OMICRON

CMS 156

Reference Manual

Article Number: VESD1030 - Manual version: ENU 1026 04 01 - Year: 2009

Safety Instructions

ATTENTION: Before starting up the CMS 156, carefully read the following safety instructions.

The system must not be put into operation without full knowledge of this information!

The CMS 156 may only be operated by trained personnel on the company premises.

For your safety

The amplifiers supply dangerous voltages of up to 300V, therefore note the following for your own safety:

- Operate the CMS 156 only with mains supplies with a protective grounding!
- Use only measuring cables with 4 mm banana plugs and plastic jacketing for connection to banana sockets;
  always insert plugs up to the stops.
  Recommendation: use 4 mm safety banana plugs.
- With regard to the cross section and length of the test lead, take note to keep the impedance of the leads at a minimum.
  Recommendation: use test leads with a minimum cross section of 2.5 mm² and maximum length of 2 m.
- Do not leave any generator cables exposed; always disconnect leads at the CMS 156 first!
- The CMS hardware and the CMC hardware should only be turned on or off (by the switch on the front panel), if no test device is connected.
- When connecting and disconnecting the test object make sure that the amplifier is not activated in the software (if the switch in the control software is "On", another automatic sequence will run, a program sequence or a transient output is active, or other signals are connected to the input on the rear panel of the CMS 156 ("Ampl. in")).
- Be careful if the red LED lights:
  at the voltage terminals, there can be a dangerous contact voltage (>42V).

The voltage outputs VOLTAGE1, VOLTAGE 2 and VOLTAGE 3 must not be connected to earth.

- Attention: if the CMS 156 is connected to "Gen. out 1-6" (CMC 56 with s/n <DExxxx: ext. Ampl.) of a CMC 56 test device the internal current amplifiers of the CMC 56 also supply currents to the corresponding outputs of the test device.

- Use correct fuse only: T10AH 250V.

- Do not insert conductive parts (screwdrivers etc.) into the sockets.

- All front panel sockets are to be considered as dangerous voltage contacts; for this reason, only cables that have a safety plug and apply with the corresponding national standards may be used for connection to the device.

- Do not operate in a wet or humid environment

- Do not operate if an explosion hazard exists.

- Do not operate if you suspect that a hardware fault exists. In this case, please contact OMICRON electronics.

- Take note of the important instructions for proper handling of the CMS 156 before starting it up
(page 9).

The device may only be opened at the manufacturer's factory - if irregularities occur, please send it to us. Voltages of up to 500 V will occur inside the unit! If the unit is opened, warranty claims will become void.

If the mains fuse must be replaced (back panel of the device):

First disconnect the mains plug of the CMA test device!

Unscrew the little plastic tile and change the fuse.

Fuse: T10AH 250V.

Table of Contents

1 Introduction

The CMS 156 amplifier has a three-phase voltage and a three-phase current system like the CMC test device. However, these systems are isolated from each other and supply substantial higher output powers (voltage 3 × 250V and current 3 × 25A) than the CMC test device.

Control is effected via an input socket at the back of the device by means of analog signals from the CMC test device. Thus, control of the overall system by means of the comfortable CMC software installed on a PC is retained.

Using the CMS 156 amplifier, the CMC test system is able to meet high requirements in terms of voltage and current range as well as power.

2 Start-Up

2.1 System Components

Prior to the start-up please verify that all components have been delivered:

- ❑ CMS 156 (amplifier)
- ❑ CMS 156 Reference Manual
- ❑ Connection cables CMS 156 ↔ test object:
  these are supplied by the user.
- ❑ Accessories:
  - Mains cable
  - Connection cable CMS 156 ↔ CMC test device (l=1m)
  - optional: Connecting cable CMS 156 ↔ CMC test device for CMC serial-no < Dxxxxx.
  - Mains fuse: T10AH 250V
  - Carry bag

2.2 Important Instructions

Please take note of the following instructions for proper handling of the CMS 156 amplifier:

- Note the safety instructions!
- Operate the CMS 156 only with mains supplies with a protective grounding!
- The CMS hardware and the CMC hardware should only be turned on or off (by the switch on the front panel), if no test device is connected.
- When connecting and disconnecting the test object make sure that all generator outputs have been turned "OFF". Never disconnect the test object when a switch in a manual program section of the software is selected "ON", a sweep is still under way or any other control signals are connected to the input at the rear panel of the CMS 156 (Ampl. in).
- The voltage outputs Voltage 1, 2 and 3 may not be connected to ground.
- Make sure that an unobstructed air flow from the ventilation slots on the base panel to those on the rear panel is possible.

- For CMC 56 test devices with serial-no < DAxxxx:

  If the CMC test system is configured for its internal amplifiers:
  Do not connect the CMS 156 (with connected test object) to the CMC 56 or leave it connected!
  The control signals are always present at the Lemo connector at the rear of the CMC 56. When the internal amplifiers are configured, these signals are not calibrated and are therefore invalid.

  (For serial-no ≥ DAxxxx, the signals at the rear connector of the CMC 56 are suppressed if the internal amplifiers are used.)

- For the position of the sliding switch on the rear panel of the device see the instructions in Section 4.2.2.

- If the current is higher than 25A then the load (burden) can only be connected to the 4mm – Banana plug.

- Please check that your OMICRON software shows the name and serial number of the CMS 156 (e.g. CMS 156 AJ123N).

  Instructions:

  If the amplifier is connected to the CMC test device through the interface "Gen. out 7-12", then the CMC reads this, and all other information about the amplifier, automatically through this interface.

  For older CMC test devices this interface is not standard, only the "Gen. Out 1-6" (or "ext. Ampl.") interface. If the amplifier is connected to this interface, then the information about the amplifier must be read from an AMP-file. The AMP-file defines the most important parameters of an amplifier (name, current or voltage amplifier, amplification factor, etc.) and is described in Chapter 3 of the CMC for DOS Software manual.

2.3 System Start

The following instructions can be followed step by step if the PC is properly installed and set up.

For DOS CMC software versions < 2.45:
First install a software version ≥ 2.45.
The CMS 156 can only be operated with a DOS CMC software version 2.45 or higher.

The following procedure should be followed for interconnecting the system components:

1. Connect the CMC test device and the PC by means of the 25-pin connecting cable.

2. Connect the CMS 156 and the CMC test device by means of the supplied connecting cable. [1]

- CMS 156: socket "Ampl. in." at the back panel.
- CMC test device: Socket "Gen. out 1-6"
  (or optional: Gen. out 7-12) on the back panel.[2]

3. Connect CMS 156, CMC test device and PC to the mains (cable supplied).

4. Turn all devices ON.

   For CMC 56 test devices with serial number < DExxxx: always turn the CMC 56 test device ON before connecting the test object (power-ON peak)!

   CMS 156:

   When the CMS 156 is switched ON, an automatic hardware test is carried out. Only after this self-test has been passed, the device turns itself ON. In case of failing this hardware test, a new attempt is made every 8 sec.

   Notice: Steps 5 – 7 are not applicable from CMC for DOS V2.8 or OMICRON Windows software, because in this case the amplifier configuration will be done automatically
   (exception: CMC56 without Gen. Out 7-12 output).

[1] The supplied cable has the required electromagnetic compatibility.
[2] For CMC 56 test devices with s/n < DExxxx: socket "ext. Ampl." on the back panel.

5. After the PC has booted, copy the file xxxxxx.AMP supplied on disc to your CMC directory.

   Example: C:\CMC>copy a:*.AMP

   This AMP-file is exactly configured for your CMS 156 and contains the necessary information for the configuration (see point 7.) of a CMS 156 as an external amplifier.

