Installation instructions

Document no.: 4189341225A

Digital Voltage Controller

DVC 550

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1. About the Installation instructions

1.1 Document information

1.1.1 Intended users of the Installation instructions

This document gives information on how to mount and wire up the DVC 550 in a default configuration. If changes are made from the default configuration, make sure to include these in the system documentation.

This manual is for the person who installs the DVC 550.

1.1.2 Notation and symbols

Warnings and safety symbols

DANGER!

This highlights a dangerous situation.

If these guidelines are not followed, the situation will result in death, serious personal injury, and equipment damage or destruction.

WARNING

This highlights a potentially dangerous situation.

If these guidelines are not followed, the situation could result in death, serious personal injury, and equipment damage or destruction.

CAUTION

This highlights a low level risk situation.

If these guidelines are not followed, the situation could result in minor or moderate injury.

Notation symbols

NOTICE

This highlights general information.

More information
This highlights where to find more information.

NOTE * This highlights a referenced note.

Example heading

This highlights an example.

1.2 Warnings and safety

General safety guidelines

The DVC 550 may contain unprotected live parts, as well as hot surfaces, during operation. Removal of protection devices, faulty installation or incorrect use could represent a serious risk to personnel and equipment.

All work relating to transportation, installation, commissioning and maintenance must be performed by experienced, qualified personnel (see IEC 364, CENELEC HD 384 or DIN VDE 0100, as well as national specifications for installation and accident prevention).

Safety guidelines during installation

- Installation of DVC 550 must comply with the supplied documentation.
- The controller must not be damaged or modified in any way.
- Avoid touching the electronic components or any live parts. The controller contains parts which are sensitive to electrostatic stress.

Safety guidelines during electrical connection

- The instructions given in this manual must be followed in all cases.
- Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.
- Any work on a powered DVC 550 must comply to national rules.
- The DVC 550 must be connected to an approved earth using the earth terminal. All 0 V terminals on the DVC 550 are connected to the earth terminal.
- The auxiliary DC power supply should be connected permanently and be protected by 1 A slow-blow fuses.
- The AC and DC AVR power supplies, which are used to create the field current, should be protected by fast-blow fuses or circuit-breakers.

For EU applications: Instrument transformers shall provide basic insulation according to the requirements of IEC 61869-1, " Instrument transformers – Part 1: General requirements " and IEC 61869-2, " Additional requirements for current transformers"

For US applications: Instrument transformers shall provide basic insulation according to the requirements of IEEE C57.13, "Requirements for Instrument Transformers," and IEEE C57.13.2, "Conformance Test Procedure for Instrument Transformers."

1.3 Support information

1.3.1 List of technical documentation for DVC 550

Document	Contents
Data sheet	• System description • Technical specifications • Ordering information
Product sheet	• Product features • Technical specifications
Installation instructions	• Mounting • Default wiring
Designer's handbook	• Hardware characteristics and configuration • System principles

1.3.2 Technical support

Technical documentation

Download free without registration any of the DVC 550 technical documentation from the DEIF website.

https://www.deif.com/products/dvc-550#documentation

Service and support

DEIF is committed to being available to our customers and partners 24 hours a day, seven days a week, to guarantee the highest levels of service and support.

https://www.deif.com/support

Training

DEIF arranges **training courses** at DEIF offices worldwide.

https://www.deif.com/training

Additional service

DEIF offers **service** with design, commissioning, operating and optimisation.

https://www.deif.com/support/local-office

1.4 Legal information

Disclaimer

DEIF A/S reserves the right to change any of the contents of this document without prior notice.

The English version of this document always contains the most recent and up-to-date information about the product. DEIF does not take responsibility for the accuracy of translations, and translations might not be updated at the same time as the English document. If there is a discrepancy, the English version prevails.

