

CMS7000



PROCOM

The optimum operation of an electrical network depends particularly on the reliability and the availability of the protection, measuring and automation devices, and the manner in which these devices can communicate the information in their possession.

PROCOM, CEE's new modular system, satisfies these criteria by providing the possibility of using either separately or in an integrated system all of the intelligent functions of an electrical cubicle: Protection, Measurement, Automation, Communication.

CEE's exceptional experience in the field of network protection using static relays (more than 400,000 units in operation throughout the world) enabled our engineers to define, develop and manufacture PROCOM to the standards of quality and concepts of technical innovation which have been the foundation of CEE's reputation over the past 30 years.

PRINCIPLE AND APPLICATIONS OF THE CMS7000

Devices in the CMS 7000 series perform the “measurement” functions of the PROCOM system. Installed in the control room or directly on an electrical cubicle, their task is to measure or calculate approximately 90 electrical quantities relevant to the rational operation of a three-phase energy network.

Two models are available in the range, depending on the number of VTs which are used:

- CMS7004 when the three phase-to-neutral voltages are accessible.
- CMS7003 when two of the three phase-to-phase voltages are accessible.

Using digital microprocessor technology, the CMS7000 operate on the principle of sampling the input signals, voltage and current, in order to calculate their harmonic spectra up to the 7th harmonic, employing a Fast Fourier Transformation (FFT).

These powerful measuring principles and methods can provide an appreciation of the “pollution” of an electrical network and enable the true “rms” value of any quantity, whether fundamental, harmonic or global, to be calculated.

All of the electrical quantities measured or calculated by the CMS7000 are defined in Table 1.

The cases of the CMS7000 provide three main series of advantages as follows:

Reliability and availability

The design and construction of equipment in the CMS7000 series respects the same standards of reliability and safety used by CEE for the manufacture of conventional static protection devices:

- conforming to the recommendations and standards of IEC 255,
- mechanical, fool-proof fouling pins on cases and bases, debugging and individual testing of certain critical components,
- component selection as a function not only of the thermal withstand but also of the withstand to overvoltages...
- withstand to severe environmental conditions: heat / humidity - 56 days, 41°C, 93% relative humidity.

In addition to these basic construction details, the CMS7000 devices incorporate an automatic self-supervision system which, together with the plug-in case facility, optimises their availability.

The automatic self-supervision system intervenes at three different levels :

- detection of loss of auxiliary supply,
- detection of a microprocessor failure using a “watchdog”,
- detection of a breakdown of a microprocessor peripheral (such as RAM, EEPROM, etc.) by executing microdiagnostic programs.
- The user is warned of the operation of the automatic self supervision system by the closure of a dry contact brought out to terminals and/or as required by the interruption of the digital communication channels.

Adaptability and autonomy

As they are mounted in modular, plug-in, metallic cases type R, devices in the CMS7000 series may be used either:

- as independant modules
- as modules integrated into a rack cradle incorporating conventional static relays in the 7000 series
- as modules integrated into a rack cradle as an element of the PROCOM structure.

This flexible presentation means that the CMS7000 devices may be easily adapted to the user’s real technical and economic requirements and can, for example, be inserted into existing schemes and

installations.

The CMS7000’s autonomous and flexible nature is further reinforced by the fact that it can, without the use of special devices, be connected to a source of AC or DC auxiliary supply having a very wide range of tolerance (38 to 250 V, or 20 to 66 V).

Power and flexibility of the communications

The CMS7000 series communicates with the external world in four major ways:

• Local communication

Dialogue between the user and the equipment is ensured by means of a keyboard on the device itself, which may be used to set up and read back all of the quantities in memory, or those calculated or measured by the CMS7000.

An easily readable LED display unit enables the user to have direct readout of the electrical quantities in true primary values.

Four programmable choices of readout are available to the user: 2 “fixed” modes for the readout of a parameter or an electrical quantity, and 2 “automatic rotation” modes for successive readout of 4 or 6 electrical quantities. Consulting the different data is performed using the CMS7000 keyboard or remotely using a telecontrol which avoids the faceplate being removed by an operator not used to this procedure.

• Communication by digital channels

The CMS 7000 contains two digital serial communication channels of the RS-232-C / DB25 or current loop (0 - 20 mA). The choice is at the user’s discretion, simply using a switch.

