to 305 VAC maximum 2 or 3 phase[1]
  : 342 VAC to 480 VAC maximum 2 or 3 phase[1]
- Frequency: 50 Hz / 60 Hz nominal[2]

• Power Input

- Voltage: 170 VAC to 220 VAC maximum, 3 phase, 3 wire
- Current: 3 A per phase
- Frequency: 100 Hz to 120 Hz nominal

• Power Output

- Voltage: Maximum 180 VDC
- Current:
  - Continuous 5 A [3]
  - Overload 7 A for 1 minute
  - Transient 12 A for 10 seconds
- Resistance: 15 Ω minimum

• Regulation

- +/- 0.25 % RMS[4]

• Thermal Drift

- 0.02 % for 1 °C change in ambient temperature[5]

• Soft Start Ramp Time

- 0.4 s to 4 s

• Typical Response

- AVR response in 10 ms
- Field current to 90 % in 80 ms
- Machine volts to 97 % in 300 ms

External Voltage Adjustment Pot

- +/- 10 % with 1 kΩ, 1 W trimmer[6]

[1] Selected by DIP Switch 2-4. Refer to: **Section 5.1.1 on page 16**
[2] Selected by link on AVR terminals.
[3] Derate linearly 5.0 A at 60 °C to 4.3 A at 70 °C.
[4] For Balance Linear Load with 4 % engine governing. The stated voltage regulation may not be maintained in the presence of certain transmitted radio signals. Any change in regulation will fall within the limits in Performance Criterion B of EN IEC 61000-6-2:2019.
[5] After 10 minutes.
[6] Alternator de-rate may apply. Check with factory.

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- **Under Frequency Protection**
  - Set point: 95 % Hz[7]
  - Slope: 100 % to 300 % down to 30 Hz
  - Maximum dwell: 20 % V/s recovery
- **Under Frequency Protection – For Variable Speed Application**
  - For linear slope from rated frequency
    - Set point: 100 % Hz [8]
    - AVR [DIP] POT: 0 %
    - Slope: Linear down to 20 Hz [9]
- **Unit Power Dissipation**
  - 44 W maximum
- **Analog Input**
  - Maximum voltage input: +/- 5 VDC[10]
    - Sensitivity: 1 V for 5 % alternator volts (adjustable)
  - Maximum current input: 4 - 20 mA
    - Sensitivity: 1.6 mA for 5 % alternator volts (adjustable)
  - Input resistance: 1 kΩ
- **Quadrature Droop Input**
  - Burden: 0.15 Ω
  - Maximum sensitivity: 0.1 A for 5 % droop, zero power factor
  - Maximum input: 0.33 A
- **Current Limit Input**
  - Burden: 0.5 Ω
  - Sensitivity range: 0.33 A to 1 A
- **Over-Voltage Detection**
  - Set point: 130 % of nominal
  - Time delay: 1 s (fixed)
- **Over-Excitation Protection**
  - Set point: 75 VDC[11]
  - Time delay: 10 s (fixed)

[7] Factory set, semi sealed, jumper selectable.
[8] User Adjustable, UFRO Set Point: 100 %. Jumper Selectable - Frequency H1, H2: Open – 60 Hz: Link – 50 Hz.
[9] AVR [DIP] should be adjusted to 0 % (anticlockwise) for variable speed application. Refer to: **Section 5.1 on page 14**. All adjustments should be done with the machine in a stopped condition.
[10] Any device connected to analog input must be fully floating (galvanically isolated from ground) with an insulation strength of 500 VAC.
[11] Factory set, semi-sealed.

Environmental

- Vibration:
    - 20 Hz to 100 Hz: 50 mm/sec
    - 100 Hz to 2 KHz: 3.3 g
- Operating temperature: -40 °C to +70 °C
- Relative humidity: 0 °C to 70 °C: 95 %
- Storage temperature: -55 °C to +80 °C [12]

[12] Non-condensing.

