

VBO3

User Manual



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The product information, specifications, and technical data embodied in this manual represent the technical status at the time of writing and are subject to change without prior notice.

We have done our best to ensure that the information given in this manual is useful, accurate, up-to-date and reliable. However, OMICRON electronics does not assume responsibility for any inaccuracies which may be present.

The user is responsible for every application that makes use of an OMICRON product.

OMICRON electronics translates this manual from the source language English into a number of other languages. Any translation of this manual is done for local requirements, and in the event of a dispute between the English and a non-English version, the English version of this manual shall govern.

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About this manual

The purpose of this user manual is to familiarize you with *VBO3* and to show you how to use it safely, properly, and efficiently. Following the instructions in this user manual will help you to prevent danger, repair costs, and possible down time due to incorrect operation, and it will help you to maintain the reliability and life of *VBO3*.

This manual is to be supplemented by existing national safety standards for accident prevention and environmental protection.

This manual shall always be available at the site where *VBO3* is used. It shall be read and observed by all personnel operating *VBO3*. Reading the user manual of *VBO3* alone does not release you from the duty of complying with all safety regulations relevant and applicable to working on systems in any power distribution network.

In addition to the user manual and the applicable safety regulations in the country and at the site of operation, the usual technical procedures for safe and competent work shall be heeded.

Keep this manual during the entire service life of the product and always have it available for reference.



This user manual describes the *VBO3* hardware, its usage and wiring. In order to get familiar with CMC test sets, please refer to the corresponding user documentation.

1 Introduction

1.1 Scope of delivery

The following accessories are part of the *VBO3* standard delivery but can also be ordered separately:

Accessory	Quantity	Order number
Connection cable <i>VBO3</i> to CMC, 4-pole, 1 m length	2	VEHK0053
Connection cable <i>VBO3</i> to test object, 4-pole, 3 m length	1	VEHK0054
Flexible jumpers	4	VEHZ0009
Module bag	1	VEHP0031

Before operating *VBO3* for the first time, use the shipping documents to verify that all accessories are available.

1.2 Designated use

VBO3 is a voltage transformer and used as an accessory for OMICRON's CMC test sets. The device is intended for use with CMC test sets only. *VBO3* transforms a CMC's output voltages of 0 ... 300 V to 0 ... 600 V.

Therefore, you can use CMC test sets for testing the $V \gg$ stage of LOM protection at wind power stations. Their threshold is at least 460 V (nominal voltage in wind power stations is 690 V L-L (398.37 V L-E)). You can also test other renewable energy systems such as biogas, photovoltaic, small hydroelectric power as well as combined heat and power plants.

Furthermore, you can test industrial networks with voltage levels > 300 V.

Disclaimer

The advisory procedures and information contained within this user manual have been compiled as a guide to the safe and effective operation of *VBO3*. It has been prepared in conjunction with application engineers and the collective experience of the manufacturer.

The in-service conditions for the use of *VBO3* may vary between customers and end-users. Consequently, this user manual is offered as a guide only. It shall be used in conjunction with the customer's own safety procedures, maintenance program, engineering judgment, and training qualifications.

If *VBO3* is used in a different manner than described in this user manual, the protection provided by *VBO3* may be impaired, and this may result in damage to property or persons.

1.3 Declaration of conformity (EU)

The equipment adheres to the guidelines of the council of the European Community for meeting the requirements of the member states regarding the low voltage directive (LVD) and the RoHS directive.

1.4 Cleaning and disposal

1.4.1 Cleaning

To clean VBO3, use a cloth dampened with isopropanol alcohol. Prior to cleaning, always disconnect VBO3 from the CMC test set and from the test object.

1.4.2 Information for disposal and recycling

This device (including all accessories) is not intended for household use. At the end of its service life, do not dispose of the device with household waste!



For customers in EU countries (incl. European Economic Area)

OMICRON devices are subject to the EU Waste Electrical and Electronic Equipment Directive (WEEE directive). As part of our legal obligations under this legislation, OMICRON offers to take back the device and ensure that it is disposed of by authorized recycling agents.



For customers outside the European Economic Area

Please contact the authorities in charge for the relevant environmental regulations in your country and dispose the OMICRON device only in accordance with your local legal requirements.

2 Safety instructions

Before working with *VBO3*, carefully read the following safety instructions and the safety instructions for the CMC test set in use. In addition, we recommend to read the user documentation of the CMC test set in use.

VBO3 may only be operated by trained personnel. Any misoperations can result in damage to property or persons.

