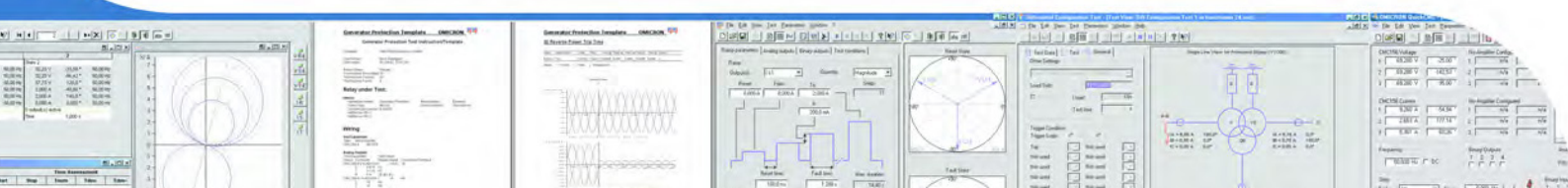
OMICRON

Reference Manual

CMC 156



5 Technical Data

The following data refer to a *CMC 156* test set with standard design, without external amplifiers.

For test sets with the EP option (Extended Precision), technical data regarding the power amplifiers are different from the corresponding data of standard devices: therefore, these data can be found separately in chapter 6, "Technical Data EP Option".

- Guaranteed values:
  - In general:
    Valid for 1 year from factory calibration, within 23 °C ± 5 °C (73 °F ± 10 °F) at nominal value and a warm-up time of > 25 min.
  - Guaranteed values of generator outputs:
    Valid in the frequency range 10 – 100 Hz.
- Accuracy specifications:
  Valid in the frequency range DC – 100 Hz.

5.1 Mains Supply

Mains supply	
Connector	Plug acc. to IEC320
Voltage, 1-phase Nominal voltage Permissible range	 110 to 240 Vac 99V to 264 Vac
Mains fuse	T6.3 AH 250 V
Power consumption	< 600 VA
Frequency Nominal frequency Permissible range	 50 / 60 Hz 47 to 63 Hz

Table 10 Supply data

5.2 Outputs

The data given in the following table are valid for all generator outputs, regardless of the amplifiers used (internal or external ones); the following tables are valid only for equipment with internal amplifiers.

For the block diagram of the generator outputs available please refer to Figure 3 on page 18.

Analog current and voltage outputs		
Frequency range [1]		
Sinusoidal signals	10 to 1000 Hz	
Transient signals	DC to 3.1 kHz	
Frequency resolution	5 µHz	
Frequency accuracy	0.5 ppm	
Frequency drift	1 ppm	
Phase range	- 360 ° to + 360 °	
Phase resolution	0.001 °	
Phase error [2]	typ. 0.02 °	Guaranteed < 0.1 °

Table 11 Analog current and voltage outputs

[1] If you purchased the option **FL-6**, the maximum output frequency is constrained to **599 Hz**.
[2] Valid for sinusoidal signals with 50 / 60 Hz.

5.2.1 Current Outputs CURRENT OUTPUT 1-3

3 current outputs[1] for standard design		
Output currents		
3-phase AC (L-N)	3 × 0 to 12.5 A	
1-phase AC (L-N)	1 × 0 to 12.5 A	
in parallel	1 × 0 to 21 A	
1-phase DC (L-N)	1 × 0 to ±12.5 A	
Power[2]		
3-phase AC (L-N)	typ. 3 × 40 VA	guar. 3 × 37.5 VA
1-phase AC (L-L)[3]	typ. 1 × 80 VA	guar. 1 × 75 VA
1-phase AC (L-N)[4]	typ. 1 × 65 VA	guar. 1 × 62 VA
1-phase DC (L-N)	typ. 1 × 62 W	guar. 1 × 59 W
Resolution	< 500 µA	
Accuracy[5]	typical error	guaranteed error
R_{Load} ≤ 0.5 Ω	< 0.03 % of rd. + 0.01 % of rg.	< 0.08 % of rd. + 0.02 % of rg.
R_{Load} > 0.5 Ω	< 0.04 % of rg.	< 0.1% of rg.
Harmonic distortion[6]	typical 0.03 %	guaranteed < 0.07 %
DC offset current	typical < 300 µA	guaranteed < 3 mA
Short-circuit protection	Unlimited against N and from L to L.	
Open-circuit protection	Open outputs (idling) allowed.	
Connection	4 mm banana sockets or amplifier combination socket.	
Isolation	Reinforced isolation to mains and to all SELV interfaces.	