6. The program is started by typing:

   CMC [↵] Program start.

   When the program has completed initialization, you are in the main menu.

7. Configuring the CMS 156 as external amplifier for the CMC test device:

   When the CMC test device is started up, the internal amplifiers are always considered to be the active amplifiers. To control the CMS 156 as amplifier, the device must be specified as the active amplifier in the CONFIGURATION menu.

   a) Select menu item **Configuration** in the main menu and enter the CONFIGURATION menu.

   b) Configure the CMS 156 as external voltage amplifier:
      - Select menu item **V-amplifier** to enter the selection list of the available voltage amplifiers.
      - Select `CMS 156 xxxxxx`.

   c) Configure the CMS 156 as external current amplifier:
      - Select menu item **I-amplifier** to enter the selection list of the available current amplifiers.
      - Select `CMS 156 xxxxxx`.

   d) Return to the main menu via menu item **Quit**.

      The following message will now appear:
      `Ext. amplifier: I: CMS 156 xxxxxx.`
      `V: CMS 156 xxxxxx.`

   Now the CMS 156 is configured as external amplifier for the CMC test device.

8. Connecting a test object:

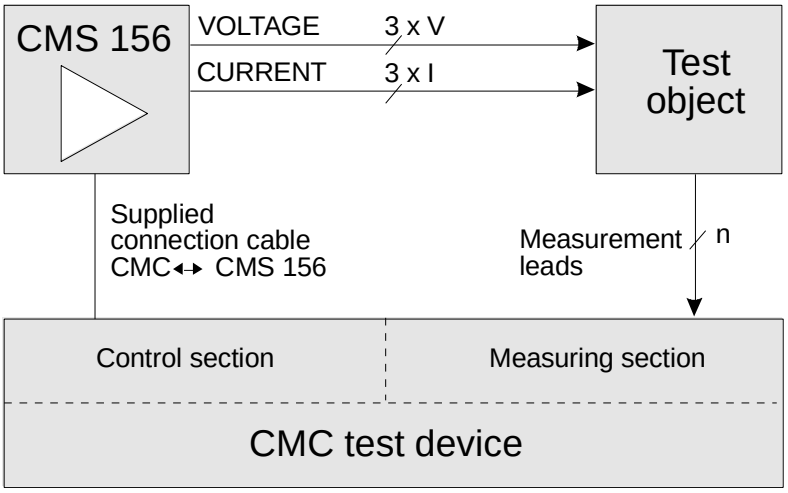


Figure 1 Connecting principle CMS, CMC and test object

9. Connect the current rotary system of the CMS 156 to the current inputs of the test object. This may be done via the individual outputs (Current 1, 2, 3, N) or the combination connector.

10. Connect the voltage rotary system of the CMS 156 to the voltage inputs of the test object. This may be done via the individual outputs (Voltage 1, 2, 3, N) or the combination connector.

11. Connect the measuring inputs of the CMC test device to the test object either via cables with 4mm connectors or via the 20-pin measurement combination connector of the CMC test device.

This completes the startup procedure.

2.4 Instructions for Control of Amplifiers through the CMC

If your CMC has a "Gen. Out 7-12" interface:

If your amplifier is connected to this interface it will be automatically identified and offered as an option by the control software used, since communication is possible over this interface. (Supported by CMC for DOS since version 2.70.) This interface is standard on all CMC 156 test devices and can be added to CMC 56 test devices from serial number DAxxxx.

If your CMC has a "Gen. Out 1-6" interface:
There is no communication between the CMC and the amplifier, so the amplifier must be defined by an AMP-file.

If you use a CMC for DOS software version < 2.7:

There is no communication between the CMC and the amplifier, so the amplifier must be defined by an AMP-file.

Significance of the sliding switches:

In the case of the amplifiers being controlled from the CMC for DOS software, the sliding switches indicate whether the current (Position II) or the voltage system (Position I) is to be amplified.

In the case of control by a CM Engine based software (all OMICRON Windows programs are based on CM Engine) the setting of these sliding switches is ignored.

6 x I in the CMC for DOS software:

The representation of 2 current systems in the CMC for DOS software is not supported - the software only displays one current and one voltage system. If 6 x I are to be controlled via the CMC test device, the CMS voltage system must be used with the voltage rotary system of the CMC for DOS software. For this purpose, the appropriate AMP file must be set in the CMC for DOS software via the menu items **Configuration** and **V–Amplifier**. In the AMP file, enter `Voltage` for `TYPE`, `25` for `MAX` and `5` for `AMPLF`.

The sliding-switch A (Current) must be set to position I. For this group, volts will be displayed in the CMC for DOS software instead of amperes. (See `AMPLIFIER 2` in the following example, with the instruction `Sw.A:I`, that is sliding switch A set to position I.)

6 x V in the CMC for DOS software:

The representation of 2 voltage systems in the CMC for DOS software is not supported - the software only displays one current and one voltage system. If 6 x V are to be controlled via the CMC test device, the CMS voltage system must be used with the current rotary system of the CMC for DOS software.

For this purpose, the appropriate AMP file must be set in the CMC for DOS software via the menu items **Configuration** and **V–Amplifier**. In the AMP file, enter `Current` for `TYPE`, `250` for `MAX` and `50` for `AMPLF`.

The sliding-switch B (Voltage) must be set to position II. For this group, amperes will be displayed in the CMC for DOS software instead of volts. (See `AMPLIFIER 3` in the following example, with the instruction `Sw.B:II`, that is sliding switch B set to position II.)

If you define your amplifiers with an AMP-file:
An external amplifier can be defined for the CMC by an AMP-file (for older CMC 56s this is the only possibility). With an AMP-file the CMC can be informed, for example, that a parallel connection from group A and B has been defined as an amplifier (see AMPLIFIER 6 in the following example, with the instruction Sw.A+B:II, that is, sliding switches A and B are set to position II).

An AMP-file with the same name:

If an amplifier definition in an AMP-file has the same name and serial number as one which has been automatically identified through the "Gen. Out 7-12" interface, then the information from the AMP-file will be ignored by the control software.

Some example of AMP-files:

The following examples shows an excerpt from a standard AMP-file which would be used with the CMC for DOS software. (An explanation of the format of the AMP-file may be found in Chapter 3 of the CMC for DOS Software Handbook.)

```
BEGIN AMPLIFIER
  NAME   CMS156 V    250V  Sw.B:I
  SERNO
  TYPE   VOLTAGE
  MAX    250
  AMPLF  50
  PHOFFS 1.95, 1.95, 1.95,50
END AMPLIFIER

BEGIN AMPLIFIER1
  NAME   CMS156 I    25A   Sw.A:II
  SERNO
  TYPE   CURRENT
  MAX    25
  AMPLF  5
  PHOFFS 1.88, 1.88, 1.88,50
END AMPLIFIER1
```

```
BEGIN AMPLIFIER2
  NAME   CMS156 I    25A   Sw.A:I  (6xI)
  SERNO
  TYPE   VOLTAGE
  MAX    25
  AMPLF  5
  PHOFFS 1.88, 1.88, 1.88,50
END AMPLIFIER2

BEGIN AMPLIFIER3
  NAME   CMS156 V    250V  Sw.B:II (6xV)
  SERNO
  TYPE   CURRENT
  MAX    250
  AMPLF  50
  PHOFFS 1.95, 1.95, 1.95,50
END AMPLIFIER3
```

3 Design and Operation

3.1 Modules

The isolated amplifier groups A and B are also isolated from its controller (the CMC test device) via isolation amplifiers. These isolation amplifiers pass the received signals from the CMC to the signal processing module. The signals are corrected and then passed to outputs 1-3 on the front panel (Voltage and Current) via the amplifiers.