Only operate *VBO3* after you have read this user manual and fully understood the instructions herein. If you do not fully understand any safety rule or instruction or any part thereof, contact OMICRON electronics before proceeding (→ page 23).

2.1 Symbols used

In this manual, the following symbols indicate safety instructions for avoiding hazards.



WARNING

Death or severe injury can occur if the appropriate safety instructions are not observed.

NOTICE

Equipment damage or loss of data possible.

2.2 Rules for use

- ▶ *VBO3* and its accessories must only be used when in a technically sound condition. Its use must be in accordance with the safety regulations for the specific job site and application.
- ▶ Always be aware of the dangers of high voltages. Pay attention to the information provided in this user manual and in the user documentation of the CMC test set in use.
- ▶ *VBO3* is exclusively intended for the application areas specified in section [Designated use](#) on page 5. The manufacturer/distributors are not liable for damage resulting from unintended usage. The user alone assumes all responsibility and risk.
- ▶ Keep this manual available on site where the *VBO3* is used. The instructions provided in this user manual and the associated manuals are considered part of the rules governing proper usage.

2.3 Safe operation procedures

- ▶ Before connecting and disconnecting test objects, verify that all outputs have been turned off and the installation is dead. Never connect or disconnect a test object while the outputs are active.
- ▶ When disconnecting power supply cables or test leads, always start from the device feeding the power or signal.
- ▶ Do not operate VBO3 when explosive gas or vapors are present.
- ▶ Only work in well lit areas. If there is not enough daylight, use a strong light to make sure that you see everything and so ensure your safety.
- ▶ Keep your work area clean to avoid accidents.
- ▶ If VBO3 seems to be functioning improperly or has visible damages, please contact the OMICRON Technical Support (→ page 23).

2.4 Operator qualifications

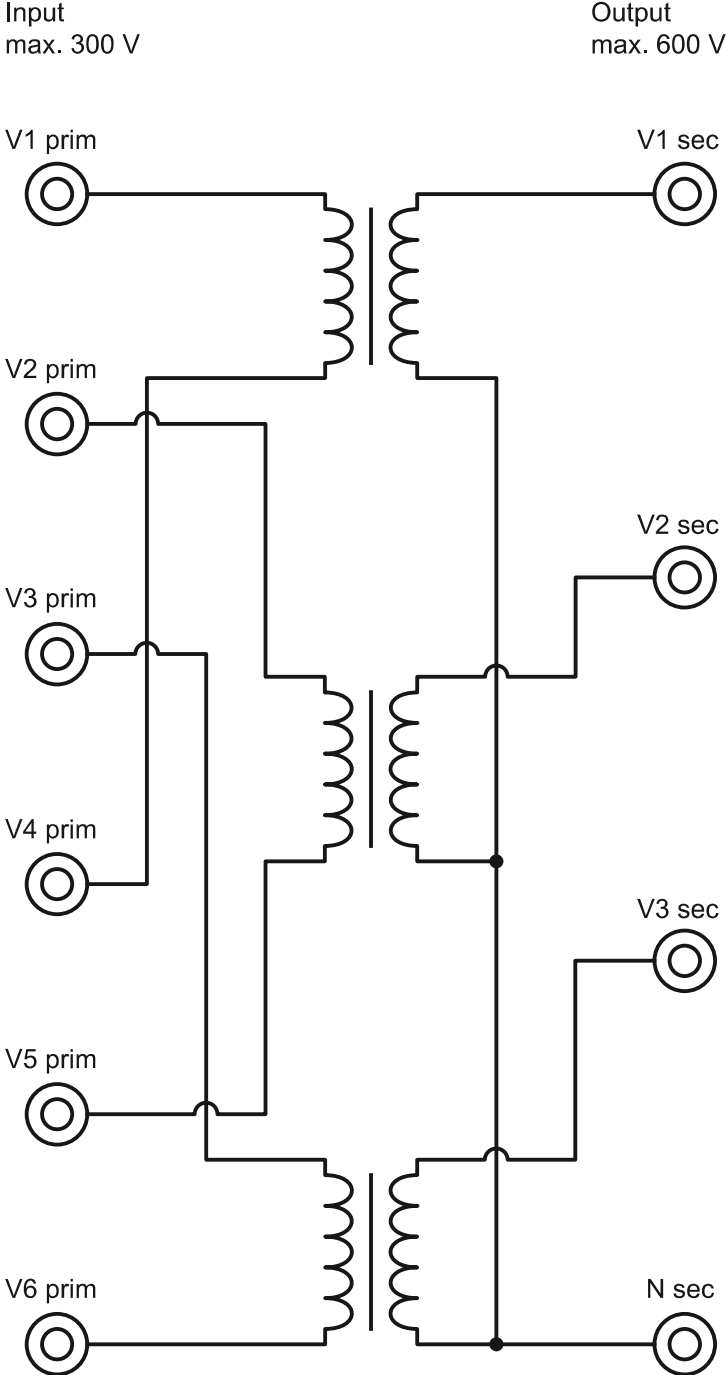
- ▶ Working on a power distribution network can be extremely dangerous. Familiarize yourself thoroughly with all the information in this manual. In addition, you need to be familiar with all manuals of the devices used in the test procedure.
- ▶ Testing with VBO3 shall only be carried out by authorized and qualified personnel. Before starting to work, clearly establish the responsibilities of all personnel involved.
- ▶ Personnel receiving training, instruction, direction, or education on VBO3 shall remain under the constant supervision of an experienced operator while working with the equipment.
- ▶ Personnel operating VBO3 must be familiar with recognized operating practices and procedures for working on high and low voltage systems. They must be familiar with the five safety rules:
 - Disconnect completely.
 - Secure against re-connection.
 - Verify that the installation is dead.
 - Carry out grounding and short-circuiting.
 - Provide protection against adjacent live parts.
- ▶ In addition, the personnel operating VBO3 must be familiar with all necessary personal safety equipment.
- ▶ Testing with VBO3 must comply with all on-site procedures and methods for personal safety and the safety instructions relevant for each test. They must be discussed with all personnel involved.

