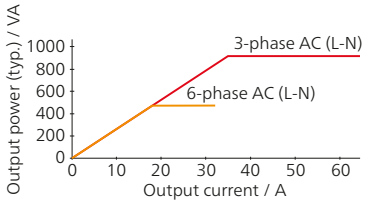
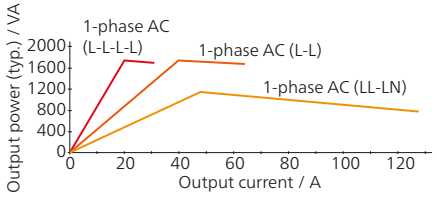
CMC 356

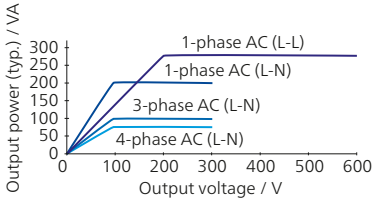
CMC 356: 6 Phase Current + 4 Phase Voltage Test Set and Commissioning Tool

The CMC 356 is the universal solution for testing all generations and types of protection relays. Its powerful six current sources (three-phase mode: up to 64 A / 860 VA per channel) with a great dynamic range, make the unit capable of testing even high-burden electromechanical relays with very high power demands. Commissioning engineers will particularly appreciate the possibility to perform wiring and plausibility checks of current transformers, by using primary injection of high currents from the test set. The CMC 356 is the first choice for applications requiring the highest versatility, amplitude and power.

Operation: PC or CMControl

Technical Data[1]

Current generators		
Setting range	6-phase AC (L-N)	6 x 0 ... 32 A
	3-phase AC (L-N)	3 x 0 ... 64 A (Group A II B)
	1-phase AC (LL-LN)	1 x 0 ... 128 A (Group A II B)
	DC (LL-LN)	1 x 0 ... ±180 A (Group A II B)
Power[2]	6-phase AC (L-N)	6 x 430 VA typ. at 25 A 6 x 250 W guar. at 20 A
	3-phase AC (L-N)	3 x 860 VA typ. at 50 A 3 x 500 W guar. at 40 A
	1-phase AC (LL-LN)	1 x 1000 VA typ. at 80 A 1 x 700 W guar. at 80 A
	1-phase AC (L-L)	1 x 1740 VA typ. at 50 A 1 x 1100 W guar. at 40 A
	1-phase AC (L-L-L-L)	1 x 1740 VA typ. at 25 A 1 x 1100 W guar. at 20 A
	DC (LL-LN)	1 x 1400 W typ. at ±80 A 1 x 1000 W guar. at ±80 A
		
		
Accuracy[3]		Error < 0.05 % rd.[4] + 0.02 % rg.[4] typ. Error < 0.15 % rd. + 0.05 % rg. guar.
Distortion (THD+N)[5]		< 0.05 % typ., < 0.15 % guar.
Resolution		1 mA
Max. compliance voltage (L-N)/(L-L)/(L-L-L-L)		35 Vpk / 70 Vpk / 140 Vpk
Connection banana sockets		4 mm (0.16 in) banana sockets (32 A continuously)
Connection combination socket		Group A only (25 A continuously max.)

Voltage generators		
Setting range	4-phase AC (L-N)	4 x 0 ... 300 V (VL4(t) automatically calculated: VL4 = (VL1+VL2+VL3)*c or freely programmable)
	3-phase AC (L-N)	3 x 0 ... 300 V
	1-phase AC (L-L)	1 x 0 ... 600 V
	DC (L-N)	4 x 0 ... ±300 V
Power	3-phase AC (L-N)	3 x 100 VA typ. at 100 ... 300 V 3 x 85 VA guar. at 85 ... 300 V
	4-phase AC (L-N)	4 x 75 VA typ. at 100 ... 300 V 4 x 50 VA guar. at 85 ... 300 V
	1-phase AC (L-N)	1 x 200 VA typ. at 100 ... 300 V 1 x 150 VA guar. at 75 ... 300 V
	1-phase AC (L-L)	1 x 275 VA typ. at 200 ... 600 V 1 x 250 VA guar. at 200 ... 600 V
	DC (L-N)	1 x 420 W typ. at ±300 V 1 x 360 W guar. at ±300 V
		