For each amplifier group, a module for self-testing and monitoring carries out a hardware test when it is switched ON and continuously detects the internal temperature of the amplifier. This facility automatically switches the amplifier OFF in case of an overtemperature.

The voltage and current outputs are monitored by a permanent theoretical vs. actual value comparison. In case of deviations, which could occur due to overburdening the current system or due to overloading the voltage system, an overload is indicated.

The information about the current operating state of the CMS 156 is displayed via the LED display on the front panel.

A communication interface is used to communicate with the controller CMC.

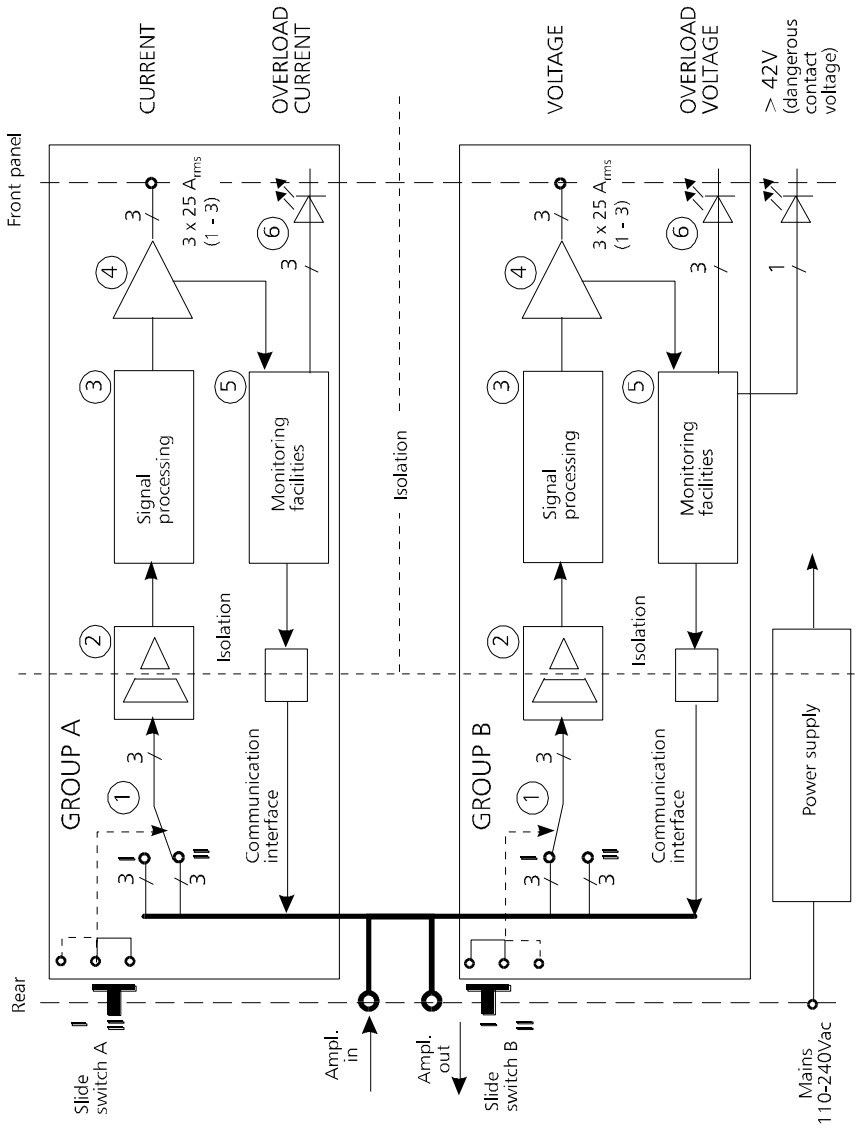


Figure 2 Block diagram CMS 156

Explanation of the block diagram for both groups:

1) 3-phase electronic switch:

   Used to select system I or II.

   This switch is controlled by the slide switch at the rear panel of the CMS 156, where system I corresponds to the voltage system and system II corresponds to the current system of the CMC test device.

2) Isolation amplifier isolating the inputs and outputs.

   The CMS 156 is isolated from the CMC test device and mains.

3) Signal processing block (filter, offset correction,...)

4) 3-phase amplifier

5) Monitoring facilities:
   Hardware test upon switching the device ON.
   Temperature monitoring
   Operating state display
   Communication interface

6) LEDs on the front panel for displaying the operating state

3.1.1 Hardware Test

During power-up, the CMS 156 automatically carries out a hardware test (separate for groups A and B); the device is only operational if this self-test is passed. A new attempt is made every 8 sec if the self-test is not passed.

3.1.2 Temperature Monitoring

Dependent on the load or burden and the output current, the internal power dissipation results in the heating up of the CMS 156.

When the temperature threshold is reached (critical temperature of the amplifier), the temperature monitoring facility of the appropriate group (separate for groups A and B) automatically switches the amplifier OFF. The LED display at the front panel flashes red/dark (0.5s/0.5s) for this amplifier group.

The time until switch-OFF due to overtemperature depends on the following factors:

- the duty factor (ON/OFF time) of the output currents,
- the burden/load,
- the ambient temperature, and
- the temperature within the device due to previous tests.

Typical data for the current system (CURRENT):

- At maximum load (3 x 25A_{rms}):
  ambient temperature = 25°C
  internal device temperature = 25°C
  outputs short circuited
  (max. power loss of a single group in CMS 156)
  $\Rightarrow$ unit switches itself OFF after approx. 4 min.

- For a typical application:

  Conditions as above; duty factor 1:2
  (e.g. 5s ON / 10s OFF)

  ⇒ unit will never switch OFF.

Typical data for the voltage system (VOLTAGE):

- Ambient temperature = 25°C

  capacitive/inductive load

  ⇒ unit possibly switches itself OFF.

- Ambient temperature = 25°C

  ohmic nominal load

  ⇒ unit will never switch OFF.

After the unit switched itself OFF, it will "wait" until the temperature in the device has dropped below a second threshold. This threshold is about 15° lower than the switch-OFF threshold, i.e. the temperature monitoring function has a hysteresis behavior.

4 Connections and Interfaces

4.1 Connections on the Front Panel

On the front panel are the output sockets of the two groups VOLTAGE and CURRENT. Four sockets for each system: three phases (1, 2, 3) and neutral (N). In addition the LED indicators displaying the operating states of the amplifiers, and the ON/OFF power switch are situated here.