Table 12 Current outputs with standard design

[1] Data for 3-phase systems are valid under symm. conditions (0 °, 120 °, 240 °).
[2] For higher current or output power demands connection of an external amplifier is possible (e.g. CMA current amplifier). The power data refers to an output current of 12.5 A_{eff} or 12.5A_{DC}.
[3] Single-phase model (operation with two phases in phase opposition): two currents in series, additional adapter SPA156 recommended.
[4] 2 phases (2 x 10.5 A) in parallel for in-phase operation.
[5] rd. = reading; rg. = range, whereat *n* % of rg. means: *n* % of upper range value (1.25 or 12.5 A).
[6] Values at 50/60 Hz, 20 kHz measuring band width, nominal value and nominal load.

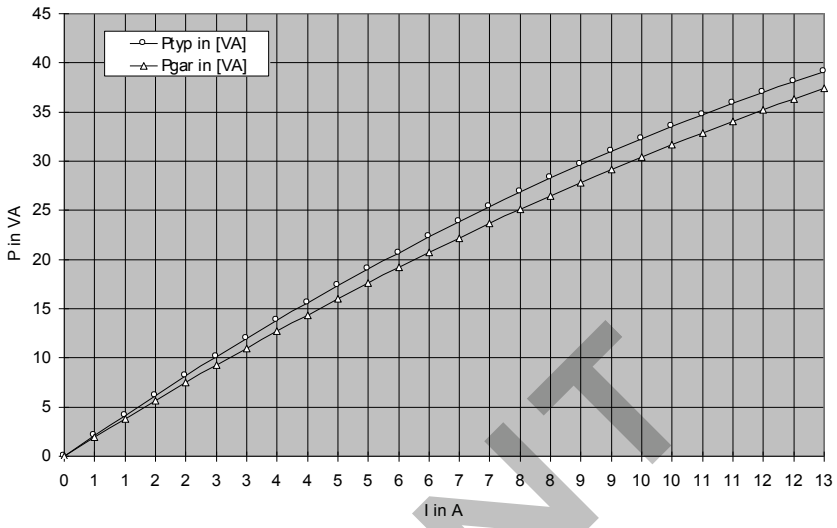


Figure 12 Typical (Ptyp.) and guaranteed (Pguar.) output power of the internal current amplifiers with standard design

For a parallel connection of two current outputs a maximum output power of Pout > 65VA$_{ac}$ is reached.

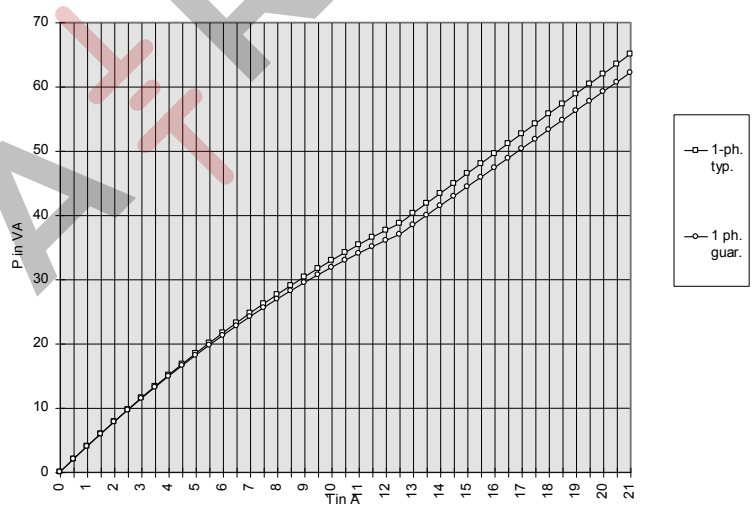


Figure 13 Typical (typ) and guaranteed (guar.) output power of the current outputs for single-phase operation (two outputs in parallel) with standard design

5.2.2 Voltage Outputs VOLTAGE OUTPUT 1-3

3 voltage outputs for standard design [1]		
Output voltages		
3-phase AC (L-N)	3 × 0 to 125 V	
1-phase AC (L-L)	1 × 0 to 250 V	
3-phase DC (L-N)	3 × 0 to ±125 V	
Resolution	6 mV	
Power[2]		
3-phase AC[3] (L-N)	3 × 50 VA for 125 V	
1-phase AC (L_1-N/L_3-N)	1 × 50 VA for 125 V	
1-phase AC (L_2-N)	1 × 100 VA for 125 V	
1-phase AC (L-L)	1 × 100 VA for 250 V	
1-phase DC (L_1-N/L_3-N)	1 × 42 W for ± 60 to ± 125 V	
1-phase DC (L_2-N)	1 × 90 W for ± 125 V	
Accuracy[4]	typical error < 0.03 % of rd. + 0.01 % of rg.	guaranteed error < 0.08 % of rd. + 0.02 % of rg.
Harmonic distortion[5]	typical 0.015 %	guaranteed < 0.05 %
DC offset voltage	typical < 20 mV	guaranteed < 100 mV
Short-circuit protection	Unlimited against N and from L to L.	
Connection	4 mm banana sockets or amplifier comb. socket.	
Isolation	Reinforced isolation to mains and to all SELV interfaces.	