3 Device overview



i If required, you can create the neutral phase for input triple 1 by short-circuiting the phases V4 prim, V5 prim, and V6 prim (→ [Wiring](#) on page 11).

4 Circuit diagram



5 Wiring

You can connect *VBO3* to *CMC 430* test sets as well as to other OMICRON CMC test sets (*CMC 256plus*, *CMC 310*, *CMC 353*, and *CMC 356*). Note, however, that the wiring and the configuration in the *Test Universe* software are different depending on the respective use case. For more information on how to configure the control software, see page [17](#).



WARNING

Avoid serious injury or death caused by electric shock.

- ▶ The isolation of *VBO3* is designed as a 600 V isolation. Therefore, only operate *VBO3* with **primary voltages** up to max. 300 V. Otherwise, output voltages higher than 600 V might occur due to the voltage ratio of about 1 : 2.16.
- ▶ Always use the connection cables with 4 mm safety banana plugs (that are included in the delivery) to connect *VBO3* to a CMC test set.
- ▶ If you need to use other cables and/or connectors, always refer to the safety instructions and user documentation of the respective CMC test set in use before proceeding.

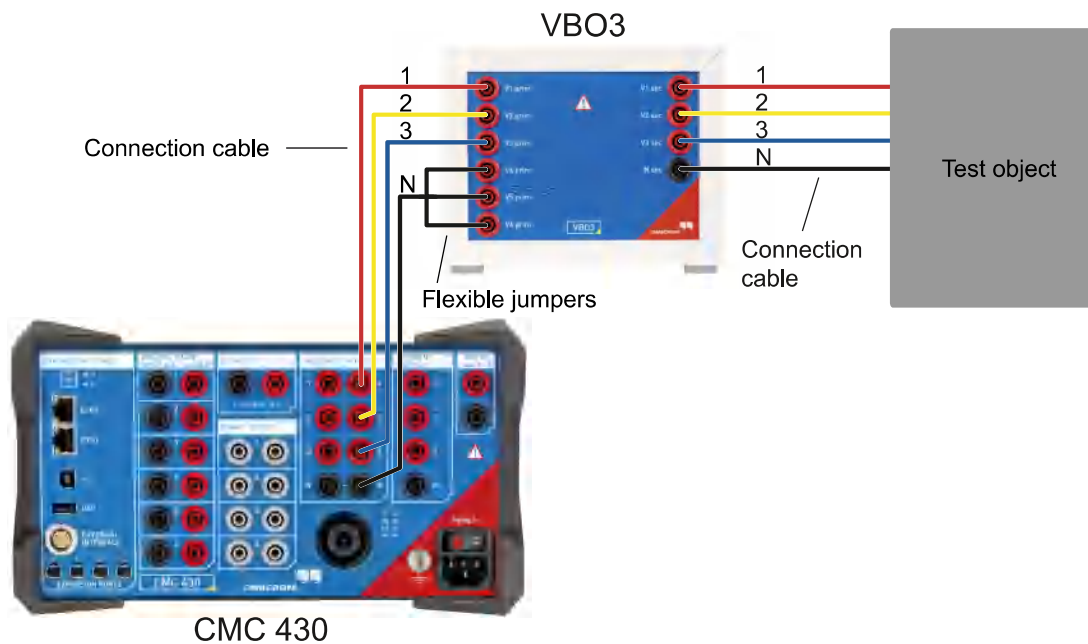
5.1 Connecting VBO3 to a CMC 430

5.1.1 Max. 300 V output voltage

There is no star point at the *VBO3* voltage inputs. Usually, a star point is not necessary for use with a *CMC 430* test set. However, if you would like to use the *CMC 430* like one of OMICRON's other CMC test sets and require an output voltage of only max. 300 V, you need to create a star point.