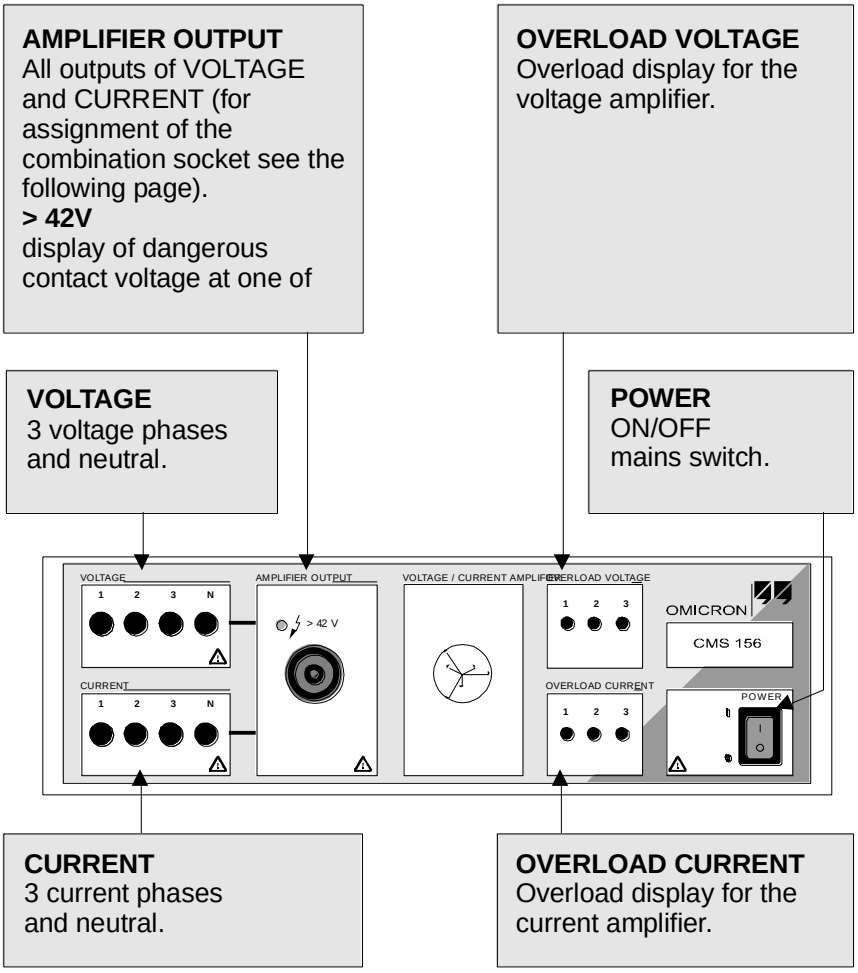


Figure 3 Front view CMS 156

4.1.1 Generators Combination Socket for AMPLIFIER OUTPUT

The generators combination socket "Amplifier output" serves for easy connection of the test object to the CMS 156. All signals of the connection sections VOLTAGE and CURRENT are brought out at this connector.

WARNING:	
	If the current is higher than 25A then the load (burden) can only be connected to the 4mm – Banana plug. The connections on this socket are dangerous voltage contacts when the device is in its ON state; for this reason, this socket may not be used without full knowledge of the safety instructions found at the beginning of this manual.

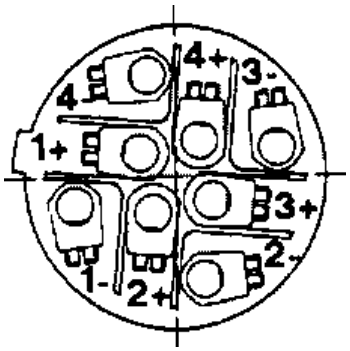


Figure 4 Generators combination plug for CURRENT 1-3 and VOLTAGE 1-3 (soldering side)

Pin	Signal
1-	Voltage_N
2-	Voltage_3
3-	Voltage_2
4-	Voltage_1
1+	Current_1
2+	Current_N
3+	Current_3
4+	Current_2

Table 1 Assignment of generators combination plug for a right-hand rotating system

Connection for a left-hand rotating system exchange:

Current 2 ↔ Current 3, Voltage 2 ↔ Voltage 3.

Ordering notes for generators combination plug	
Description	SPEAKON LINE 8-pole
Article number	NL8FC
Manufacturer	Neutrik

Table 2 Ordering notes

Suppliers for generators combination plug	
USA	Neutrik USA Inc., 195-S3 Lehigh Avenue, Lakewood, NJ 08701-4527 Tel.: (908) 901 94 88, Fax: (908) 901 96 08
RSA	Eltron (Pty.) Ltd. P.O. Box 44598, Linden, Johannesburg 2104, Tel.: (11) 787 03 55, Fax: (11) 787 96 27
D	H. Adam & Co, Felix -Wankel-Str. 1, 8060 Dachau, Tel.: (08131) 2808-0 or NCV, Erzbischof Buchberger Allee 14, 8400 Regensburg, Tel.: (0941)-98041, FAX: (0941)-999772

Table 3 Suppliers

If you want to order from OMICRON, see Section 8.1 "Ordering Information".

4.2 Rear View

The mains connection (power supply block) and the connection to the CMC test device (detail B) are located on the rear panel.

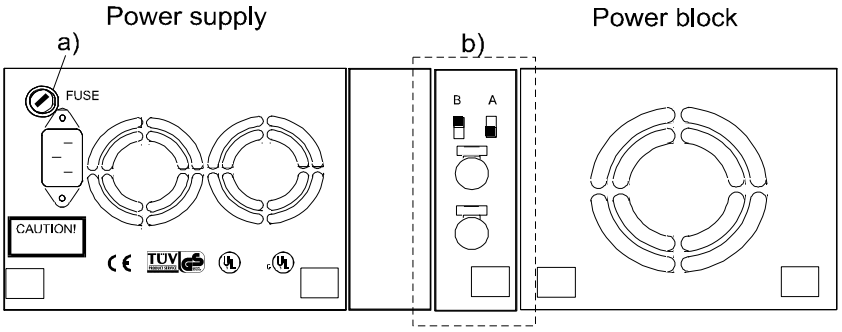


Figure 5 Rear view CMS 156

4.2.1 Mains Fuse

Disconnect the mains cable of the device before replacing the mains fuse!

Unscrew the little plastic tile and change the fuse.

Fuse: T10AH 250V.

4.2.2 Interface to the CMC Test Device

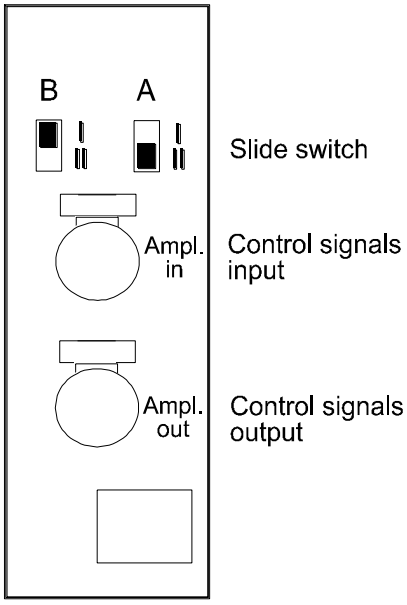


Figure 6 Detail B of rear view CMS 156

Slide Switches A (CURRENT) and B (VOLTAGE):

Relevant for use with the CMC for DOS software.

Rotary System I ..... Voltage system in the DOS-Software.

Rotary System II ..... Current system in the DOS-Software.

CM Engine based software (all OMICRON Windows software) ignores the sliding switch.

The position of this switch specifies which of the 3-phase systems of the CMC test device (current or voltage) is used to control the CMS 156. In position II, the signals of the current system of the CMC test device are taken as the signals to be amplified; in position I, the signals from the voltage system are amplified.

Amplifier	Slide switch	Default position of slide switch
VOLTAGE	B	I
CURRENT	A	II

Table 4 Default position of slide switches

Ampl. in

The Lemo jack "Ampl. in" is used to connect the CMS 156 to the CMC test device. Use the supplied cable for connection to this jack.

Amplification:

(see "Technical Data", sections 7.2.1 and 7.2.2)

Slide switch position:

With the slide switch, you select which rotary system (I or II) is switched to which amplifier group.

Slide switch A influences CURRENT.

Slide switch B influences VOLTAGE.

(see also the block diagram in Figure 2.)