Table 13 Voltage outputs for standard designs

[1] If not indicated otherwise, the voltages quoted are L-N.
[2] Refer to output power curve in Figure 14
[3] Data for three-phase systems are valid under symmetrical conditions (0°, 120°, 240°).
[4] rd. = reading; rg. = range, whereat *n* % of rg. means: *n* % of upper range value (125V).
[5] Values at 50/60 Hz, 20 kHz measuring band width, nominal value and nominal load.

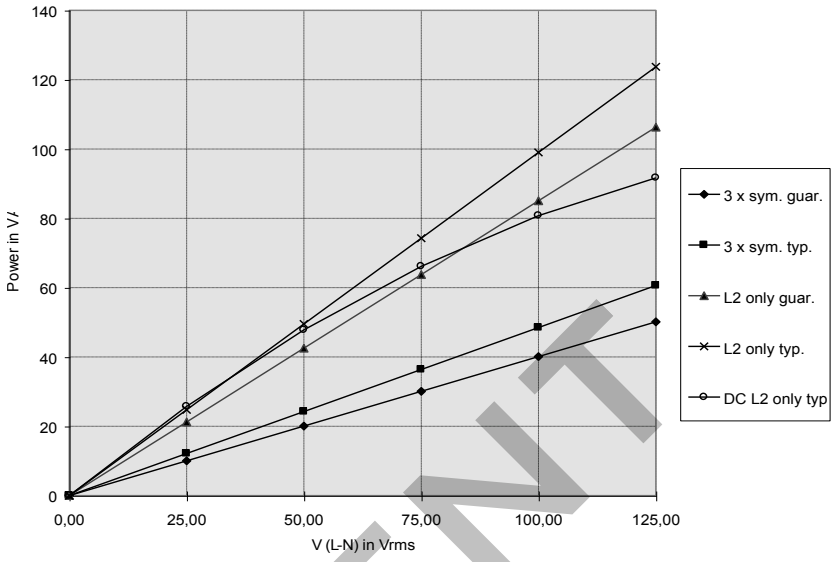


Figure 14 Typical (Ptyp) and guaranteed (Pmin) output power of the voltage amplifiers1 with standard design

5.2.3 Interface for an External Amplifier 'Gen. out 7-12'

6 outputs		
Setting range	0 to 5 V_{rms}	
Output current	max. 2 mA	
Resolution	< 250 µV	
Accuracy	typ. error < 0.025 %	guar. error < 0.05 %
Harmonic distortion[2]	typ. < 0.015 %	guar. < 0.05 %
Short-circuit protection	Unlimited against GND_A.	
Isolation	SELV isolated to all other potential groups. Electrically connected to ground.	

Table 14 Interface Gen. out 7-12

[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] Values at nominal voltage (5V), 50/60 Hz and 20 kHz measuring band width.

5.2.4 Binary Outputs Relays

4 Binary outputs relays (Binary outputs 1-4)	
Type	potential free contacts, software controlled
AC break capacity	V_{max} 250 V_{AC}; I_{max} 8 A; P_{max} 2000 VA
DC break capacity	V_{max} 300 V_{DC}; I_{max} 8 A; P_{max} 50 W (see the following limit curve)
Inrush current	15 A (max. 4 sec. At 10 % ON period)
Electrical endurance	10^5 switching cycles at 220 V_{ac} / 8 A; ohmic
Time to stable closed condition	approx. 6 ms
Time to stable open condition	approx. 10 ms
Bounce time	approx. 0.5 ms
Connection	4 mm banana sockets
Isolation	Functional isolation to power outputs. Reinforced isolation to all SELV interfaces and to mains.

Table 15 Binary outputs relays

The following diagram shows the limit curve for direct voltage (for alternative voltage a max. power of 2000 VA is achieved).