The RS-232-C / DB25 outlet can be used for direct connection (either by galvanic connection or via fibre optics) to a PC (microcomputer).

The current loop terminals (0 - 20 mA) may be used to incorporate the unit into a communications network controlled by a PC or other device. All data available locally, whether measured or introduced as an input, may be transmitted to a remote location.

• Communication by “all or nothing” channels

The CMS 7000 are fitted with electromagnetic output units to provide trip or load shedding, recording or alarm signals :

- trip or load shedding: an electromagnetic output unit with a dry contact can provide a trip or load-shedding signal if a set-level (programmed by the user) of mean “rms” current I or active power P is exceeded.

*Please consult us.

- remote recording: active energy in MWh may be recorded remotely using a relay which produces pulses at a rhythm defined in the “GENERAL CHARACTERISTICS” section
- local recording: by pressing on the “TRACE” key or by closing an external contact, it is possible to “freeze” all 6 usual electrical quantities (mean “rms” current and voltage I and V, active power P, reactive power Q, power factor $\cos \phi$, and frequency F, over a three second period around an event (2 seconds before and 1 second after). All of these quantities may subsequently be transferred to the digital communication channels.
- alarm: the closure of a dry contact available to the user gives an indication of the operation of the automatic self-supervision system.

• Communication by analogue channels

Two digital / analogic transducers (4 - 20mA current sources) with programmable outputs enable 2 of the 6 usual electrical quantities already mentioned above under “local recording” to be reproduced remotely in an analogue form.