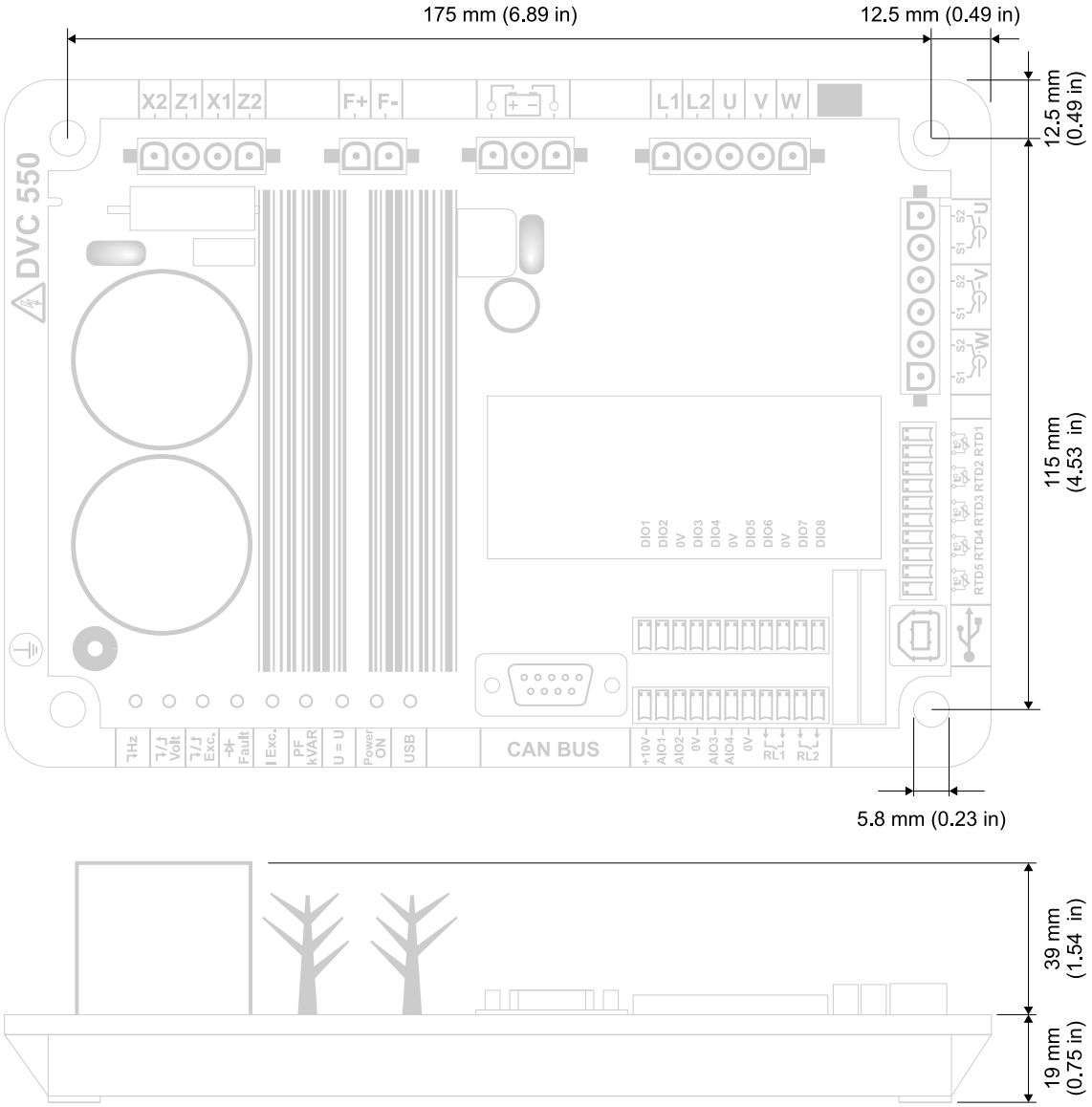
Third party equipment

DEIF takes no responsibility for the installation or operation of any third party equipment, including the **genset**. Contact the **genset company** if you have any doubt about how to install or operate the genset.

Copyright

2. Mounting the equipment

2.1 Dimensions



2.2 Mounting

DANGER!

Hazardous live currents and voltages

Risk of electrical shock

Installation must only be carried out by authorised personnel who understand the risks involved in working with electrical equipment.

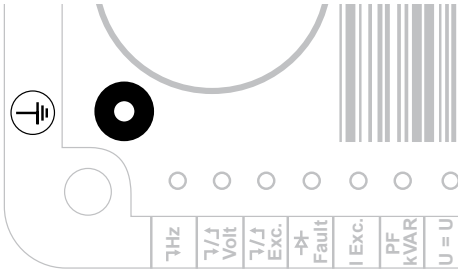
Prerequisites

- Find a mounting location and drill the mounting holes, max. 5.8 mm (0.23 in).
- Make sure that there is enough space around the heat sink for sufficient cooling. If the space is limited, a ventilation system or cooling system can be installed.
- Protect the terminals from static discharge during installation.

