

DM710

Digital Automatic Voltage Regulator (AVR)

SPECIFICATION AND CONTROLS

Table of Contents

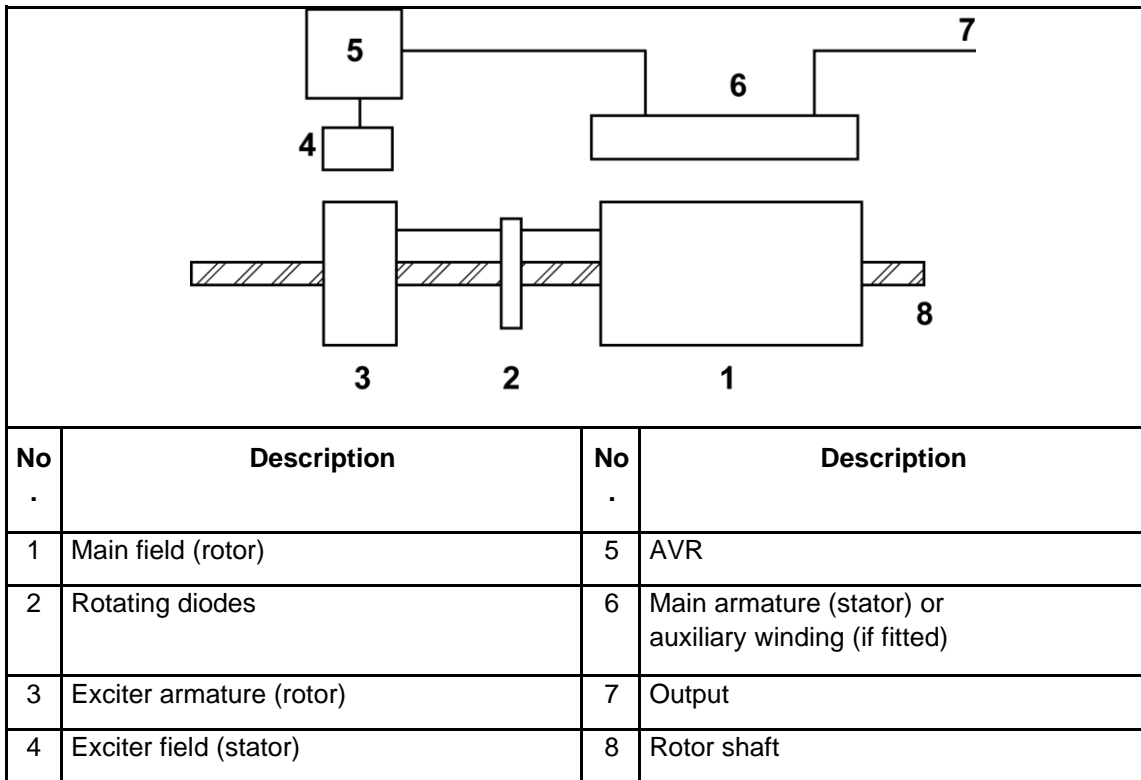
- 1 Description 3
 - 1.1 Self-Excited AVR Controlled Alternators 3
 - 1.1.1 Main Stator Powered AVR 3
- 2 Specification..... 3
 - 2.1 DM710 Technical Specification 3
- 3 Controls 5
 - 3.1 Initial AVR Setup 7
 - 3.2 Adjust the AVR [VOLTS] Voltage Control 8
 - 3.3 Adjust the AVR [STAB] Stability Control 9
 - 3.4 Adjust the AVR [kVA] Max kVA Control 9

1 Description

1.1 Self-Excited AVR Controlled Alternators

1.1.1 Main Stator Powered AVR

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, magnetises the rotating main field which induces voltage in the main stator windings. A self-excited AVR receives power from the alternator output terminals or a special auxiliary winding in the main stator winding.



2 Specification

2.1 DM710 Technical Specification

Sensing Input

- Voltage: 195 VAC to 280 VAC (delta) or 360 VAC to 485 VAC (star)
- Frequency: 50 Hz to 60 Hz nominal

Power Input

- Voltage: 70VAC to 140VAC 1 phase only
- Frequency: 50 Hz to 60 Hz nominal

Power Output

- Voltage: maximum 100 VDC at 115 VAC input
- Current
- continuous: 5 A
- Transient: 12 A for 8 seconds
- Resistance: 6 Ω minimum