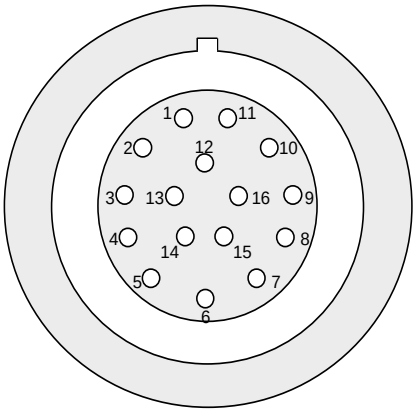


Figure 7 Interface "Ampl. in" (upper 16 pole Lemo-jack); (view of cable connections)

Socket	Signal from CMC test device[1]	Function
Pin 1	Gen. out 7	L1 rotary system II (input)
Pin 2	Gen. out 8	L2 rotary system II (input)
Pin 3	Gen. out 9	L3 rotary system II (input)
Pin 4	GND_A	GNDA Analog Ground
Pin 5	Gen. out 10	L1 rotary system I (input)
Pin 6	Gen. out 11	L2 rotary system I (input)
Pin 7	Gen. out 12	L3 rotary system I (input)
Pin 8-16	reserved	reserved
Housing	Shield connection (earth)	Shield connection (earth)

Table 5 Assignment

[1]Gen. out 7-9 and Gen. out 10-12 each form a selectable triple (voltage or current system).

Ampl. out

This interface is used to control additional CMS 156, CMA 156 or CMA 56 devices. The signals applied at "Ampl. in" for the CMS 156 are looped through to "Ampl. out".

Use the supplied cable for connection to this jack.

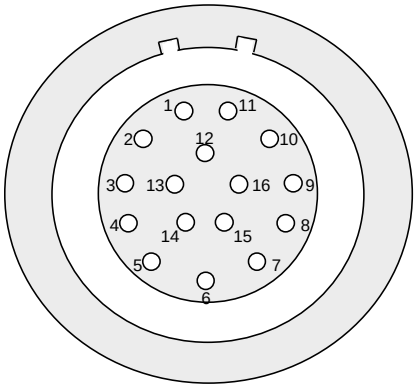


Figure 8 Interface "Ampl. out" (lower 16 pole Lemo jack); (view of cable connection)

Socket	Signal from CMC test device[1]	Function
Pin 1	Gen. out 7	L1 rotary system II (input)
Pin 2	Gen. out 8	L2 rotary system II (input)
Pin 3	Gen. out 9	L3 rotary system II (input)
Pin 4	GND_A	GNDA Analog Ground
Pin 5	Gen. out 10	L1 rotary system I (input)
Pin 6	Gen. out 11	L2 rotary system I (input)
Pin 7	Gen. out 12	L3 rotary system I (input)
Pin 8-16	reserved	reserved
Housing	Shield connection (earth)	Shield connection (earth)

Table 6 Assignment

[1]Gen. out 7-9 and Gen. out 10-12 each form a selectable triple (voltage or current system).

Ordering Notes for "Ampl. in" and "Ampl. out"

Manufacturer designation of plug for "Ampl. out" and "Ampl. In"	
For "Ampl. out": Plug with 2 guide cams and pull relief	FGB.2B.316.CLAD 72Z
For "Ampl in": Plug with 1 guide cam and pull relief	FGG.2B.316.CLAD 72Z
Bend protection spout black	GMA.2B.070 DN

Table 7 Manufacturer designation

Manufacturer / Supplier of plug for "Ampl. Out" and "Ampl. In"	
USA	LEMO USA Inc. 335 Tesconi Circle, Santa Rosa, CA 95406, Tel.: 001/707/578 88 11, Fax: 001/707/578 08 69
D	LEMOSA GmbH , Stahlgruberring 7, 8000 München 82 Tel. (089) 42 30 85 FAX (089) 42 71 92

Table 8 Manufacturers / Suppliers

If you want to order from OMICRON, see Section 8.1 "Ordering Information".

5 Single Phase Operation

5.1 Single Phase Operation Series Circuit 1,2 (L,L)

Maximum output voltage:	$20V_{rms}$
Maximum power:	140VA at 7.5A
Current range:	$1 \times 0 \ldots 25A_{rms}$

Currents 1 and 2 have to be controlled in phase opposition; for this operation, there is a “single-phase-model” in the CMC for DOS software.

To maintain a valid overload display in this case, the outputs must be connected via low-impedance resistors. This can be achieved by means of the supplied SPA156 cable.

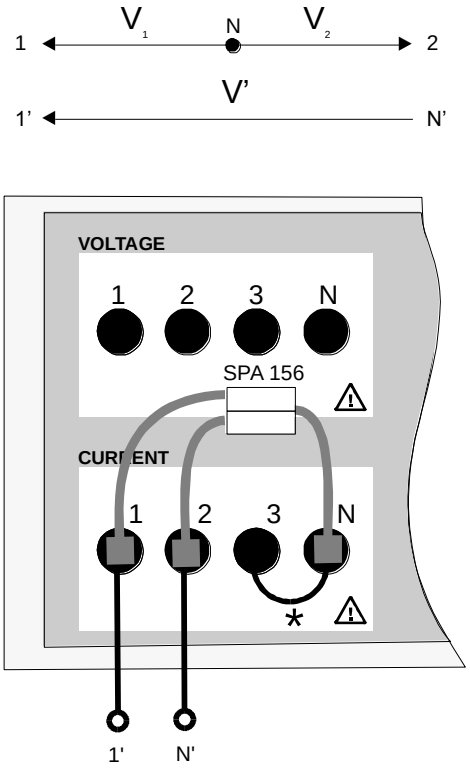


Figure 9 Current system in single phase operation *

See also the power curve in Figure 15.

* The jumper is only used for suppressing the overload message of phase 3.

5.2 Single Phase Operation Parallel Circuit 1+2+3

Maximum output voltage: $10V_{rms}$

Maximum power: 210VA at 25A

Current range: $1 \times 0 \ldots 75A_{rms}$

Currents 1, 2 and 3 are connected in parallel.

All current channels must be controlled in phase so that the currents will add up.

Make sure that the connecting cables have a sufficient cross section!

Each current plug can supply up to $25A_{rms}$, the N plug up to $3 \times 25A_{rms} = 75A_{rms}$.

Because there is a power loss of up to 10W on each test lead, we recommend choosing the connection[1] technique displayed in Figure 15.

WARNING:	
	If the current is higher than 25A, then the load (burden) can only be connected to the 4mm banana plug.

[1] Use the cable so that the N socket is interconnected through 3 banana cables. The circuits of the load (burden) side should be interconnected in the same manner.

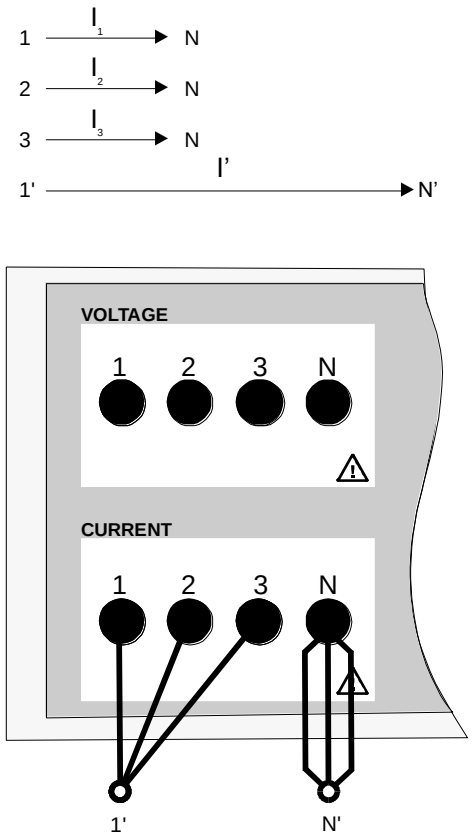


Figure 10 Single phase operation
parallel circuit 1+2+3

See also the power curve in Figure 17.