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5 Controls

⚠ DANGER

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- ***Remove or isolate stored energy.***
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- ***Use lock out/tag out safety procedures.***

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- ***Know all related hazards and risks.***
- ***Know and understand all location specific emergency procedures and locally applicable laws and regulations.***

NOTICE

Refer to alternator wiring diagram for connection details.

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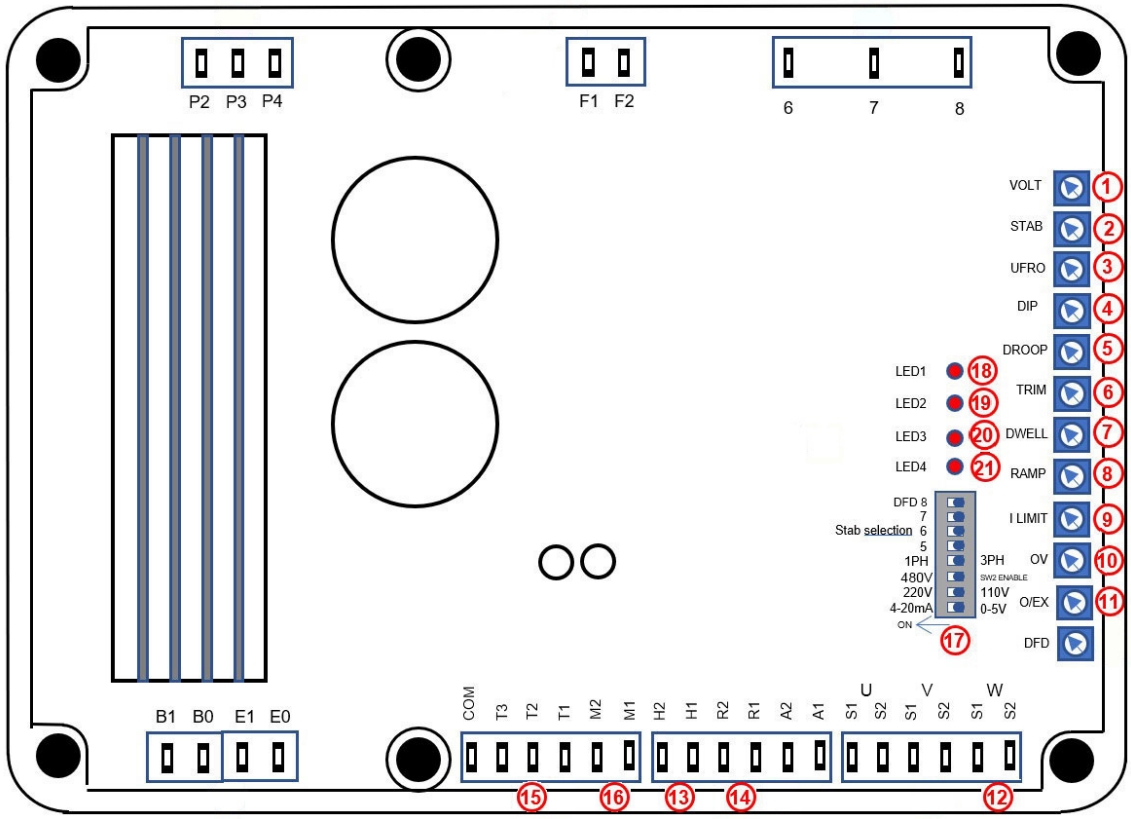
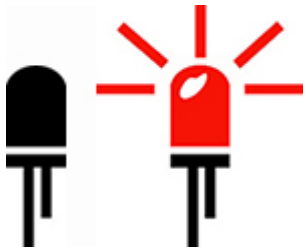
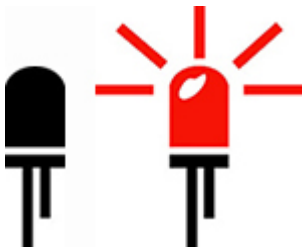
5.1 Controls and Adjustments

TABLE 3. CONTROLS AND ADJUSTMENTS



ON and OFF switch positions are referenced from this view, AVR facing.