- **Regulation**
- +/- 0.5% RMS with Linear Load
- **Thermal Drift**
- Typically, 0.0125% per 1 °C change in AVR ambient temperature
- **Typical Response**
- AVR response in 5 ms
- Machine Volts to 97% in 300 ms
- **External Voltage Adjustment**
- +/-5% with 100 kΩ trimmer
- **Unit Power Dissipation**
- Max 8 W at 5 ADC output
- **Build-up Voltage**
- 3 VAC at AVR terminals
- **Under-Frequency Protection**
- Set point to 95% Hz of nominal value (50 or 60Hz)
- **Output voltage limitation in case of highly unbalanced loads**
- Phase not loaded cannot increase the voltage beyond 13% of the setup voltage
- Red LED blinking
- **Over-excitation voltage control**
- AVR protects the alternator by limiting the excitation (Calibrated in factory at moment of final inspection)
- **Short-circuits protection**
- Alarm set points: 3-phase 8 sec, phase-phase 5 sec, phase-neutral 2 sec
- **High AVR operating temperature**
- If the AVR temperature exceeds 70°C the output Voltage is limited until the AVR temperature falls below 70°C and at 85°C or above, there is a sudden Voltage drop and to reset the alarm the Genset must be stopped.
- **Environmental**
- Operating temperature: -20 °C to +70 °C
- Relative Humidity: 0 °C to 70 °C: 95%
- Storage temperature: -40 °C to +85 °C
- **Weight: 460g**

3 Controls

⚠ DANGER

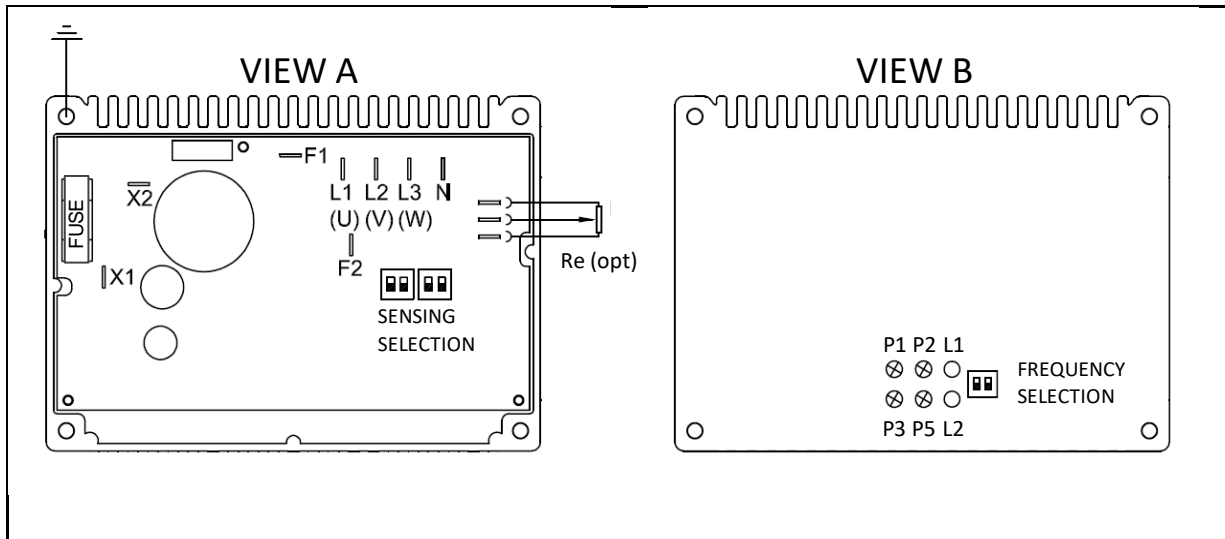
Live Electrical Conductors
 Live electrical conductors can cause serious injury or death by electric shock and burns. To prevent injury and before removing covers over electrical conductors, isolate the generator set from all energy sources, remove stored energy and use lock out/tag out safety procedures.

⚠ DANGER

Live Electrical Conductors
 Live electrical conductors at output, AVR and AVR accessory terminals, and AVR heat sink can cause serious injury or death by electric shock and burns.
 To prevent injury, take suitable precautions to prevent contact with live conductors including personal protective equipment, insulation, barriers and insulated tools.

NOTICE

Refer to alternator wiring diagram for connection details.