OPERATION

Example of simplified operation and connection diagram

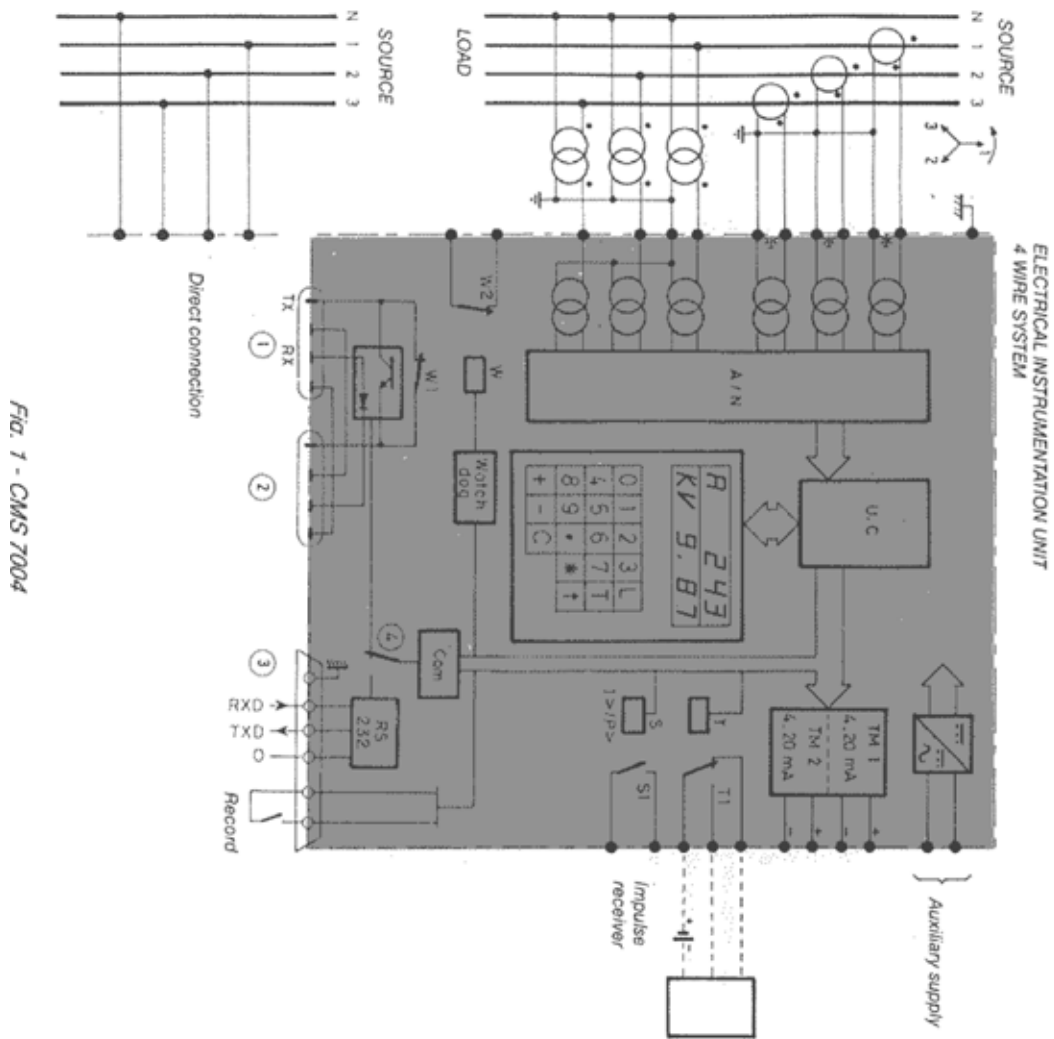


Fig. 1 - CMS 7004

Fig. 1 - CMS7004

CALCULATED ELECTRICAL QUANTITIES (continued)

6. Apparent power: key S <ul style="list-style-type: none"> • total "rms" three-phase • integrated demand on total three-phase (Note 2) • Maximum integrated demand (permanently registered every 12 hours) • "deforming" power per phase 	S	MVA	X	X
	< S >	MVA	X	X
	< S > M X	MVA	X	X
	P D -	MVA	NO	X
7. Energy: key energ. <ul style="list-style-type: none"> • flow on active power in normal direction* • flow on active power in inverse direction* • flow on reactive power in normal direction* • flow on reactive power in inverse direction* <p>*permanently registered every 12 hours.</p>	MWH +		X	X
	MWH -		X	X
	MVARH +		X	X
	MVARH -		X	X
8. Frequency: key F				

Note 1: X - available on the device

Note 2: the period of integration, common to all of the electrical quantities, is adjustable from 5 to 60 min in steps of 1 min.

GENERAL CHARACTERISTICS

1. Input quantities <ul style="list-style-type: none"> • Frequency <ul style="list-style-type: none"> - nominal frequency FN - Operating range • Voltages <ul style="list-style-type: none"> - nominal Ph-N voltage VN - nominal Ph-Ph voltage UN - nominal operating range - permanent withstand - short-time thermal withstand - burden • Currents <ul style="list-style-type: none"> - nominal current IN - nominal operating range - permanent withstand - short-time thermal withstand - burden • Auxiliary supply <ul style="list-style-type: none"> - Range - Burden 	50 / 60 Hz 40 - 70 Hz 100/√3 - 110/√3 - 220 Vac CMS7004 100 - 110 - 380 Vac CMS7003 0.5 to 1.5 VN / UN 1.5 VN UN 2 VN / UN - 10 s < 0.3 VA per phase at VN / UN 1 A or 5 A 0 to 1.5 IN 2 IN 80 IN 1 s - 20 IN for 3 s < 0.3 VA per phase at IN 20 to 66 Vdc 38 to 250 Vdc or Vac 50 / 60 Hz ~ 11 W dc ~ 18 VA ac
2. Output quantities <ul style="list-style-type: none"> • Analogue outputs TM1 and TM2 <ul style="list-style-type: none"> - output current Is - output load - influence of load resistance - maximum output voltage - peak-to-peak ripple at 20 mA / 1 kΩ - quantities which can be transmitted via TM1 and TM2 - correspondence between quantities and output currents Is 	4 to 20 mA 0 to 1 kΩ < 0.1 % ~27 V < 0.25% I MEAN, U MEAN, P, Q, COS φ, F and S

Is	+4 mA	+ 12 mA	+ 20 mA	Precision class index
I MEAN	0	0.75 IN	1.5 IN	0.5
V MEAN	0	0.75 IN	1.5 IN	0.5
P	- 1.25 PN	0	+ 1.25 PN	1
Q	- 1.25 QN	0	+ 1.25 QN	1
S	0	0.75 SN	1.5 SN	1
COS PHI	0 -----CAP+	-----1-----	IND+	0
F FN = 50 Hz	40 Hz	50 Hz	60 Hz	0.5
F FN = 60 Hz	50 Hz	60 Hz	70 Hz	0.5

• Tripping or load shedding level

- quantities which may be used for this level
- operating time
- adjustment range
- drop-out level
- precision class index
- contact characteristic