Ref.	Control	Function	Turn potentiometer CLOCKWISE to
1	**AVR [VOLTS]**	Adjust alternator output voltage	Increase voltage
2	**AVR [STAB]**	Adjust stability to prevent voltage hunting	Increase damping effect
3	**AVR [UFRO]**	Adjust under-frequency roll-off knee point	Reduce UFRO frequency
4	**AVR [DIP]**	Adjust under-frequency voltage dip rate	Increase rate
5	**AVR [DROOP]**	Adjust alternator droop rate to 5% at Zero Power Factor	Increase droop
6	**AVR [TRIM]**	Adjust analog input sensitivity	Increase sensitivity
7	**AVR [DWELL]**	Adjust voltage recovery	Increase recovery time
8	**AVR [RAMP]**	Adjust soft start voltage ramp	Increase ramp time

9	**AVR [I LIMIT]**	Adjust current limit protection[13]	Increase current limit
10	**AVR [OVER V]**	Adjust over-voltage protection	Increase trip voltage
11	**AVR [O/EXC]**	Adjust over-excitation protection	Increase trip excitation voltage
12	**Droop CT terminals:** S1, S2 – W phase	Select alternator for droop [14]	N/A
13	**Link - Frequency H1, H2:** Open – 60 Hz Link – 50 Hz	Select alternator frequency for UFRO	N/A
14	**Link R1, R2 - Hand trimmer:** Open: No trimmer Closed: Trimmer fitted	Adjust alternator voltage remotely	Increase voltage
15	**Fault indication terminals:** T1-COM: For over-voltage and current limit indications T2-COM: For over-excitation trip indication T3-COM: For diode failure detection indication	Confirmation signal terminals for steady state relay	N/A
16	**M1 - M2: Start/Stop switch for excitation:** Open – No excitation Close – Set voltage	Excitation switch function for ON/OFF, typically for motor starting external inputs	N/A
17	**DIP switch:** For the 8-pole DIP switch functions, refer to: **Section 5.1.1 on page 16**	Selection switches for voltage sensing, analog input source, stability and DFD	N/A
18	**Light emitting diode - LED1:** Blink: I-limit reached Steady: Over-voltage	LED blinks or glows steadily during stator over-current or over-voltage	
19	**Light Emitting Diode – LED2:** Steady: Over-excitation	LED glows steadily during over excitation	

[13] To connect current limiting CTs, please refer to the wiring diagram.
[14] To connect the droop in W phase, please refer to the wiring diagram.

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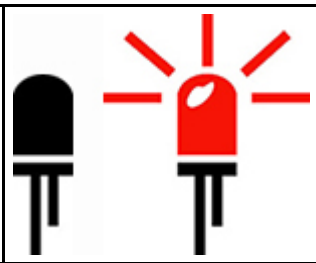
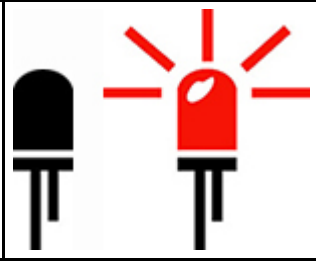
20	**Light Emitting Diode – LED3:** Steady: UFRO	LED glows for under-frequency operation	
21	**Light Emitting Diode – LED4:** Steady: Diode failure monitor	LED glows for exciter diode failure condition	

NOTICE
Do not open the link across M1 - M2 for correct functioning of the AVR.

5.1.1 VITA™ 05 DIP Switch Settings

TABLE 4. DIP SWITCH SETTINGS

Dip switches	Switch 1: Analog input selection	Switch 2: Sensing voltage selection	Switch 3: Sensing voltage selection	Switch 4: 1-phase / 3-phase sensing selection	Frame	Switches 5, 6, 7: Rating selection			Switch 8:
						5	6	7	
OFF	+/-5 VDC	110 VAC	Switch 2 enable	3-phase mode	**UC22**	OFF	OFF	OFF	ON
ON	4-20 mA	220 VAC	480 VAC	1-phase mode	**UC27**	ON	OFF	OFF	ON
-	-	-	-	-	**S4**	OFF	ON	OFF	ON
-	-	-	-	-	**S5**	ON	ON	OFF	ON
-	-	-	-	-	**S6**	OFF	OFF	ON	ON
-	-	-	-	-	**S7**	ON	OFF	ON	ON

5.2 Initial AVR Setup

NOTICE
The AVR must be setup only by authorized, trained service personnel. Do not exceed the designed safe operating voltage, shown on the alternator rating plate.