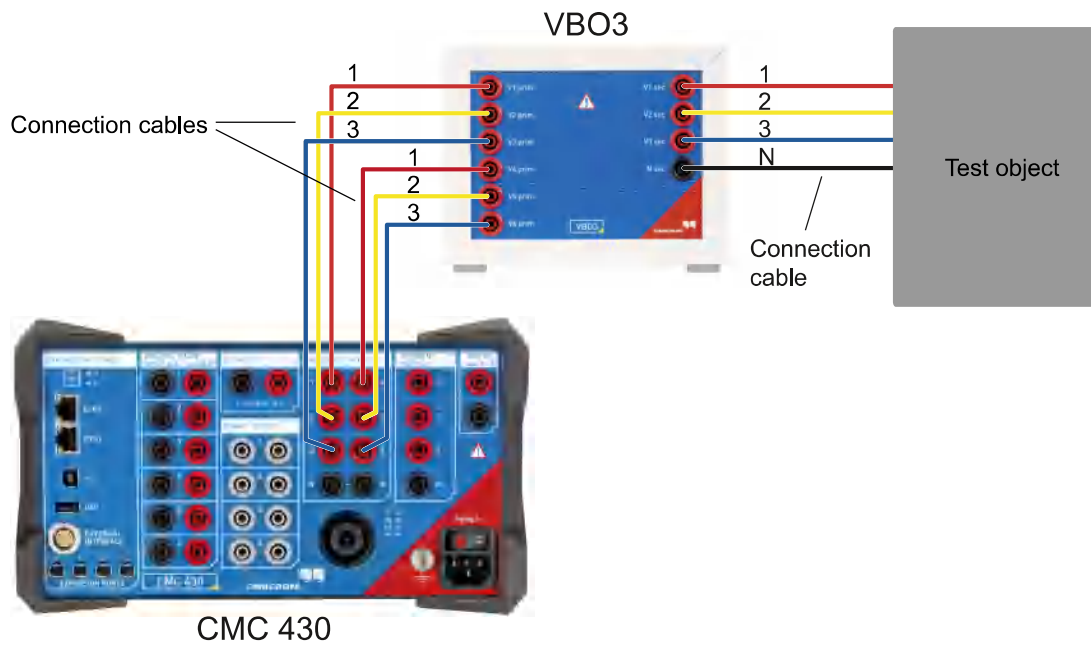
To create a star point:

- Connect the *CMC 430* voltage outputs to one of the *VBO3* voltage input triples using a connection cable with 4 mm safety banana plugs (included in the delivery).
- Use flexible jumpers (included in the delivery) to interconnect the other *VBO3* voltage input triple, and thus, create a star point.
- Connect the star point to the *CMC 430*'s neutral phase.