Procedure

1. Place the DVC 550 on the mounting location.
2. Tighten the mounting screws to 2.5 N·m (22 lb-in) of torque.
3. Insert one end of the earth cable in the earth terminal, and tighten the screw to 2.5 N·m (22 lb-in) of torque.
4. Secure the other end of the earth cable to an approved earth location.

Figure 2.1 Protective earth location



3. Wiring

3.1 Wiring precautions

- Use the terminal blocks supplied with DVC 550.
- Cables must not be longer than 100 m.
- Use shielded cables, if DVC 550 is installed outside the terminal box (to comply with IEC standards).
- The total resistance of the exciter loop (out and back) must not exceed 5 % of the exciter resistance, regardless of the cable length.

Table 3.1 Approximate resistance for copper cables at 20°C

Cross-section (mm^2)	Resistance (mΩ/m)
1.5	13.3
2.5	7.98
4	4.95
6	3.3
10	1.91

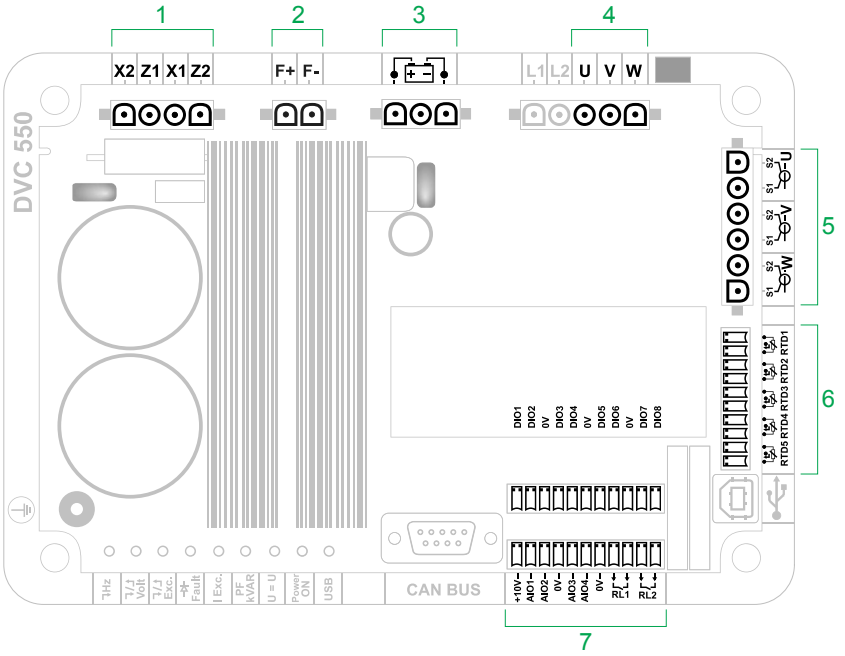
Example: Calculation of required cable cross-section

For a 10 Ω exciter, the maximum cable resistance is 2 × 0.25 Ω = 0.5 Ω.
The required cross-section as a function of the distance between the AVR and the alternator is:

Distance (m)	Cross-section (mm^2)
30	2.5
50	4
75	6
100	10

3.2 Wiring the terminal connections

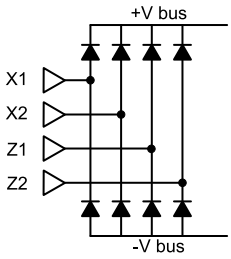
3.2.1 Terminals overview



1. AC power supply terminals
2. Exciter field terminals
3. Auxiliary DC power supply terminals
4. Alternator voltage measurement terminals
5. Alternator current measurement terminals
6. Temperature measurement input terminals
7. Inputs, outputs and relays terminals