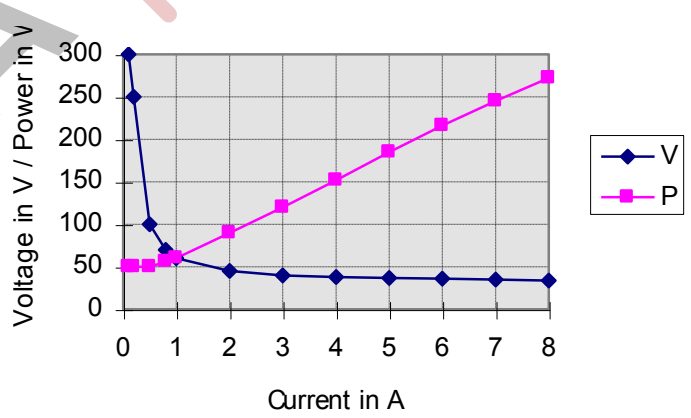


Figure 15 Limit curve of the relays of the binary outputs for direct voltage

5.2.5 Binary Outputs Transistor

4 Binary outputs transistor (Binary outputs 11-14)	
Type	Open collector transistor outputs; external pull-up resistor; see Figure 16.
Switching voltage	max. 15V
max. input voltage.	±16V
Switching current	max. 5 mA (current limited) min. 100 µA
update time	100 µs
rise, fall time	< 3 µs ($V_{external}$= 5 V, R_{pullup}= 4k7)
Connector	Socket "ext. Interf." (Back panel *CMC 156*)
Isolation	SELV to all other potential groups of the test set. Electrically connected to Gen. Out 7-12 and ground.

Table 16 Binary outputs transistor

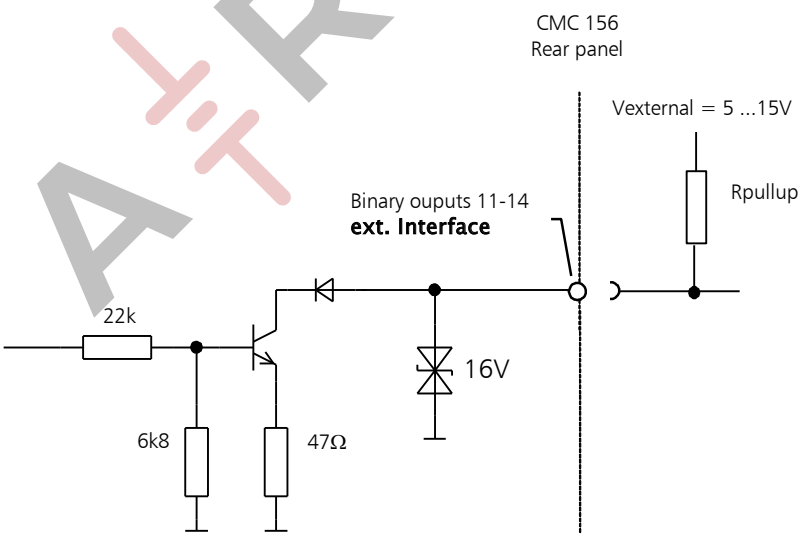


Figure 16: Binary outputs transistor 11-14 output module

5.3 Inputs

5.3.1 Binary Inputs

10 Binary inputs	
Response time	typ. 220 µs (debounced)
Sampling rate	< 100 µs
Measurement accuracy	See Table 18 and Table 19
Counter function Counting frequency Pulse width	 3 kHz (per input) > 150 µs (for high and low signal)
Operating threshold for potential-free operation	- Guaranteed 0: input open or load against N > 100 kΩ - Guaranteed 1: input short-circuited to N or load against N < 20kΩ
Operating threshold for potential-sensing operation	2 to 250 V_{dc} to be set in the software
Hysteresis	0.36V ± 0.2V
Input resistance	70kΩ against reference potential (GND_BI)
Input capacity	10nF against reference potential (GND_BI)
Trigger criteria	Switching of a potential-free contact or application of direct voltage up to 250 V. Configurable operating threshold.
Integration period	27 min
Connection	4 mm banana sockets
Isolation	Functional isolation to power outputs and between the two groups, with galvanic separation from each other. Reinforced isolation to all SELV interfaces and to mains.
Configuration	The binary inputs are configurable. Information about binary input configuration is found in the CMC software user's manual in Chapter 3 "Configuring the binary inputs”

Table 17 Binary inputs

Time measurement on binary inputs

Due to the sampling rate and to the features of the input filters, a signal present on binary inputs can only be sampled with a certain time tolerance.

All input binary signals are filtered on a period of 100 µs to remove possible noise and therefore this time represents a delay in all measurements. As all inputs are filtered in the same way, this delay does not appear when:

- we measure the difference between the switching times on two inputs, or
- we achieve synchronization between two devices.