5.1.2 Max. 600 V output voltage

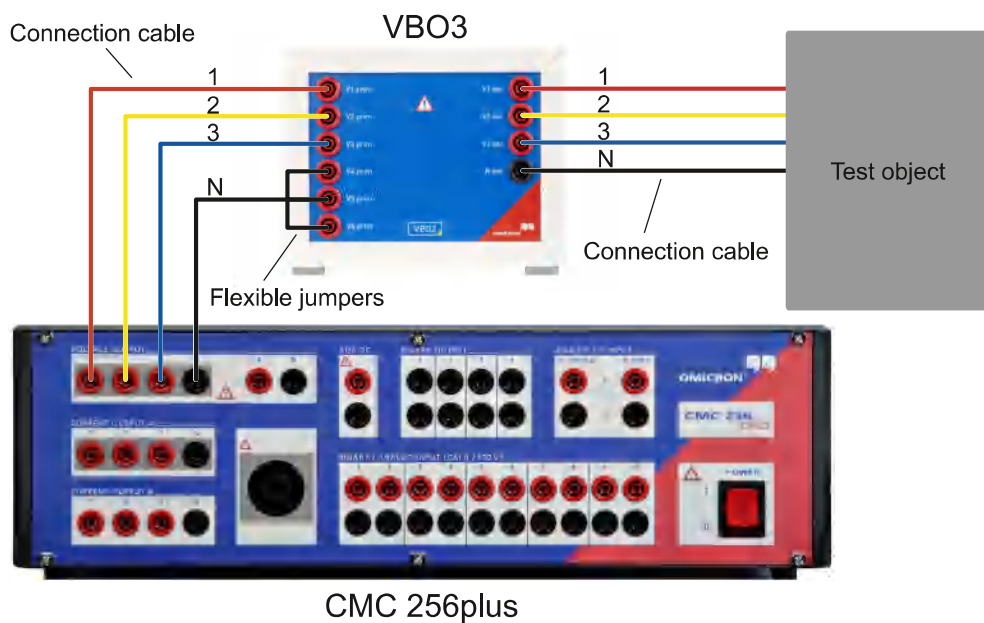
There is no star point at the *VBO3* voltage inputs. However, a star point is not necessary for use with a *CMC 430* test set when an output voltage of 0 ... 600 V is required. You can simply connect the voltage outputs of the *CMC 430* to the *VBO3* inputs using connection cables with 4 mm safety banana plugs (included in the delivery).



5.2 Connecting VBO3 to other CMCs

There is no star point at the VBO3 voltage inputs. Therefore, you need to create one when connecting a CMC test set other than the CMC 430 (i.e., the CMC 256plus, CMC 310, CMC 353, or CMC 356):

- Connect the CMC voltage outputs to one of the VBO3 voltage input triples using a connection cable with 4 mm safety banana plugs (included in the delivery).
- Use flexible jumpers (included in the delivery) to interconnect the other VBO3 voltage input triple, and thus, create a star point.
- Connect the star point to the CMC's neutral phase.

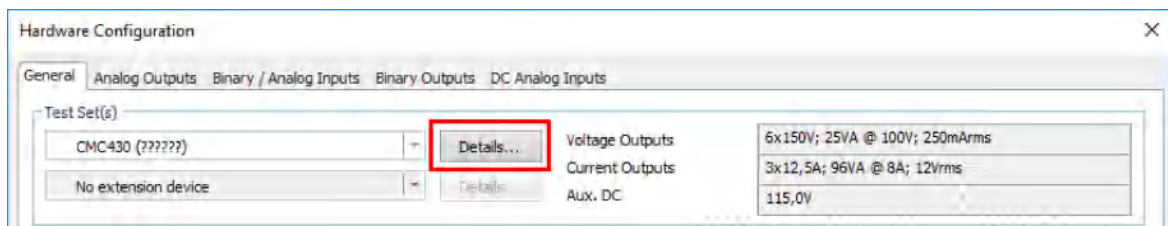


6 Configuring VBO3 in the control software

6.1 Configuration in Test Universe

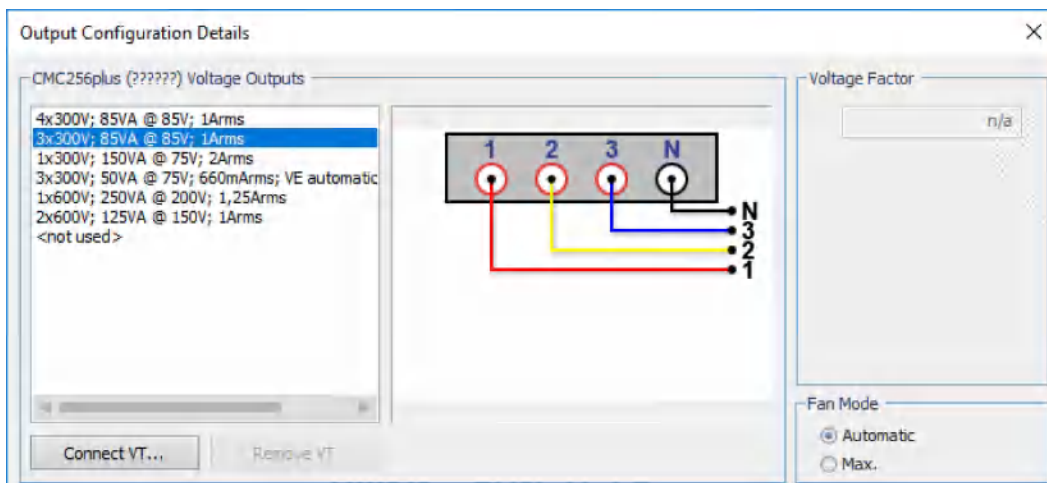
To configure the voltage outputs in *Test Universe*:

1. Launch a *Test Universe* module of your choice, and go to the **Hardware Configuration**.
2. On the **General** tab, select your CMC from the **Test Set(s)** list.
3. Click the **Details** button.