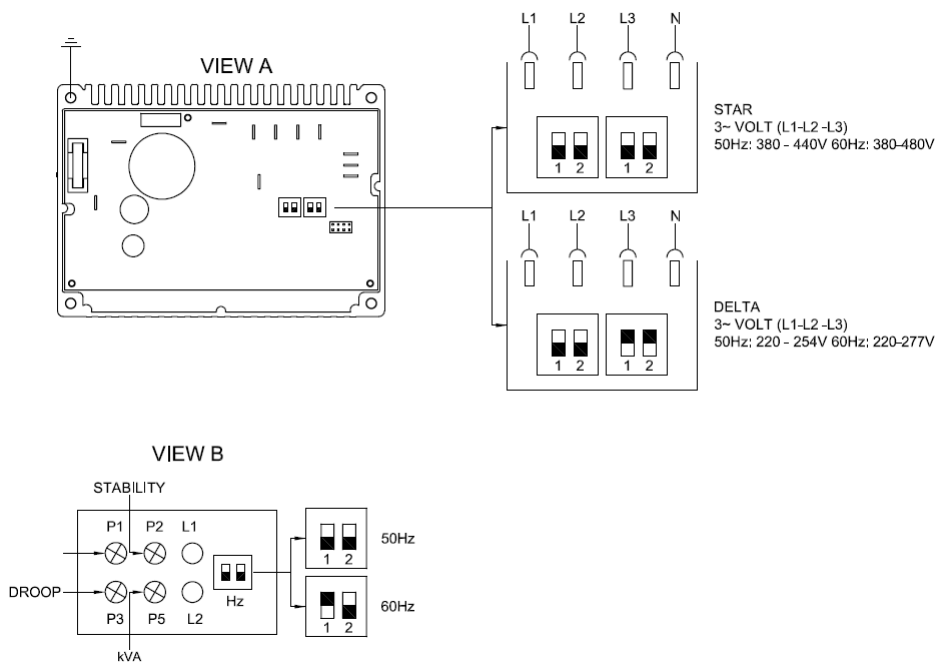
Ref.	Control	Function	Turn potentiometer CLOCKWISE to
P1	AVR (Volts)	Adjust alternator output Voltage	Increase voltage
Re (opt)	Remote AVR Volts Adjustment Potentiometer (100kΩ)	Adjust alternator output Voltage remotely	Increase voltage by AVR voltage adjustment pot Re (opt)
P2	AVR (Stab)	Adjust stability to prevent Voltage hunting. (Calibrated in factory at moment of final inspection)	Increase damping effect
P3	AVR (Droop)	Function currently not available	N/A
P5	Maximum kVA	AVR protects the alternator by limiting the excitation (Calibrated in factory during final inspection)	N/A

Frequency Selection Switches	Dip switches refer to diagram	Select alternator frequency for UFRO	N/A
Sensing Selection Switches	Dip switches refer to diagram	Select alternator sensing for Star or Delta connection.	N/A
L1 (Yellow)	Light Emitting Diode Refer to LED Fault / Warning / Operating Status Table	Indicates Fault / Warning / Operating Status	N/A
L2 (Red)	Light Emitting Diode Refer to LED Fault / Warning / Operating Status Table	Indicates Fault / Warning / Operating Status	N/A
L1(U), L2(V), L3(W), N		AVR Sensing Input	N/A
X1, X2	AVR Power Supply	AVR Supply Source	N/A
Fuse	Additional Protection	Fuse - 5x20mm >250V, 8A on the AVR Input	N/A
F1, F2	Exciter Stator Supply	Exciter Stator Supply Source	N/A

DM710 AVR CONTROLS

Dip Switches

Dip Switches are located on the AVR, related to the electrical connections (View A) or the output frequency (View B).



NOTICE

Attention! If You are going to change the factory setting be very careful to set them correctly. Correct settings are reported later in the wiring diagram of this manual and also in the quick reference label stuck on the bottom side of the terminal box cover.
Adjust the Dip Switch gently using an appropriate screwdriver: once the ON-OFF position has been reached, do not force further.

LED Fault / Warning / Operating Status

led	status	Alarm *	cause	AVR action	Alarm reset **
L1, L2	ON, OFF	---	<ul style="list-style-type: none"> None (regular operation) 	---	---
L1	blinking	W0	<ul style="list-style-type: none"> Underspeed operation 	Decreases the output voltage	Auto
L2	blinking	A1	<ul style="list-style-type: none"> Unbalanced voltages (due to unbalanced load) 	Limits the output voltage	Auto
L2	2x blinking	A2	<ul style="list-style-type: none"> Prolonged overload high winding temperature wrong P5 setting 	Limits the excitation current (and consequently voltage and power)	Auto
L2	3x blinking	A3	<ul style="list-style-type: none"> High AVR temperature >70°C 	Limits the excitation current (and consequently voltage and power)	Auto
L2	ON	A4	<ul style="list-style-type: none"> Heavy overload short-circuit AVR temperature > 85 °C lack of sensing connection unidentified electrical connection 	Abruptly drops the voltage	Manual

* L1 and L2 status LEDs can indicate alarms simultaneously, so warning W0 (L1 blinking) can show with alarms A1-A4.

** Auto: alarm will stop once the fault that caused it is removed. Manual: The genset needs to be switched off and restarted after having removed the fault. (wait 10 seconds once the fault has been removed before starting up).