• Watchdog alarm relay

- relay is normally picked up in a quiescent state, dropping off for an abnormal condition
- contact characteristics:
 - maximum voltage
 - max permanent current
 - closing current (0.2 s)
 - breaking current:
 - dc (L/R = 40 ms)
 - ac (cos φ = 0.4)

• Pulse relay: MWh transmission

- output contacts
- contact operating capacity
- pulse width
- correspondence between nominal apparent power and kWh / pulse

I MEAN, P+, P-
500 to 800 ms
1 to 120 % of nominal
97 % of nominal
0.5 % of nominal or 10 % of setting
1 NO (see Watchdog alarm relay)

1 NC
600 V
5 A
10 A

50 W (1 A / 48 Vdc - 0.5 A / 110 Vdc)
1250 VA; 1 < 3 A

1 changeover
100 V / 0.1 A DC max.
120 ms

SN	kWh / pulse
100 kVA to 1 MVA	1
1 MVA to 10 MVA	10
10 MVA to 100 MVA	100

3. Digital communication

- Support
- Information exchange protocol
- Operating speed

2 switchable channels, each with its own outputs:

- current loop 0-20 mA
- DB25 / RS232C

 Master / slave, as required J-BUS or other standard.
1200 - 2400 - 4800 bauds (programmable)

4. Nominal ranges of influencing factors

- temperature
- auxiliary voltage

-10°C to +55°C
20 to 66 Vdc
38 to 250 Vdc or ac 50 / 60 Hz

5. Measurements

• Voltages

- nominal primary value
- resolution (of adjustments and settings)
- precision class index

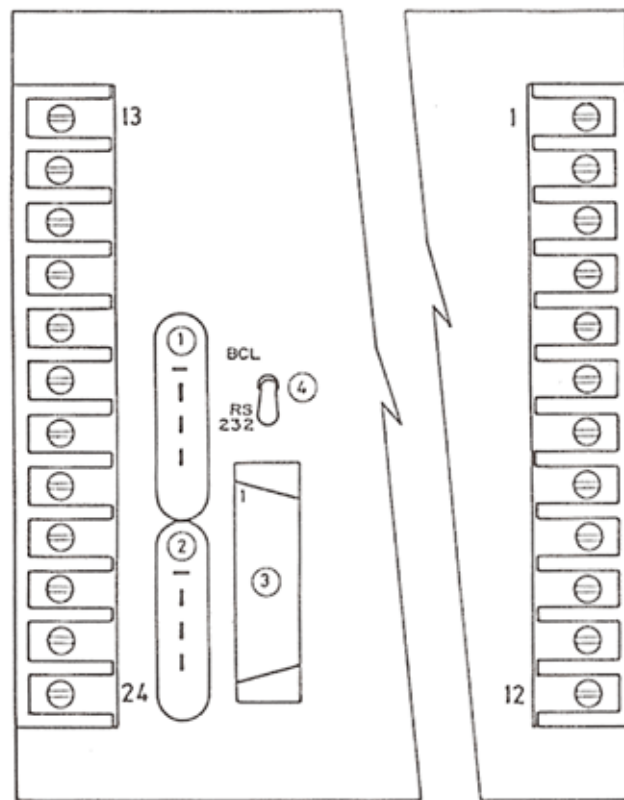
VN/UN: adjustable 0.100 kV to 1000 kV
1 V from 0.100 kV to 10 kV
10 V from 10 kV to 100 kV
100 V from 100 kV to 1000 kV
0.5 (on measured voltages)

• Currents

- nominal primary value
- resolution (of adjustments and settings)

IN - adjustable from 10 A to 100 kA
1 A from 10 A to 10 kA
10 A from 10 kA to 100 kA