4. In the **Output Configuration Details** dialog, select a suitable configuration for the voltage outputs:
 - *CMC 256plus*, *CMC 310*, *CMC 353*, or *CMC 356* with max. 300 V output voltage: Select a **3 x 300 V** configuration.

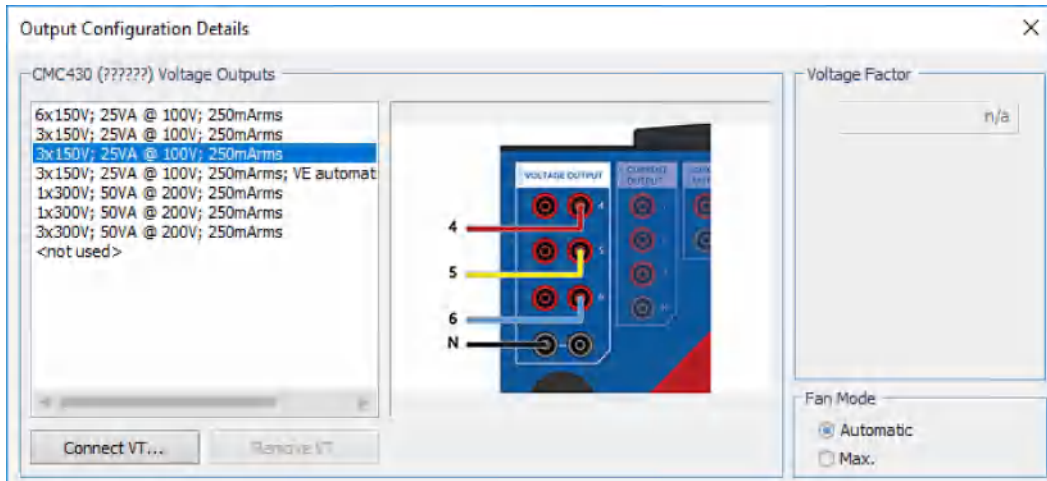
Example:



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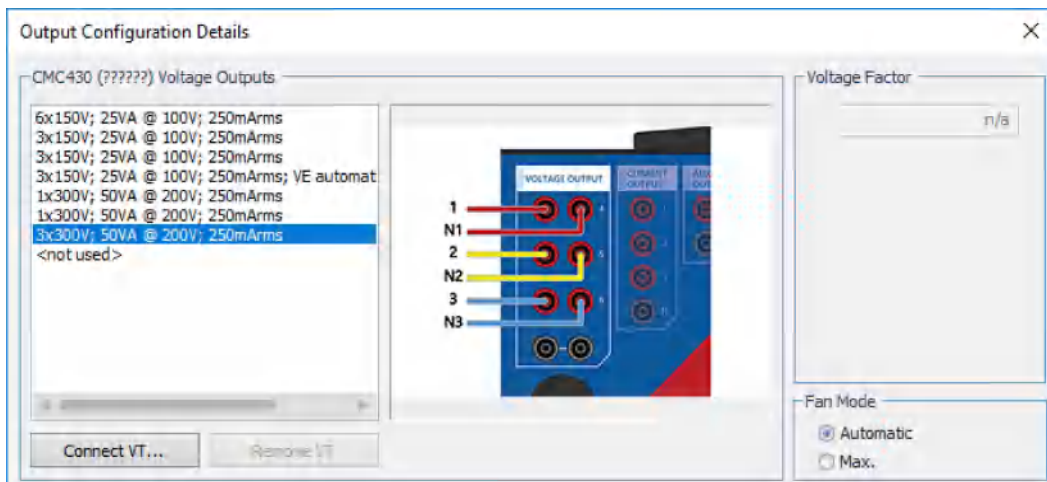
- CMC 430 with max. 150 V output voltage: Select a **3 x 150 V** configuration.

Example:



- CMC 430 with max. 600 V output voltage: Select a **3 x 300 V** configuration.

Example:



5. Click the **Connect VT** button.
6. To complete the VT configuration details, you need to calculate the true voltage ratio. Proceed with section [Calculation of voltage ratio](#) on page 17.

6.2 Calculation of voltage ratio

Without load, the voltage ratio between the primary and secondary side of VBO3 is roughly 1 : 2.16. In real-life testing scenarios with load, however, the voltage ratio will be lower. To ensure accurate testing conditions, you need to determine the true voltage ratio under load conditions and enter the corresponding value in *Test Universe*. You can determine the voltage ratio using a multimeter that fulfills the requirements for measurement categories CATIII/1000V and CATIV/600V. It is important that you always connect the load before measuring the output voltages (see workflow below).