The AVR controls are set at the factory for initial running tests. Check that the AVR settings are compatible with the required output of the end user. Do not adjust controls that have been sealed. To set up a replacement AVR, follow these steps:

1. Stop and isolate the generator set.

2. Install and connect the AVR. Refer to the connection diagram.
3. Turn the **AVR [VOLTS]** volts control fully counter-clockwise. Refer to: **Section 5.3 on page 17**.
4. If hand trimmer is fitted, turn it to 50%, the midway position.
5. Turn the **AVR [STAB]** stability control to 75%, the midway position. Refer to: **Section 5.4 on page 18**.
6. Select the DIP switches as per the alternator connections.
7. Select correct voltage sensing range as per alternator rating.
8. Connect a suitable voltmeter across the alternator terminals, as per voltage rating of alternator.
9. Start the generator set with no load.
10. Adjust speed to nominal frequency (50 Hz to 53 Hz or 60 Hz to 63 Hz). If the LED is lit, adjust the **AVR [UFRO]** control. Refer to: **Section 5.5 on page 19**
11. Carefully turn **AVR [VOLTS]** control clockwise until the voltmeter shows rated voltage.
12. If voltage is unstable, adjust the **AVR [STAB]** stability control.
13. Re-adjust the **AVR [VOLTS]** control as needed.

5.3 Adjust the AVR [VOLTS] Voltage Control

NOTICE
Do not exceed the designed safe operating voltage, shown on the alternator rating plate.

NOTICE
Hand trimmer terminals may be above earth potential. Do not ground any of the hand trimmer terminals. Grounding hand trimmer terminals could cause equipment damage.

To set the output voltage AVR [VOLTS] control on the AVR:

1. Check the alternator nameplate to confirm the designed safe operating voltage.
2. Check sensing voltage available to AVR as per system and then select a suitable voltage range with the help of DIP SWITCH 2, 3 and 4. Refer to: **Section 5.1.1 on page 16**
3. Set the **AVR [VOLTS]** control to 0%, the fully counter-clockwise position.

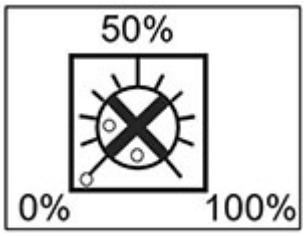


FIGURE 3. 0% POSITION

4. Check that the remote hand trimmer is fitted, or Terminals 1 and 2 are open.

NOTICE
If a remote hand trimmer is connected, set it to 50%, the midway position. If 1 and 2 are linked the terminal voltage will drop to a minimum level of hand trimmer.

5. Turn the **AVR [STAB]** control to 75%, the midway position.
6. Start the alternator and set at the correct operating speed.

7. If the Light Emitting Diode (LED3) is illuminated, refer to the Under Frequency Roll Off **AVR [UFRO]** adjustment.
8. Adjust the **AVR [VOLTS]** control slowly clockwise to increase the output voltage.

NOTICE
If the voltage is unstable, set the AVR stability before proceeding. **If hand trimmer is fitted, turn it to 50%, the midway position. Refer to: Section 5.4 on page 18**

9. Adjust the output voltage to the desired nominal value (VAC).
10. If instability is present at the rated voltage, refer to the **AVR [STAB]** adjustment, then adjust **AVR [VOLTS]** again, if necessary.
11. If a remote hand trimmer is connected, check its operation.

NOTICE
0% to 100% rotation of hand trimmer corresponds to 90% to 110% VAC.