3.2.2 AC power supply

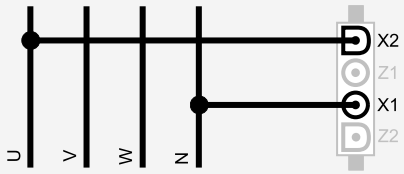
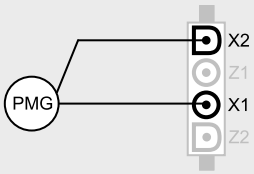
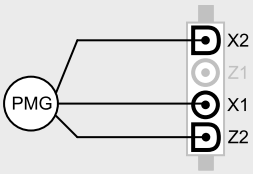
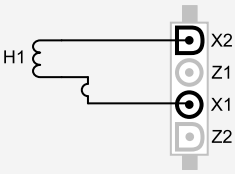
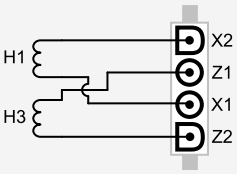
The AC power supply terminals are connected to a rectifier circuit.



The AC power supply terminals can be connected to the alternator terminals (SHUNT), permanent magnet generator (PMG), auxiliary winding excitation principle (AREP) or external power supply.

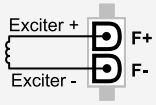
The maximum allowed voltage between each of the connection point (X1, X2, Z1, Z2) is 277 V AC. For US applications the power supply input must be protected by fuses from listed Class CC Fuse (25 A max.) or listed inverse time circuit breaker (20 A max.).

Table 3.2 Wiring examples

Connection	Electrical schematic
Phase/neutral shunt (low voltage)	
PMG	 2-wire  3-wire
AREP	 2-wire  3-wire

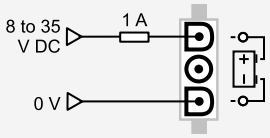
3.2.3 Exciter field

Table 3.3 Exciter field wiring example

Connection	Electrical schematic
Exciter	

3.2.4 Auxiliary DC power supply

The auxiliary DC power supply is used to power the AVR measurement, control and monitoring circuits. The allowed voltage range is 18 to 35 V DC.

Connection	Electrical schematic
Auxiliary DC power supply	

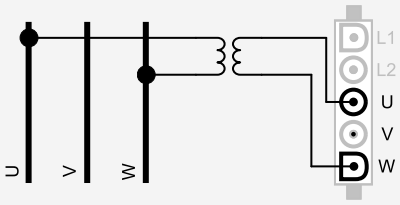
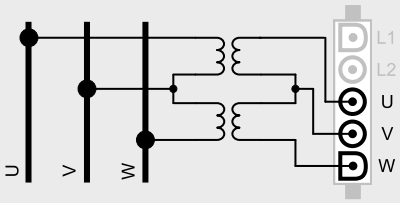
3.2.5 Alternator voltage measurement

Voltage transformers must be used if the alternator voltage measurement is higher than 480 VAC RMS phase-to-phase (686 VAC RMS maximum for 10 seconds). The alternator voltage measurement connection must match the transformer mounting phase(s)

For higher accuracy, select a measurement range that suits to your application:

- Low range: 0 to 110 V AC RMS max.
- High range: 0 to 530 V AC RMS max.

Table 3.4 Wiring examples

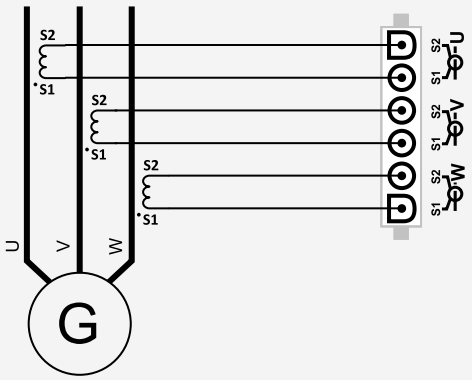
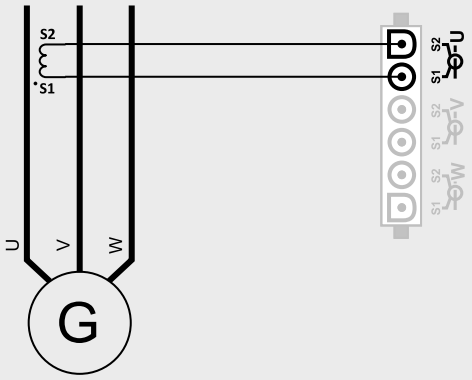
Connection	Electrical schematic
Phase/Phase	
3-Phase	

More information
See **Glossary, Vector permutations** for example of vector permutations.