WARNING

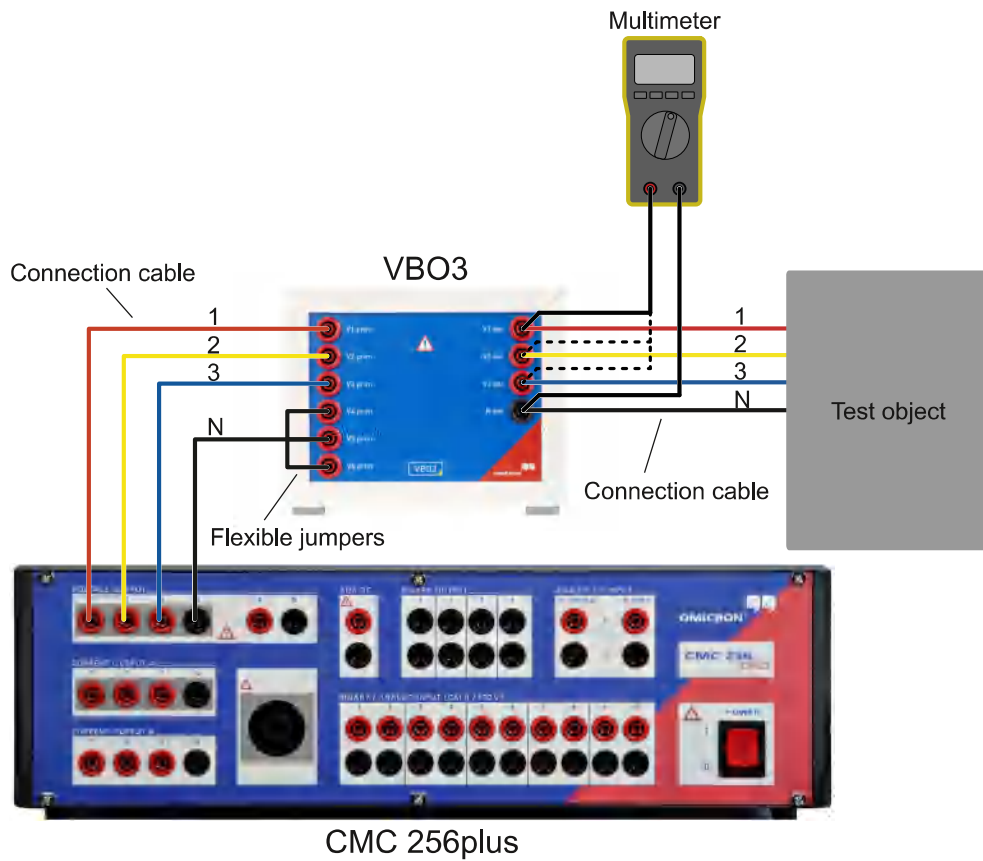
Avoid serious injury or death caused by electric shock.

- ▶ Always measure the output voltages with a multimeter suitable for up to 1000 V working voltage because at the VBO3 outputs, voltages higher than 600 V might occur due to the voltage ratio of about 1 : 2.16.
- ▶ Do not use a CMC test set for measuring the output voltages. CMC test sets are designed for input voltages of max. 600 V. Due to the VBO3's voltage ratio of about 1 : 2.16, voltages higher than 600 V might occur.

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To determine the voltage ratio:

1. Connect the CMC test set to VBO3 (as shown in section [Wiring](#) on page 11).
2. Connect the load by connecting the VBO3 secondary outputs to the test object.
3. Connect the multimeter as shown in the example below.