3.1 Initial AVR Setup

NOTICE

The AVR must be setup only by authorized, trained service engineers. 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 your required output. To set up a replacement AVR, follow these steps:

1. Stop and isolate the generator set.
2. Install and connect the AVR.
3. Turn the **AVR [VOLTS]** volts control **P1** fully counter-clockwise.
4. Turn the hand trimmer (if fitted) to 50%, the midway position.
5. Turn the **AVR [STAB]** stability control **P2** to 50%, the midway position.

6. Connect a suitable voltmeter (0 to 300 VAC range) between one output phase and neutral.
7. Start the generator set with no load.
8. Adjust speed to nominal frequency (50 to 53 Hz or 60 to 63 Hz).
9. Carefully turn **AVR [VOLTS]** control **P1** clockwise until the voltmeter shows rated voltage.
10. If voltage is unstable, adjust the **AVR [STAB]** stability control **P2**.
11. Re-adjust the **AVR [VOLTS]** control **P1**, as needed.

3.2 Adjust the AVR [VOLTS] Voltage Control

NOTICE

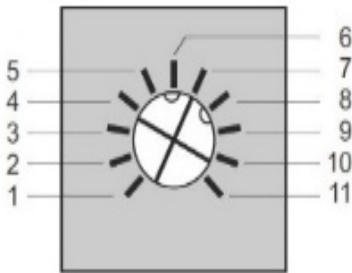
Do not exceed the designed safe operating voltage, shown on the alternator rating plate.

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. Set the **AVR [VOLTS]** control **P1** to minimum the fully counter-clockwise position.



3. Check that the remote hand trimmer is fitted.

NOTICE

If a remote hand trimmer is connected, set it to 50%, the midway position.

4. Turn the **AVR [STAB]** control **P2** to 50%, the midway position.
5. Start the alternator and set at the correct operating speed.
6. Adjust the **AVR [VOLTS]** control **P1** slowly clockwise to increase the output voltage.

NOTICE

If the voltage is unstable set the AVR stability before proceeding

7. Adjust the output voltage to the desired nominal value (VAC).
8. If instability is present at rated voltage, refer to the **AVR [STAB]** adjustment **P2**, then adjust **AVR [VOLTS]** **P1** again, if necessary.
9. If a remote hand trimmer is connected, check its operation.

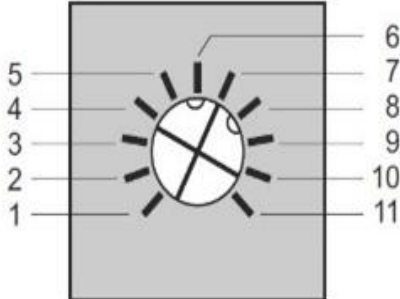
NOTICE

0% to 100% rotation corresponds to 95% to 105% VAC

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

3.3 Adjust the AVR [STAB] Stability Control

1. Check the nameplate to confirm the power rating of the alternator.
2. Set the AVR [STAB] control **P2** to approximately 75% position.



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

NOTICE

If the voltage is unstable go immediately to step 5.

5. Adjust the AVR [STAB] control **P2** slowly counter-clockwise until the output voltage becomes unstable.
6. Adjust the AVR [STAB] control **P2** slowly clockwise until the voltage is stable.

NOTICE

Readjust the voltage level if necessary (see Section 3.2 on page 8).

7. Adjust the AVR [STAB] control **P2** a further 5% clockwise.
The AVR [STAB] control is now set.

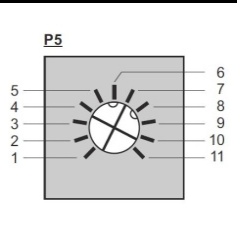
3.4 Adjust the AVR [kVA] Max kVA Control

NOTICE

The AVR [kVA] control is set at the factory to protect the alternator from over-excitation usually caused by overload. Incorrect AVR [kVA] control setting could damage the alternator components.

Depending on the alternator model it must be set in the correct specific position, as detailed below.

Alternator model	P5
N10G4	7
N15G4	6
N20G4	8



P5 [kVA] limits the maximum excitation voltage of the alternator and therefore the maximum output power of the generator. This parameter is an integral over time, allowing a 200%-300% overload for a few seconds without limiting and illuminating L2 (Red LED blinking 3 times) or a slight overload for a longer period.

It is adjusted to an excitation voltage which corresponds to approximately 105% at operating temperature. This means that the generator can also give 110-115% of the nominal power when the machine is cold without P5 function limiting.

NEWAGE® | STAMFORD® | AvK®

Powering the world with confidence since 1904



Copyright 2020, Cummins Generator Technologies Ltd. All rights reserved.

Cummins and the Cummins logo are registered trademarks of Cummins Inc.

NEWAGE, STAMFORD and AvK are registered trademarks of Cummins Generator Technologies Ltd.