3.2.6 Alternator current measurement

The alternator current can be measured on 1 phase or on 3 phases. If there is only one current transformer (CT), it should always be mounted on phase V.

Table 3.5 Wiring examples

Connection	Electrical schematic
With one CT per phase	
With one CT	

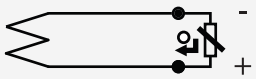
3.2.7 Temperature measurement inputs

2-wire Pt100 and PTC temperature sensors can be connected to DVC 550. The measurement range for the temperature sensor inputs is -50 to 250 °C.

The PT100 inputs are non-isolated and referenced to the product earth.

For each connected sensor, an alarm threshold and trip threshold can be defined.

Table 3.6 Wiring example

Connection	Electrical schematic
Without compensation	

3.2.8 Inputs, outputs and relays

DVC 550 has eight wiring locations for digital inputs or outputs, four wiring locations for analogue inputs and outputs and two wiring locations for relays.

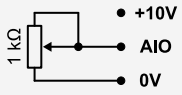
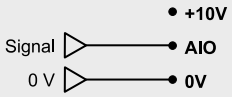
Analogue inputs

Each analogue input is defined by a destination parameter, minimum and maximum limits and the signal type, which can be

- Potentiometer
- 4 to 20 mA
- -10 to 10 V
- 0 to 10 V

The 10 V terminal is used as voltage reference or for potentiometers with a value > 1 k ohms configured in the 0 to 10 V mode. The analogue inputs are non-isolated and the 0 V terminal is referenced to the product earth.

Table 3.7 Wiring examples

Connection	Electrical schematic
Potentiometer	
4 to 20 mA -10 to 10 V 0 to 10 V	

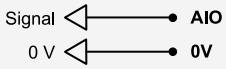
Analogue outputs

Each analogue output is defined by a source parameter, minimum and maximum limits and the signal type, which can be

- 4 to 20 mA
- -10 to 10 V
- 0 to 10 V

The analogue outputs are non-isolated and the 0 V terminal is referenced to the product earth.

Table 3.8 Wiring examples

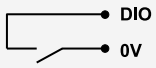
Connection	Electrical schematic
4 to 20 mA -10 to 10 V 0 to 10 V	

Digital inputs

Each digital input should be controlled by a volt-free contact. The digital inputs are configured by a destination parameter and the activation mode, which can be Normally open (active low) or Normally closed (active high).

The digital inputs are non-isolated and the 0 V terminal is referenced to the product earth.

Table 3.9 Wiring examples

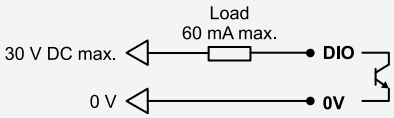
Connection	Electrical schematic
Digital input	

Digital outputs

Each digital output is open collector transistor type that can withstand a maximum of 24 V DC and 60 mA. Digital outputs are configured by a source parameter and the activation mode, which can be Normally open (active low) or Normally closed (active high).

The digital outputs are non-isolated and the 0 V terminal is referenced to the product earth. Reversed polarity on the voltage might cause the output to break.

Table 3.10 Wiring examples

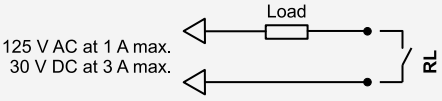
Connection	Electrical schematic
Digital output	

Relay outputs

Relay outputs are volt-free contacts, isolated from the product earth. They can withstand a maximum voltage of 125 V AC at 1 A or 30 V DC at 3 A. The relay switching maximum power is 90 W/125 VA.

Relay outputs are configured by a source parameter and the activation mode, which can be Normally open (active low) or Normally closed (active high).