12. The **AVR [VOLTS]** control is now set.

5.4 Adjust the AVR [STAB] Stability Control

1. Check the nameplate to confirm the power rating of the alternator.
2. Check that the DIP SWITCHES 5, 6 and 7 selections match the alternator power rating for optimal stability response. Refer to: **Section 5.1.1 on page 16**
3. Set the **AVR [STAB]** control to approximately 75% position.

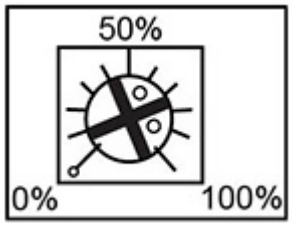


FIGURE 4. 75% POSITION

4. Start the alternator and set at the correct operating speed.
5. Verify that the alternator voltage is within safe limits.

NOTICE
If the voltage is unstable go immediately to step 5.

6. Adjust the **AVR [STAB]** control slowly counter-clockwise until the output voltage becomes unstable.
7. Adjust the **AVR [STAB]** control slowly clockwise until the voltage is stable.
8. Adjust the **AVR [STAB]** control a further 5% clockwise.

NOTICE
Re-adjust the voltage level if necessary. Refer to: Section 5.3 on page 17

The **AVR [STAB]** control is now set.

5.5 Adjust the AVR [UFRO] Under-Frequency Roll-Off Control

Below the UFRO threshold frequency (‘knee’ point), the AVR under-speed protection operates to reduce (‘roll-off’) the excitation voltage in proportion to the alternator frequency. The AVR LED3 glows steadily when UFRO gets activated.

1. Check the nameplate to confirm the frequency of the alternator.

NOTICE
Switch off power to AVR (stop alternator and prime mover). Adjusting the frequency selection jumper link to 60 Hz mode for a 50 Hz alternator may result in low voltage. Adjusting the frequency selection jumper link to 50 Hz mode for a 60 Hz alternator may result in overheating of field windings during under-speed conditions.

2. Check that the jumper link of H1-H2 matches the alternator frequency.
3. Set the **AVR [UFRO]** control to 100%, the fully clockwise position.

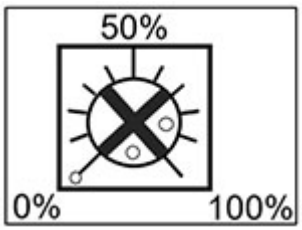


FIGURE 5. 100% POSITION

4. Start the alternator and set at the correct operating speed.
5. Verify that the alternator voltage is correct and stable.

NOTICE
If the voltage is high/ low/ unstable, refer to: Section 5.3 on page 17 or Section 5.4 on page 18.

6. Reduce the alternator speed to approximately 95% of rated operating speed, i.e., 47.5 Hz for 50 Hz operation, 57.0 Hz for 60 Hz operation.
7. Adjust the **AVR [UFRO]** control slowly counterclockwise until the AVR LED3 glows steadily.

FIGURE 6. ILLUMINATED LED

8. Adjust the **AVR [UFRO]** control slowly clockwise until the AVR LED is just OFF.

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FIGURE 7. EXTINGUISHED LED

9. Adjust the alternator speed back to 100% nominal. The LED should be off.

The **AVR [UFRO]** control is now set.

5.6 Adjust the AVR [O/EXC] Over-Excitation Control

NOTICE
The AVR [O/EXC] control is set and sealed at the factory to protect the alternator from over-excitation, usually caused by overload. Incorrect AVR [O/EXC] control setting could damage the alternator rotor components.

The AVR protects the alternator by limiting the excitation if it senses that the excitation voltage exceeds the threshold set by the **AVR [O/EXC]** control. The AVR LED2 glows steadily when the O/EXCITATION gets activated.

1. If the excitation voltage exceeds the over-excitation limit setting, the red LED2 on the AVR turns ON.
2. After a short time, the AVR removes the excitation voltage and the red LED2 flashes (which can also indicate an over-voltage trip or UFRO operation).
3. Stop the alternator to investigate the cause of over-excitation.