5.3 Single Phase Operation of the Voltage System

Example:

150VA at 75 … 250V.

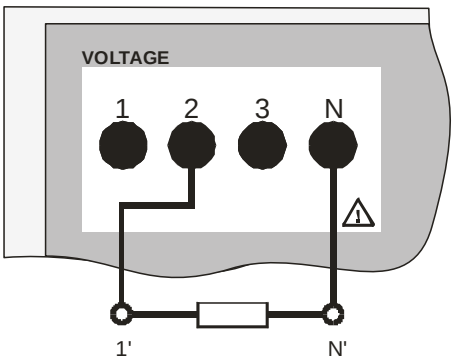


Figure 11 Single phase operation of the voltage system (L-N)

Example:

150VA at 150 … 500V.

Voltage 1 and Voltage 2 are used in phase opposition.

See also the power curve in Figure 18.

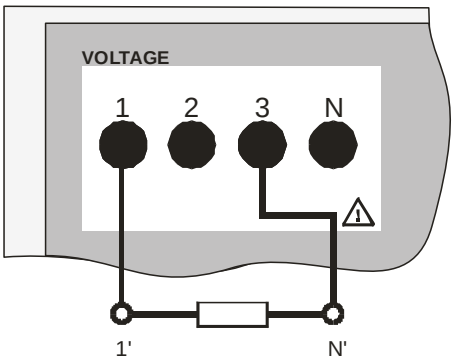


Figure 12 Single phase operation of the voltage systems (L-L in phase opposition)

5.4 SPA - 156 Cable

The SPA–156 cable is needed for in series connected current sources as a stabilizing resistor circuit; because of assembly tolerances, the currents of two outputs are never the same. This facilitates operation without an overload message.

For the configuration shown in section 5.1, 1 SPA - 156 is supplied:

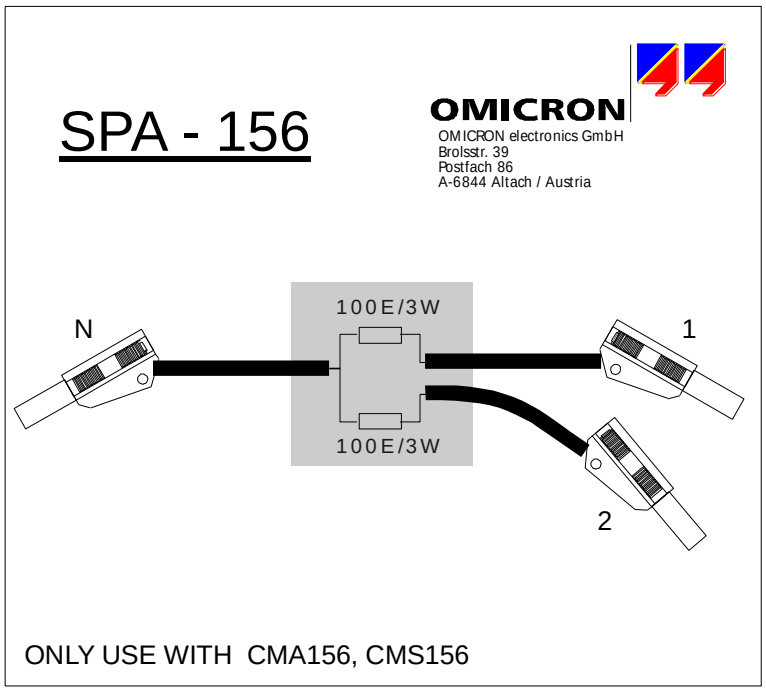


Figure 13 Supplied SPA - 156 cable

6 Status Messages

6.1 OVERLOAD VOLTAGE, OVERLOAD CURRENT

The status displays OVERLOAD VOLTAGE and OVERLOAD CURRENT consisting of three LEDs each are used to display the operating states of the amplifier groups Voltage and Current.

Via different color- and flash-combinations the individual operating states can be displayed.

LED indicators	Meaning
Green	Normal operation; no overload, output not clipped
Red	OVERLOAD CURRENT; the relevant phase is open circuited or is connected to a too high burden. If the output is open circuited, even without any input signal, an overload indication might result due to the offset current of the amplifier.
	OVERLOAD VOLTAGE; the relevant phase is connected to a too high load.
Red/dark flashing (0.5s/0.5s)	Temperature overload; the device has turned OFF one amplifier group due to overtemperature. It will turn itself back ON automatically after the temperature has dropped again.
Red/dark flashing (1s/1s)	Overcurrent/Overvoltage at one of the outputs, caused by a too high input signal; Approx. from 28 A_{rms} or 280V_{rms} output Switching ON is attempted every 8 sec.
Red/green flashing (0.5s/0.5s)	Hardware fault in the device; Switching ON is attempted every 8 sec.
Dark	Amplifier group is turned OFF

Table 9 LED messages displayed on the front panel of the CMS 156

6.2 > 42V

Warning display: if this LED is illuminated, at least on one of the voltage outputs a dangerous contact voltage against N is present (> 42V).

7 Technical Data

Guaranteed values are valid over 1 year from the date of factory calibration, at 23°C ± 5°C over a frequency range DC ... 100 Hz at nominal value and after a warm-up time greater 25 min.

7.1 Mains Supply

Mains supply	
Connector	Plug after IEC320
Voltage, 1-phase Nominal voltage Permissible range	 110 ... 240V_{AC} 99V ... 264V_{AC}
Mains fuse	T10AH 250V
Power consumption	< 1000VA
Frequency	
Nominal	50 / 60Hz
Permissible range	45 ... 65Hz

Table 10 Mains supply

7.2 Outputs

7.2.1 Amplifier group CURRENT 1, 2, 3

3 current outputs [1]		
Output currents		
3-phase AC	3 × 0 ... 25A	
1-phase AC (1+2+3)[2]	1 × 0 ... 75A	
1-phase DC	1 × 0 ... ±25A	
Output power		
3-phase AC	3 × 70VA at 7.5A	; Figure 14, page 38
1-phase AC (L-L)	1 × 140VA at 7.5A	; Figure 15, page 39
1-phase AC (1+2+3)	1 × 210VA at 22.5A	; Figure 16, page 39
1-phase DC (L-N)	1 × 140W at ±10.5A	
Amplification	5A / V	1V at inp. → 5A at outp.
Accuracy [3]	typ. error < 0.03%	guar. error < 0.1%
Harmonic distortion [4]	typ. 0.1%	guaranteed < 0.3%
Bandwidth (-3dB)	> 6kHz	
Phase lag at 50Hz / 60Hz	typ. 1.88° / 2.26° (output lagging) (autom. corrected by the CMC test device)	
DC offset current	typ. < 5mA	guaranteed < 20mA
Short-circuit protection Open-circuit protection	Short-circuit proof against N. Open outputs (idling) allowed.	

Table 11 Current amplifiers

[1] Data for three-phase systems are valid under symmetrical conditions (0°, 120°, 240°).
[2] If currents are greater than 25A only banana sockets can be used (valid at 50/60Hz)
[3] Percentage refers to nominal current (25A).
[4] Values at nominal current (25A), 50 / 60Hz and 20kHz measuring band width.