Accuracy		Error < 0.03 % rd.[4] + 0.01 % rg.[4] typ. at 0 ... 300 V Error < 0.08 % rd. + 0.02 % rg. guar. at 0 ... 300 V
Distortion (THD+N)[5]		0.015 % typ., < 0.05 % guar.
Ranges		150 V / 300 V
Resolution		5 mV / 10 mV in range 150 V / 300 V
Connection		4 mm (0.16 in) banana sockets / combination socket (1,2,3,N)

Generators, general		
Frequency	Range sine signals[6]	10 ... 1000 Hz
	Range harmonics / interharmonics	Voltage: 10 ... 3000 Hz[7] Current: 10 ... 1000 Hz
	Range transient signals	DC ... 3.1 kHz[7]
	Accuracy / drift	±0.5 ppm / ±1 ppm
	Resolution	< 5 µHz
Phase	Angle range	-360° ... +360°
	Resolution	0.001°
	Error at 50 / 60 Hz	Voltage: 0.02° typ., < 0.1° guar. Current: 0.05° typ., < 0.2° guar.[3]
Bandwidth (-3 dB)		3.1 kHz

[1] All data specified are guaranteed, except where indicated otherwise. OMICRON guarantees the specified data for one year after factory calibration, within 23 °C ±5 °C (73 °F ±10 °F) in the frequency range from 10 to 100 Hz and after a warm-up phase > 25 minutes
[2] Typical AC values valid for inductive loads (e.g. e/m relays)
[3] Rload: 0 ... 0.5 Ω
[4] rd. = reading, rg. = range
[5] THD+N: Values at 50/60 Hz, > 1 A / 20 V with 20 kHz bandwidth
[6] For current outputs amplitude derating at > 380 Hz
[7] Amplitude derating at > 1000 Hz

Low level outputs [1]	
Number of outputs	6 (12 with Option LLO-2)
Setting range	0 ... ±10 Vpk
Max. output current	1 mA
Accuracy	error < 0.025 % typ., < 0.07 % guar.at 1 ... 10 Vpk
Resolution	250 µV
Distortion (THD+N) [2]	< 0.015 % typ., < 0.05 % guar.
Unconventional CT/VT simulation	linear, Rogowski (transient and sinewave)
Overload indication	yes
Isolation	SELV
Usability	completely independent from internal amplifier outputs
Connection	16 pin combination socket (rear side)
Auxiliary DC supply	
Voltage ranges	0 ... 264 VDC, 0.2 A / 0 ... 132 VDC, 0.4 A / 0 ... 66 VDC, 0.8 A
Power	max. 50 W
Accuracy	error < 2 % typ., < 5 % guar
Binary inputs	
Number	10
Trigger criteria	Toggling of potential-free contacts or DC voltage compared to threshold voltage
Input characteristics	0 ... ±300 VDC threshold or potential-free If equipped with ELT-1 [3]: 0 ... ±600 VDC threshold or potential-free
Ranges	20 V / 300 V If equipped with ELT-1 [3]: 100 mV / 1 V / 10 V / 100 V / 600 V
Resolution of threshold	50 mV (0 ... 20 V), 500 mV (20 V ... 300 V) ELT-1 [3]: ±2 mV, ±20 mV, ±200 mV, ±2 V, ±20 V in ranges
Sample rate	10 kHz (resolution 100 µs)
Time stamping accuracy	±0.00015 % of rd.[5] ±70 µs
Max. measuring time	infinite
Debounce / Deglitch time	0 ... 25 ms / 0 ... 25 ms
Counting function	< 3 kHz at pulse width > 150 µs
Galvanic isolation	5 galvanically isolated groups (2+2+2+2+2)
Max. input voltage	CAT IV / 150 V, CAT III / 300 V, transient immunity 2 kV If equipped with ELT-1 [3]: CAT IV / 150 V, CAT III / 300 V, CAT II / 600 V (850 Vpk)
Counter inputs 100 kHz	
Number	2
Max. counting frequency	100 kHz
Pulse width	> 3 µs
Threshold voltage	6 V
Voltage hysteresis	2 V
Max. input voltage	±30 V
Isolation	SELV
Connection	16 pin combination socket (rear side)
Trigger on overload	
Supported generators	Current generators
Timer accuracy	error < 1 ms