5.7 Adjust the AVR [DROOP] Voltage Droop Control for Parallel Operation (If CT is fitted)

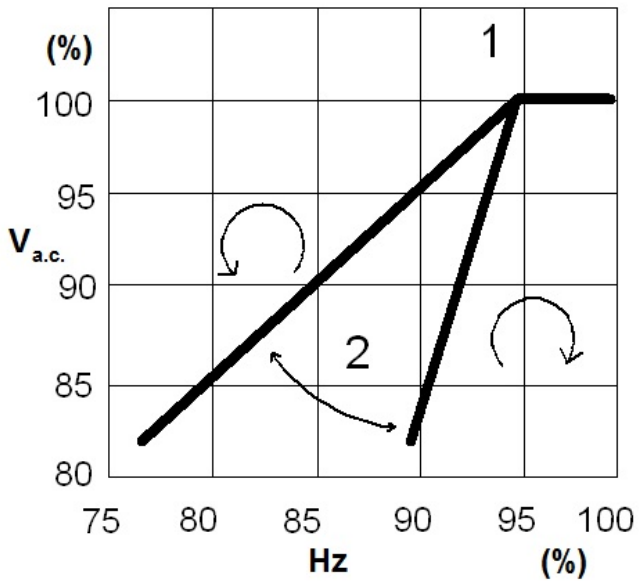
A correctly fitted and adjusted droop current transformer (CT) allows the alternator to share reactive current for stable parallel operation.

1. Mount the Droop CT to the correct phase lead of the main output windings of the alternator.
2. Connect the two secondary leads marked S1 and S2 from the CT to the terminals S1 and S2 of the AVR (W-phase).
3. Turn the **AVR [DROOP]** control to the midway position.
4. Start the alternator(s) and set at the correct operating speed and voltage.
5. Parallel the alternator(s) according to installation rules and procedures.
6. Set the **AVR [DROOP]** control to produce the required balance between individual alternator output currents. Set the AVR droop off-load and then check the currents when the output load is applied, on-load.
7. If the individual alternator output currents rise (or fall) in an uncontrolled way, isolate and stop the alternators then check that:
    - The droop transformer is fitted to the correct phase and in the correct polarity (see the machine wiring diagrams).
    - The droop transformer secondary S1 and S2 leads are connected to the AVR terminals S1 and S2.
    - The droop transformer is the correct rating.

5.8 Adjust the AVR [DIP] Dip Control

Some generator set prime movers, for example turbocharged engines, have limited capacity to tolerate sudden load increases. The rotational speed, and therefore the frequency of the alternator output, falls below the UFRO setting. The AVR reduces the excitation voltage - and hence the output power - in proportion to the frequency, to allow the prime mover to recover. The **AVR [DIP]** control adjusts the proportion.

TABLE 5. EFFECT OF AVR [DIP] CONTROL



1	Under-frequency roll-off setting, AVR [UFRO] control
2	Adjust drop in voltage with frequency, AVR [DIP] control

1. For the minimum effect (1% fall in frequency gives 1% voltage drop), turn the **AVR [DIP]** control fully counter-clockwise.
2. For the maximum effect (1% fall in frequency gives 3% voltage drop), turn the **AVR [DIP]** control fully clockwise.

5.9 Adjust the AVR [DWELL] Dwell Control

Some generator set prime movers, for example turbocharged engines, have limited capacity to tolerate sudden load increases. The AVR introduces a time delay before increasing the excitation voltage after an under-frequency condition, to allow the prime mover to recover. The **AVR [DWELL]** control adjusts the proportion.

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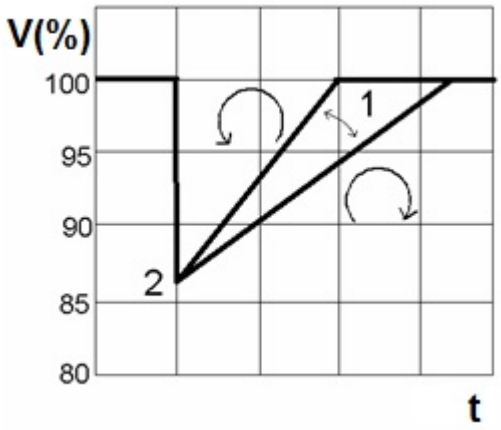
TABLE 6. EFFECT OF AVR [DWELL] CONTROL