3 current outputs		
Frequency range Sine signals Transient signals	 10 ... 1000Hz DC ... 3.1kHz	
Output current resolution	1mA	
Frequency resolution	5 µHz	
Frequency accuracy/-drift	±0.5ppm/1ppm	
Phase range	-360° ... +360°	
Phase resolution	0.001°	
Phase error [1]	typ. < 0.02°	guaranteed < 0.1°

Table 12 Current amplifiers, specifications valid only if the CMS 156 is controlled by a CMC test device

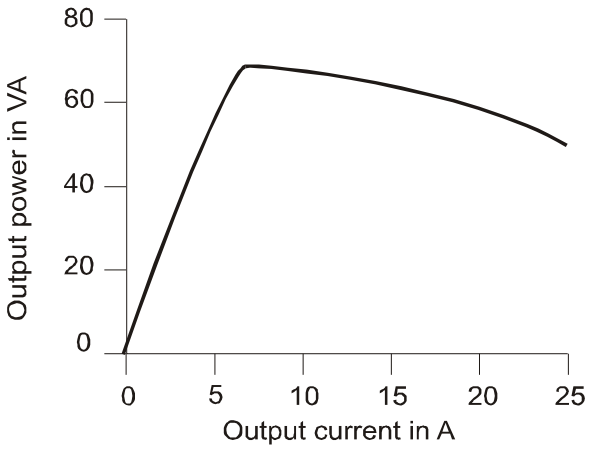


Figure 14 Typical output power per phase (L-N) [2]

[1] Valid for sine signals with 50 / 60Hz.

[2] The given output power is valid for the output plugs, the maximum power at the load (burden) is reduced by the power loss of the connection cables.

Doubling the output power:

Operating two phases in phase opposition (180° phase shift).[1]

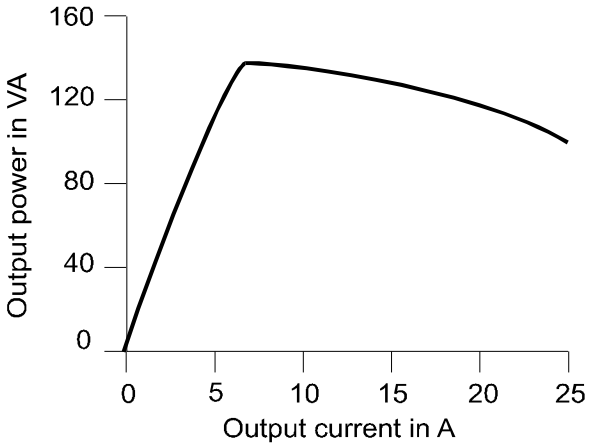


Figure 15 Typical output power (L-L) when operating two outputs in phase opposition.

Trippling the output power:

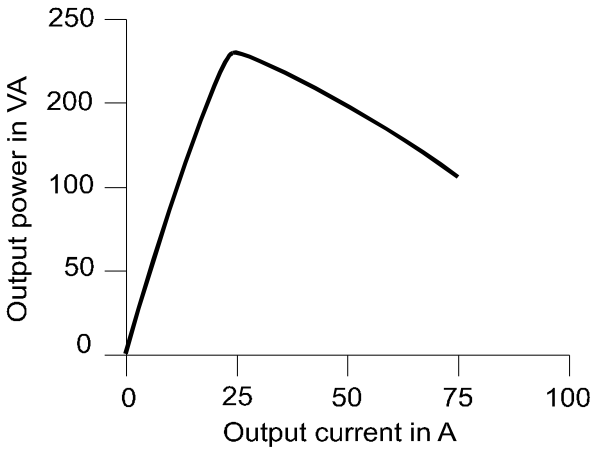


Figure 16 Typical output power (50 / 60Hz)
for single phase operation when connected in parallel (1+2+3) [2]

Methods for increasing the output can be found in Chapter 5, "Increasing the output power".

[1] From software version 2.5, the CMC software provides the “Single-phase model“ for this purpose, which operates the current phases 1 and 2 of the test system in phase opposition (double power in the current path). The outputs have to be connected via balancing resistors. For this purpose an SPA - 156 cable is used (see Chapter 5).

[2] The given output power is valid for the output plugs, the maximum power at the load (burden) is reduced by the power loss of the connection cables.

7.2.2 Voltage Amplifiers VOLTAGE 1, 2, 3

3 voltage outputs [1]		
Output voltages		
3-phase AC	3 × 0 ... 250V	
1-phase AC (L-L)	1 × 0 ... 500V	
3-phase DC (L-N)	3 × 0 ... ±250V	
Output power		
3-phase AC [2]	3 × 75VA for 75 ... 250V	; see Figure 17
1-phase AC (L-N)	1 × 150VA for 75 ... 250V	; see Figure 18
1-phase AC (L-L)	1 × 150VA for 150 ... 500V	; see Figure 19
1-phase DC (L-N)	1 × 212W for ±150 ... ±250V	
Amplification	50V / V (1V at input → 50V at output)	
Accuracy [3]	typ. error < 0.03%	guaranteed error < 0.1%
Harmonic distortion [4]	typ. < 0.03%	guaranteed < 0.1%
3dB Bandwidth	> 6kHz	
Phase lag at 50Hz / 60Hz	typ. 1.95° / 2.34° (output lagging) (automatically corrected by the CMC test device)	
DC offset-voltage	typ. < 20mV	guaranteed < 100mV
Short-circuit protection	Short-circuit proof against N	

Table 13 Voltage outputs

3 voltage outputs		
Frequency range Sine signals Transient signals	 10 ... 1000Hz DC ... 3.1kHz	
Output voltage resolution	12mV	
Frequency resolution	5µHz	
Frequency accuracy/-drift	±0.5ppm/1ppm	
Phase range	-360° ... +360°	
Phase resolution	0.001°	
Phase error[5]	typ. 0.02°	guaranteed < 0.1°

Table 14 specifications of the voltage amplifier (valid if controlled by a CMC test device)

[1] If not indicated otherwise, the voltages quoted are L-N.
[2] Data for three-phase systems are valid under symmetrical conditions (0°, 120°, 240°).
[3] Percentage refers to nominal voltage (250V).
[4] Values at nominal voltage (250V), 50 / 60Hz and 20kHz measuring band width.
[5] Valid for signals of 50 / 60Hz.

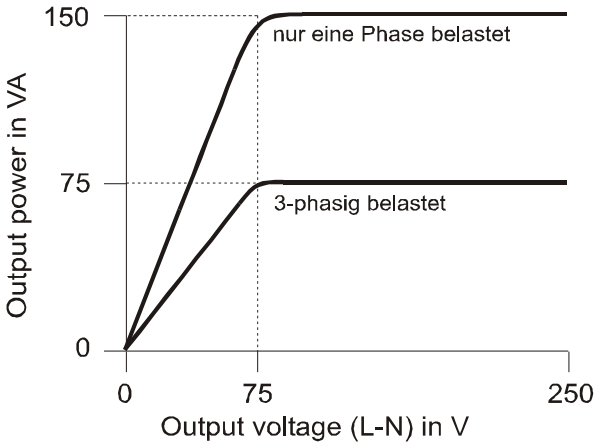


Figure 17 Output power per phase of the voltage amplifier1

For a single-phase operation the voltage can also be tapped between two phases (for example 1-2). In addition, if a phase shift of 180° is set, voltages of up to 500V can be generated.