Binary outputs, relays	
Type	Potential-free relay contacts, software controlled
Number	4
Break capacity AC	Vmax: 300 VAC / Imax: 8 A / Pmax: 2000 VA
Break capacity DC	Vmax: 300 VDC / Imax: 8 A / Pmax: 50 W
Binary outputs, transistor	
Type	Open collector transistor outputs
Number	4
Update rate	10 kHz
Imax	5 mA
Connection	16 pin combination socket (rear side)
DC voltage measuring input (If option ELT-1 is equipped [3])	
Measuring range	0 ... ±10 V
Accuracy	Error < 0.003 % rg. [5] typ., < 0.02 % rg. guar.
Input impedance	1 MΩ
DC current measuring input (If option ELT-1 is equipped [3])	
Measuring range	0 ... ±1 mA, 0 ... ±20 mA
Accuracy	Error < 0.003 % rg. [5] typ., < 0.02 % rg. guar.
Input impedance	15 Ω
Analog AC+DC measuring inputs (If option ELT-1 is equipped [3,4])	
Type	AC + DC analog voltage inputs (current measurement with external current clamps or shunt resistors)
Number	10
Nominal input ranges (RMS values)	100 mV, 1 V, 10 V, 100 V, 600 V
Amplitude accuracy	Error < 0.06 % typ., < 0.15 % guar.
Bandwidth	DC ... 10 kHz
Sampling frequency	28.44 kHz, 9.48 kHz, 3.16 kHz
Input impedance	500 kΩ // 50 pF
Transient input buffer at 28 kHz	3.5 s for 10 input channels 35 s for 1 input channel
Transient input buffer at 3 kHz	31 s for 10 input channels 5 min. for 1 input channel
Transient trigger	Threshold voltage, power quality trigger: sag, swell, harmonic, frequency, frequency change, notch
Measurement functions	I (AC + DC), V (AC + DC), phase, frequency, power, harmonics, transient-, event- and trend recording
Input overload indication	Yes
Input protection	Yes
Max. input voltage	CAT IV / 150 V, CAT III / 300 V, CAT II / 600 V (850 Vpk)
Galvanic isolation	5 groups (2+2+2+2+2)
Time synchronization	
Timing accuracy (voltage/current) IRIG-B synchronization with CMIRIG-B GPS synchronization with CMGPS 588	 Error < 1/5 µs typ., < 5/20 µs guar. Error < 1/5 µs typ., < 5/20 µs guar.
To external voltage	Reference signal on binary input 10: 15 ... 70 Hz
Precision Time Protocol (PTP)	IEEE 1588-2008 IEEE C37.238-2011 (Power Profile)
With the unique PermaSync functionality, analog and Sampled Values outputs stay permanently in sync with the internal CMC time reference. When a CMC is time-synchronized (IRIG-B, GPS, or PTP), the output quantities are continuously synchronized to the external time source. With CMIRIG-B it is also possible to transmit the internal PPS signal of the CMC to the device under test (e.g. PMUs or IEDs stimulated with a synchronized Sampled Values data stream).	

[1] For directly testing relays with low level inputs by simulating signals from non conventional CTs and VTs with low level interfaces and for controlling external amplifier units

[2] THD+N: Values at 50/60 Hz, 20 kHz measurement bandwidth, nominal value, and nominal load

[3] The ELT-1 hardware option turns the ten binary inputs into multifunctional analog AC and DC voltage measuring inputs and adds two DC measuring inputs (0 … 10 V / 0 … 20 mA) for transducer testing

[4] Up to three inputs can be used for measuring RMS values, frequency, and phase angle without the EnerLyzer software license. Full functionality requires EnerLyzer software license

[5] rd. = reading, rg. = range

Technical Data CMC 356 (continued)