Measurement accuracy when sensing a signal		
Operating mode	**Time in µs**	
	minimum	**maximum**
Zero potential contact opening	200	400
Zero potential contact closing	110	220
Active signals	110	220

Table 18 Maximum accuracy for time measurements on one input

Measurement accuracy when assessing the difference between switching times on two different inputs or when synchronizing two devices (GPS)		
Operating mode	**Time in µs**	
	minimum	**maximum**
Zero potential contact opening	0	200
Zero potential contact closing	0	120
Active signals	0	120

Table 19 Maximum accuracy for time measurements between two inputs or during a synchronization

5.3.2 Counter Inputs 100 kHz

2 Counter inputs	
max. counting frequency	100 kHz
Pulse width	>3 µs (high and low signal)
Operating threshold pos. edge neg. edge	 max. 8 V min. 4 V
Hysteresis	typical: 2 V
rise, fall time	< 1 ms
max. input voltage	± 30 V
Connector	Socket "ext. Interf." (rear panel *CMC 156*)
Isolation	SELV to all other potential groups of the test set. Electrically connected to Gen. Out 7-12 and ground.

Table 20 Counter inputs 100 kHz

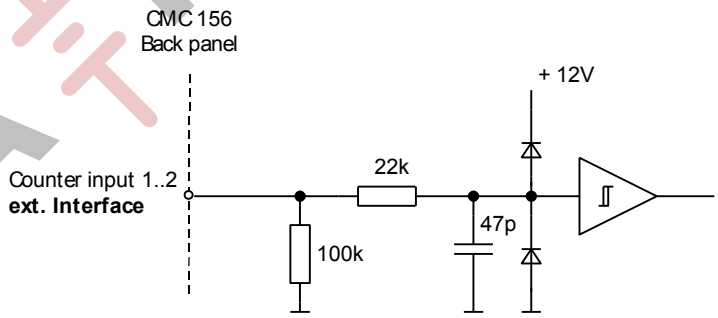


Figure 17 Input circuit of counter inputs 1, 2

5.3.3 Measuring Inputs

1 Direct current measuring input		
Measuring range	0 to ± 20 mA	
max. input current[1]	600 mA	
Accuracy	typ. error 0.01 %	guaranteed error < 0.05 %
Connection	4 mm banana sockets or measuring comb. socket.	
Isolation	Electrically connected to the current and voltage power outputs.	

Table 21 Direct current measuring input

1 Direct voltage measuring input		
Measuring range	0 to ± 10 V	
max. input voltage[1]	±11 V	
max. input current[1]	± 90 mA	
Accuracy	typ. error < 0.01 %	guaranteed error < 0.05 %
Connection	4 mm banana sockets or measuring comb. socket.	
Isolation	Electrically connected to the current and voltage power outputs.	

Table 22 Direct voltage measuring input

[1] Exceeding this value may lead to destruction in the device.

5.4 Computer Interface

25-pole SUB-D-plug	
Designation	Host Interface
Use	The Host Interface (parallel interface) serves as connection from the *CMC 156* test set to the computer (LPT or USB). If the computer is equipped with a parallel printer port, too, use the 25-pole cable (VEHK0002) that was supplied with the test set to connect the *CMC 156* to the computer. If the computer is equipped with a USB port, use an OMICRON *CMUSB-P* converter (ordering number VEHZ2007) instead of the VEHK0002 to connect the *CMC 156* to the computer.
Isolation	SELV isolated to all other potential groups; electrically connected to ground.

Table 23 Computer interface

5.5 Ambient Conditions

5.5.1 Climate

Climate	
Operating temperature	0 ... 50 °C (32 … 122 °F)
Storage and transport	-25 ... +70 °C (-13 … 158 °F)
Humidity range	5 ... 95 % relative humidity; non condensing

Table 24 Climate

5.5.2 Shock and Vibration

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

Table 25 Shock and Vibration

5.5.3 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/EEC).
Emission	
International	EN 50081-2
Europe	FCC Subpart B of Part 15 Class A
Susceptibility	
International	EN 50082-2:1992
Europe	IEC 1000-4-2/3/4/6

Table 26 Electromagnetic Compatibility

5.6 Safety

Safety standards and certificates complied with	
European standards	EN 61010-1
International standards	IEC 61010-1 CAN/CSA-C22.2 No 61010-1-04

Table 27 Safety standards and certificates complied with

5.7 Mechanical Data

Dimensions and weight	
Weight	9.8 kg (22.46 lbs)
Dimensions W x H x D (without handle)	343 × 145 × 268 mm (13.5" × 5.7" × 10.6")

Table 28 Dimensions and weight