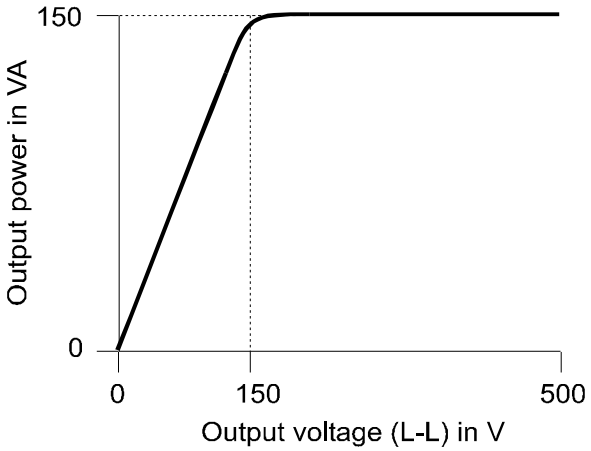


Figure 18 Phase-to-phase output power of the voltage amplifier for two voltage phases to opposite phase[2]

[1] To obtain the specified power, in the test object parameters file (.TYP) in the CMC software the corresponding voltage has to be set.
[2] To obtain the specified power, in the test object parameters file (.TYP) in the CMC software the corresponding voltage has to be set.

7.2.3 Isolation

Isolation between the systems CURRENT and VOLTAGE	
Isolation voltage	typ. 2kV$_{DC}$ (CTI > 175)
Clearance and creep distance	2mm

Table 15 Isolation

7.3 Inputs Ampl. in

6 analog inputs	
Input resistance	> 40kΩ
Input voltage range	0 ... 5V
Max. permissible input voltage	±15V$_{peak}$
Isolation from the inputs to the outputs	SELV (SaveExtraLowVoltage)

Table 16 Inputs

7.4 Ambient Conditions

7.4.1 Climate

Climate	
Temperature	
Operation	32 ... 122°F (0 ... +50°C)
Storage / transport	-13 ... 158°F (-25 ... +70°C)
Relative humidity	5 … 95% relative humidity, noncondensing

Table 17 Climate

7.4.2 Shock and Vibration

Dynamics	
Vibration	Tested according to IEC68-2-6 (operating mode) frequency range 10..150Hz; acceleration 2g continuous (20m/s^2); 10 sweeps, each axis
Shock	Tested according to IEC68-2-27 (operating mode) 15g/11ms, half-sine, each axis

Table 18 Shock and Vibration

7.4.3 Electromagnetic Compatibility (EMC)

EMC	
CE Conformity	The product complies to the normative document about electromagnetic compatibility for standardization of the laws of the member states of the council of the European Union (EMC standard 89/336/EWG).
Emission International Europe	 FCC Subpart B of Part 15 Class A EN 55011/3.1991/Group1/Class A
Susceptibility International Europe	 IEC 801-2/3/4 EN 50082-2:1992

Table 19 Electromagnetic Compatibility

7.5 Safety

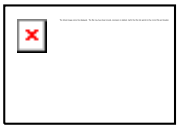
Safety standards and certificates complied with	
International standards	IEC1010-1 CAN/CSA-C22.2 No1010.1-92
European standards	EN61010-1/1993 EN60950 +A1:1993-05
Certificates	   UL/CSA certified up to amplifier serial number **Qxnnnx**. (Example: a test set with serial number **P**D123A is UL/SCA-certified, a test set with the serial number **R**B101A not).

Table 20 Safety standards and certificates complied with

7.6 Mechanical Data

Mechanical data	
Weight	32.4 lbs (14.7 kg)
Dimensions (W x H x D; without handle)	17,7" × 5,7" × 15,4" (450, 145, 390 mm)

Table 21 Mechanical data

8 Appendix

8.1 Ordering Information

In this section you will find ordering information for accessories of the CMS 156.

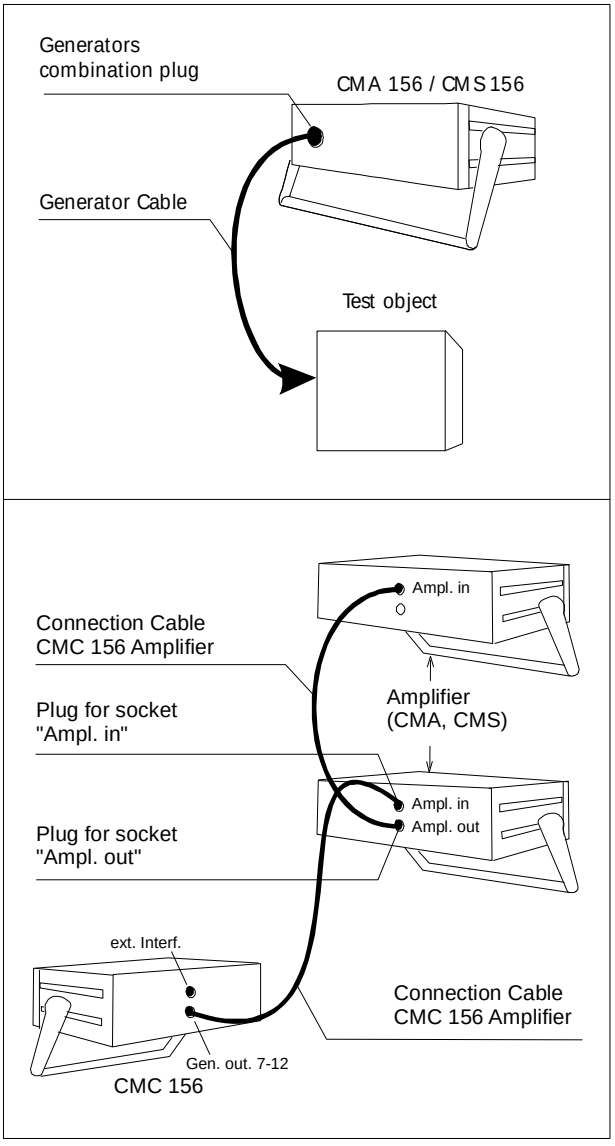


Figure 19 Connection cables and plugs

Ordering Specification	Order number
Plugs	
Plug for 16-pole Lemo socket "Ampl. in"	VEHS0001
Plug for 16-pole Lemo socket "Ampl. out"	VEHS0002
Plug for generator combination socket	VEHS0103
Plug for measurement combination socket	VEHS0104
Cable	
Connection cable for CMC 156 amplifier	VEHK0003
Generator cable	VEHZ0103
- 1st end Generator connection plug 8-pole	
- 2nd end with fused plug 4mm sw	
- 3 m, 8 x 2.5 mm²	
Standard cable set consisting of a pair of 2 m safety test leads (2,5mm², red & black) and a pair of sockets (2,5mm², red & black)	VEHK0102
Exif Board option for CMC 56	VEHB0003
Carrying bag CMA/CMS	VEHP0010
Transport case for CMA/CMS	VEHP0011
Additional Instruction Manuals for CMS 156	VESD1030

Table 22 Ordering Information

Support

When you are working with our products we want to provide you with the greatest possible benefits. If you need any support, we are here to assist you!

24/7 Technical Support – Get Support

www.omicron.at/support
www.omicronusa.com/support

At our technical support hotline, you can reach well-educated technicians for all of your questions. Around the clock – competent and free of charge.

Make use of our 24/7 international technical support hotline:

Americas:	+1 713 830-4660 or +1 800-OMICRON
Asia-Pacific:	+852 3767 5500
Europe/Middle East/Africa:	+43 59495 4444

Additionally, you can find our Service Center or Sales Partner closest to you at www.omicron.at or www.omicronusa.com.

Customer Area – Stay Informed

www.omicron.at/customer
www.omicronusa.com/customer

The customer area on our website is an international knowledge exchange platform. Download the latest software updates for all products and share your own experiences in our user forum.

Browse through the knowledge library and find application notes, conference papers, articles about daily working experiences, user manuals and much more.

OMICRON Academy – Learn More

www.omicron.at/academy
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Learn more about your product in one of the training courses offered by the OMICRON Academy.

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