IEC 61850 GOOSE [1]	
Simulation	Mapping of binary outputs to data attributes in published GOOSE messages. Number of virtual binary outputs: 360 Number of GOOSEs to be published: 128
Subscription	Mapping of data attributes from subscribed GOOSE messages to binary inputs. Number of virtual binary inputs: 360 Number of GOOSEs to be subscribed: 128
Performance	Type 1A; Class P2/3 (IEC 61850-5). Processing time (application to network or vice versa): < 1 ms
VLAN support	Selectable priority and VLAN-ID
IEC 61850 Sampled Values (Publishing) [1]	
Specification	According to the "Implementation Guideline for Digital Interface to Instrument Transformers Using IEC 61850-9-2" of the UCA International Users Group
Sampling Rate	80 samples per cycle for nominal frequencies of 50 Hz and 60 Hz.
Synchronization	Synchronization attribute (smpSynch) is set when the CMC is in synchronized operation mode. Sample count (smpCnt) zero is aligned with top of the second. Accuracy data see above
VLAN support	Selectable priority and VLAN-ID
Max. number of SV streams	2 (with option LLO-2: 3 SV streams)
Power supply	
Nominal input voltage [2]	100 – 240 VAC, 1-phase
Permissible input voltage	85 ... 264 VAC
Nominal frequency	50/60 Hz
Permissible frequency range	45 ... 65 Hz
Rated current	12 A at 115 V / 10 A at 230 V
Connection	Standard AC socket (IEC 60320)
Environmental conditions	
Operation temperature [3]	0 ... +50 °C (+32 ... +122 °F)
Storage temperature	-25 ... +70 °C (-13 ... +158 °F)
Humidity range	Relative humidity 5 ... 95 %, non-condensing
Vibration	IEC 60068-2-6 (20 m/s² at 10 ... 150 Hz)
Shock	IEC 60068-2-27 (15 g/11 ms half-sine)
Safety standards, electromagnetic compatibility	
EMC	The product adheres to the electromagnetic compatibility (EMC) Directive 2004/108/EC (CE conform).
International	IEC 61326-1; IEC 61000-6-4; IEC 61000-3-2/3
USA	FCC Subpart B of Part 15 Class A
Safety	The product adheres to the low voltage Directive 2006/95/EC (CE conform).
International / USA	IEC 61010-1 / UL 61010-1
Canada	CAN/CSA-C22.2 No 61010-1-04

Miscellaneous	
Weight	16.8 kg (37.0 lbs)
Dimensions (W x H x D, without handle)	450 x 145 x 390 mm (17.7 x 5.7 x 15.4 in)
PC connection	Two PoE [4] Ethernet ports: • 10/100 Mbit/s (10/100 Base-TX, auto-crossover) • IEEE 802.3af compliant • Port capability limited to one Class 1 (3.84 W) and one Class 2 (6.49 W) powered device USB 2.0 port: • Full speed (Type B connector)
Signal indication (LED)	> 42 V for voltage and current outputs and AUX DC
Connection to ground (earth)	4 mm (0.16 in) banana socket (rear side)
Hardware diagnostics	Self diagnostics upon each start-up
Galvanically separated groups	The following groups are galvanically separated from each other: mains, voltage amplifier output, current amplifier group A/B, auxiliary DC supply, binary/analog input
Protection	All current and voltage outputs are fully overload and short circuit proof and protected against external high-voltage transient signals and over temperature
Certifications	
	Developed and manufactured under an ISO 9001 registered system

Ordering Information

CMC 356 with Test Universe software	
VE002801	CMC 356 Basic
VE002802	CMC 356 Protection
VE002803	CMC 356 Advanced Protection
VE002825	CMC 356 Recloser

CMC 356 with CMControl (without Test Universe software)	
VE002820	CMC 356 with CMControl P
VE002824	CMC 356 with CMControl R
VE002826	CMC 356 with CMControl P App activation key

The CMControl can also be ordered as add-on together with a CMC 356 with Test Universe software or as a later upgrade.

CMC 356 hardware options	
VEHO2801	Option ELT-1 if ordered with a new unit
VEHO2802	Option ELT-1 if ordered as an upgrade
VEHO2803	Option LLO-2 if ordered with a new unit
VEHO2804	Option LLO-2 if ordered as an upgrade

[1] The GOOSE and Sampled Values functionality require software licences for the respective configuration modules
[2] For line input voltages below 230 V, a derating of the simultaneously available sum output power of the voltage/current amplifiers and the AuxDC will occur All other technical specifications (e.g. the maximum output power of a single amplifier) are not affected
[3] For an operational temperature above +30 °C (+86 °F) a duty cycle of down to 50 % may apply
[4] PoE = Power over Ethernet