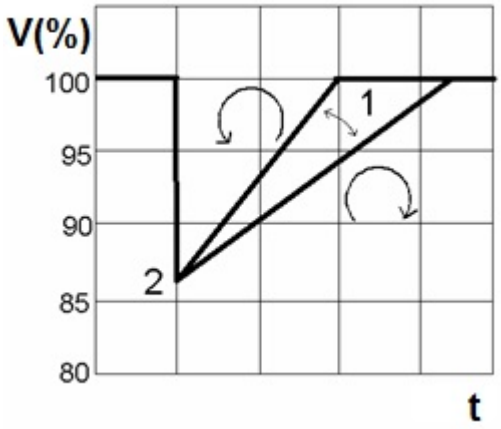
1	Adjustable rate of excitation voltage rise, AVR [DWELL] control
2	Prime mover starts to recover from under-frequency condition

1. For the minimum effect (excitation voltage follows speed according to UFRO V/Hz ramp), turn the **AVR [DWELL]** control fully counter-clockwise.
2. For the maximum effect (excitation voltage lags speed increase by several seconds), turn the **AVR [DWELL]** control fully clockwise.

5.10 Adjust the AVR [RAMP] Ramp Control

The AVR includes a soft start circuit to control the rate of excitation voltage rise, as the alternator starts and runs up to speed. The **AVR [RAMP]** control adjusts the rate.

TABLE 7. EFFECT OF AVR [RAMP] CONTROL



1	Adjustable rate of excitation voltage rise, AVR [RAMP] control
2	Alternator starts

1. For the minimum effect (excitation voltage reaches 100% in about 0.5s), turn the **AVR [RAMP]** control fully counter-clockwise.
2. For the maximum effect (excitation voltage reaches 100% in about 4.0s), turn the **AVR [RAMP]** control fully clockwise.

5.11 Adjust the AVR [TRIM] Trim Control

NOTICE
AVR analog inputs must be fully floating (galvanically isolated from ground) with an insulation strength of 500 VAC to avoid equipment damage.

An analog input voltage source (-5 VDC to +5 VDC) or current source (4 mA to 20 mA) modifies the AVR excitation voltage, by adding to or subtracting from, the sensed alternator voltage. A selection of analog sources can be selected via DIP Switch 1. Refer to: **Section 5.1.1 on page 16**. A Stamford Power Factor Controller (PFC3) can provide such an input. The **AVR [TRIM]** control adjusts the effect.

1. Connect the analog input from the PFC3, or similar, to Terminals A1 and A2 of the AVR. Terminal A1 is connected to AVR zero volts. Positive voltage connected to A2 increases AVR excitation, negative voltage connected to A2 decreases AVR excitation.
2. Turn the **AVR [TRIM]** control to the desired position. The analog signal has no effect on excitation when the **AVR [TRIM]** control is fully counter-clockwise, and maximum effect when fully clockwise.

5.12 Adjust the AVR [OVER V] Over-Voltage Control

NOTICE
The AVR [OVER V] control is set and sealed at the factory to protect the alternator from over-voltage. Incorrect AVR [OVER V] control setting could damage the alternator.

The AVR protects the alternator by removing excitation if it senses that the alternator output voltage exceeds a threshold set by the **AVR [OVER V]** control.

1. If the alternator output voltage exceeds the over-voltage setting, the red LED2 on the AVR turns on.
2. After a short time, the AVR removes the excitation voltage and the red LED2 flashes (which can also indicate an over-excitation trip or UFRO operation).
3. Stop the alternator to reset the over-voltage condition.

5.13 Current Limiting Transformers

Alternator main output current can be electronically limited by connecting additional current transformers to the VITA™ 05 AVR. In any situation where the output current attempts to rise above a preset threshold (set on AVR) then the AVR will reduce the terminal voltage to restore the set current level. For unbalanced loads, operation is based on the highest of the three phase currents.

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