Table 3.11 Wiring examples

Connection	Electrical schematic
Relay output	

4. Glossary

4.1 Terms and abbreviations

Term	Abbreviation	Explanation
Alternating current	AC	
Analogue input	AI	Terminals on a controller hardware module that the controller uses to measure an analogue input. The analogue input type and range are typically selected during commissioning from a list of pre-configured voltage, current, and resistance measurement input ranges. A pre-configured analogue input function or alarm can also be assigned to the input.
Analogue input or output	AIO	
Analogue output	AO	Terminals on a controller hardware module that the controller uses to send an analogue output. The analogue output type and range are typically selected during commissioning from a list of pre-configured voltage and current output ranges. A pre-configured analogue output function can also be assigned to the output.
Auxiliary winding regulation excitation principle	AREP	Auxiliary windings installed in the machine which are used to supply the AVR with power. They often consist of 2 windings: the first “H1” which is affected by voltage variations, the second “H3” which is affected by current variations.
Configuration		Assigning input and output functions to terminals, and setting parameters, so that the controller is suitable for the application where it is installed.
Current transformer	CT	A transformer for the current measurements.
Digital input	DI	Terminals on a controller hardware module that the controller uses to measure a digital input. A pre-configured digital input function or alarm can be assigned to the input.
Digital input or output	DIO	
Direct current	DC	
Digital output	DO	
Earth		A connection between the equipment and earth. For marine applications, a earth is a connection to the ship's frame.
Neutral	N	The neutral line in a three-phase electrical system.
Parameter		A value, or set point, used to determine the controller's operation. Parameters include nominal values, the configuration options for the configurable inputs and outputs, and alarm settings. The same set of parameters can be uploaded to several controllers.
Phase U	U	The power line for one phase of a three-phase electrical system. Corresponds to R in Germany, Red in the UK and Pacific, Red in New Zealand, Black in the USA, and U on electrical machine terminals. The above colour codes are for guidance only. If uncertain perform a phase measurement.
Phase V	V	The power line for one phase of a three-phase electrical system. Corresponds to S in Germany, Yellow in the UK and Pacific, White in New Zealand, Red in the USA, and V on electrical machine terminals. The above colour codes are for guidance only. If uncertain perform a phase measurement.
Phase W	W	The power line for one phase of a three-phase electrical system. Corresponds to T in Germany, Blue in the UK and Pacific, Blue in New Zealand, Blue in the USA, and W on electrical machine terminals. The above colour codes are for guidance only. If uncertain perform a phase measurement.
Permanent magnet generator	PMG	
Pt100		Platinum temperature sensor

Term	Abbreviation	Explanation
Pulse width modulation	PWM	Terminals with an output that uses variable pulse widths, and behaves as an analogue output.
Single-phase		A system where the load is connected between one of the phases and the neutral. Note: Single-phase does NOT mean a 3-wire single-phase distribution system, where the waveforms are offset by a half-cycle (180 degrees) from the neutral wire.
Voltage	V	Electrical potential difference. U is used as an abbreviation for voltage in most of Europe, Russia and China.
Voltage transformer	VT	A transformer for the voltage measurements, so that the voltage at the controller is within the controller's specifications.

4.2 Vector permutations

If only one stator current measurement CT is wired up, the vector permutations can compensate for voltage measurement and current measurement transformer layouts which generate incorrect power and power factor (cos phi) calculations.

The DVC 550 must be wired according to the position of the stator current measurement if only one stator current measurement CT is used. The table below gives the possible permutations according to the phase used for the stator current measurement CT.

Table 4.1 Single CT wiring guidelines for DVC 550

Position of stator current measurement CT	Alternator direction of rotation (a/c IEC 60034-1)	Alternator voltage measurement			
		AVR terminals	U	V	W
Phase V (standard)	Clockwise	Alternator phases (three-phase measurement)	U	V	W
		Alternator phases (phase/phase single-phase measurement)	U	-	W
	Anti-clockwise	Alternator phases (three-phase measurement)	W	V	U
		Alternator phases (phase/phase single-phase measurement)	W	-	U
Phase U	Clockwise	Alternator phases (three-phase measurement)	W	U	V
		Alternator phases (phase/phase single-phase measurement)	W	-	V
	Anti-clockwise	Alternator phases (three-phase measurement)	V	U	W
		Alternator phases (phase/phase single-phase measurement)	V	-	W
Phase W	Clockwise	Alternator phases (three-phase measurement)	V	W	U
		Alternator phases (phase/phase single-phase measurement)	V	-	U
	Anti-clockwise	Alternator phases (three-phase measurement)	U	W	V
		Alternator phases (phase/phase single-phase measurement)	U	-	V