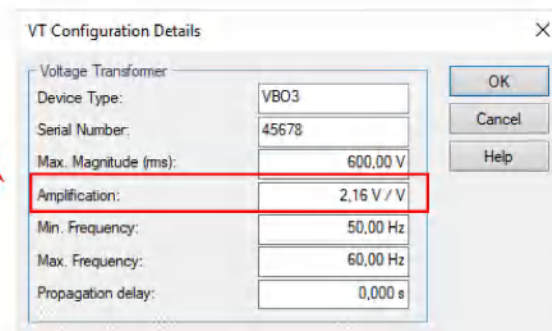
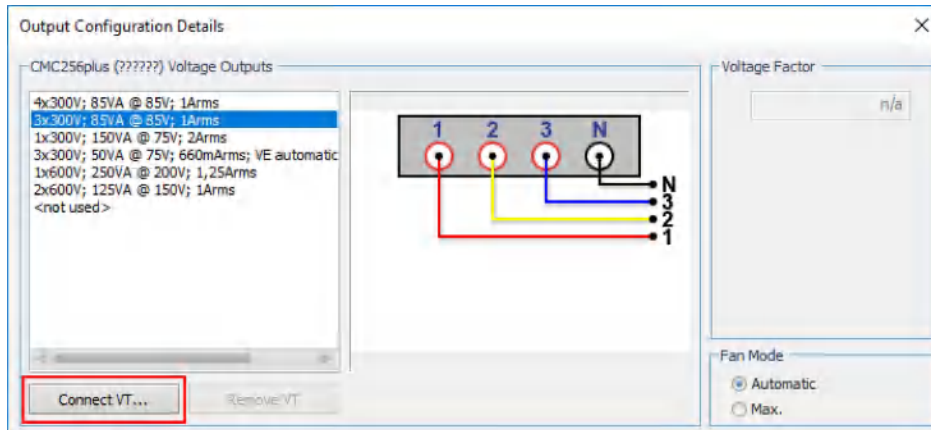


4. With the multimeter, measure the output voltages of VBO3 for each phase.
5. Calculate the voltage ratio for each phase, and then calculate the average value of the voltage ratios:

$$\text{Amplification} = \frac{V1_{sec}}{V1_{prim}} + \frac{V2_{sec}}{V2_{prim}} + \frac{V3_{sec}}{V3_{prim}} \\ 3$$

Configuring VBO3 in the control software

6. In *Test Universe*, go to the **Output Configuration Details** dialog (→ page 15), click the **Connect VT** button, and enter the average ratio in the **Amplification** field.



7 Setup with OMICRON transport case

If you are using *VBO3* in combination with a *CMC 430*, you can create a joint test setup with both devices in an OMICRON transport case. Simply detach *VBO3*'s handle to conveniently use the voltage transformer without needing to take it out of the transport case.

Example:



To detach the handle:

1. Remove the two grey cover caps on both sides of the Aluminium handle.
2. Remove the aluminium handle by loosening the screws.
3. Bring the two levers into a 45° position and remove them.
4. Remove the two fasteners on the left and on the right.

NOTICE

Equipment damage possible.

- ▶ Do not use the OMICRON transport case for transporting the *VBO3* voltage transformer. The OMICRON transport case does not offer sufficient protection against transport damage for *VBO3* voltage transformers.

8 Transportation with OMICRON trolley

VBO3 is delivered with a carry bag that can easily be placed on an OMICRON trolley (order number VEHP0029) together with a *CMC 430* test set and an additional accessory bag (order number VEHP0030). This enables you to conveniently transport your test set, voltage transformer, and additionally required accessories on one single trolley.

Example:



NOTICE

Equipment damage possible.

- ▶ Do not use the OMICRON trolley and carry bags for shipping CMC test sets or *VBO3* voltage transformers.
- ▶ Do not drop the OMICRON trolley and carry bags when CMC test sets or *VBO3* voltage transformers are stored inside. The OMICRON trolley and carry bags do not offer protection against drop damage.

9 Technical data

General

Characteristic	Specification
Voltage range primary	0 ... 300 V, 3-phase
Voltage range secondary	0 ... 600 V, 3-phase
Nominal frequency	50/60 Hz
Nominal power	33 VA per phase
Protection class of VBO3 voltage transformer	II (for CAT III / 300 V , CAT II / 600 V)
Measurement category for VBO3 cables	CAT III / 300V , CAT II / 600 V

Environmental conditions

Characteristic	Specification
Temperature	
Operating	- 25 °C ... + 50 °C (- 13 °F ... + 122 °F)
Storage and transportation	- 40 °C ... + 70 °C (- 40 °F ... + 158 °F)
Maximum altitude	
Operating	4,000 m (13,000 ft)
Storage	15,000 m (49,000 ft)
Humidity	5 % ... 95 % relative humidity; no condensation

Mechanical data

Characteristic	Specification
Weight (mass)	6.3 kg (13.9 lb)
Dimensions without handle (w x h x d)	160 mm x 125 mm x 260 mm (6.30 " x 4.92 " x 10.24 ")

Standards

Safety	
International/Europe	IEC/EN 61010-1, IEC/EN 61010-2-030
USA	UL 61010-1, UL 61010-2-030
Canada	CAN/CSA-C22.2 No. 61010-1, CAN/CSA-C22.2 No. 61010-2-030

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