<ul style="list-style-type: none"> • Currents (suite) <ul style="list-style-type: none"> - precision class index - permanent register of max • Power factors <ul style="list-style-type: none"> - measured range - resolution - precision class index • Power P - Q - S <ul style="list-style-type: none"> - measured range - resolution - extent of measurement - precision class index - permanent register of max • Energy <ul style="list-style-type: none"> - maximum values stored - precision class index - permanent register • Frequency <ul style="list-style-type: none"> - measured range - resolution - precision class index 	<p>0.5 every 12 hours</p> <p>4 quadrants (2 quadrants for analogue transducers) 0.01 1</p> <p>100 k* to 100 M * 0.1 k* from 100 k* to 1 M* 1 k* from 1 M* to 10 M* 10 k* from 10 M* to 100 M* *W or var or VA</p> <p>0 to (1.5 UN) x (1.5 IN) x 3 1 every 12 hours</p> <p>1 kWh / pulse: 10⁸ kWh 10 kWh / pulse: 10⁹ kWh 100 kWh / pulse: 10¹⁰ kWh</p> <p>1 every 12 hours</p> <p>40 to 70 Hz for 0.6 UN < U < 1.5 UN 0.01 Hz 0.3</p>
<p>6. Relative variations within the following ranges::</p> <ul style="list-style-type: none"> • temperature • auxiliary supply <ul style="list-style-type: none"> - on readings - on analogue transducers - on telemetering - on operating level 	<p>-10°C to +55°C</p> <p>< 0.5 % < 0.02 % per 1°C < 0.5% < 0.5% of nominal</p>
<p>7. Insulation (according to CEI 255-5)</p> <ul style="list-style-type: none"> • dielectric withstand • impulse voltage withstand (except the DB 25/ RS-232-C socket) <ul style="list-style-type: none"> - common mode - differential mode • insulation resistance at 500 V 	<p>2 kV 1 minute DB25 / RS232C output: 500 V for 1 minute</p> <p>5 kV peak 1.2/50 µS 5 kV peak 1.2/50 µS > 10 000 MΩ</p>
<p>8. High frequency disturbance withstand</p> <ul style="list-style-type: none"> • (to CEI 255-22-1) except the DB 25 / RS-232-C socket <ul style="list-style-type: none"> - common mode - differential mode 	<p>2.5 kV 1 MHz class III 1 kV 1 MHz class III</p>
<p>9. Recommended transformers</p> <ul style="list-style-type: none"> • measuring CT • measuring VT <p>Note: the CMS7003 and 7004 may be used on protection class CTs (withstand is 80In, 1 sec), and the measuring accuracy will be dependent upon the precision class index of the CTs..</p>	<p>5 ou 10 VA precision class 0.5% 5 ou 10 VA precision class 0.5%</p>
<p>10. Case</p>	<p>R4</p>
<p>11. Identifying drawings</p> <ul style="list-style-type: none"> • CMS7003 • CMS7004 	<p>05 A2 03 A7</p>
<p>12. Weight</p>	<p>4.2 kg</p>
<p>13. Associated remote control unit TLC 7000 (in option)</p>	<p>05A6</p>



Rear view

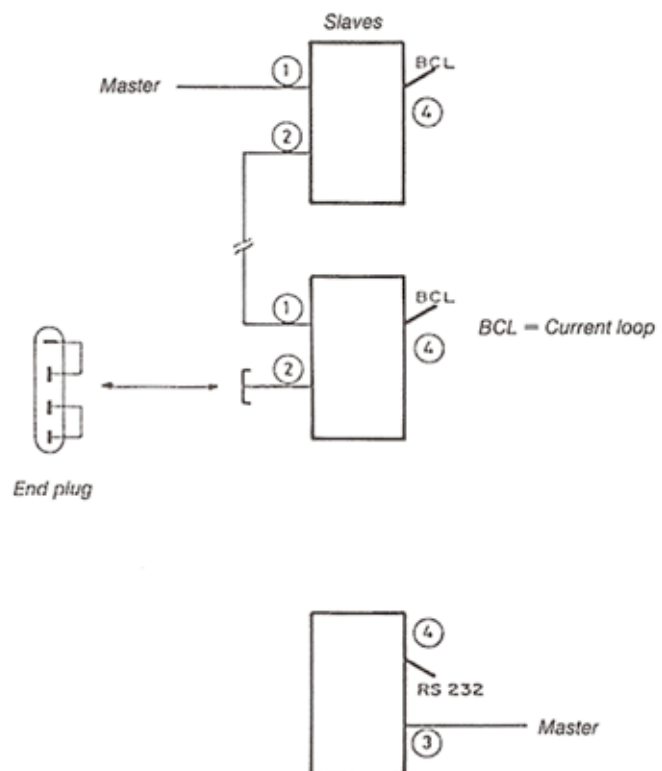
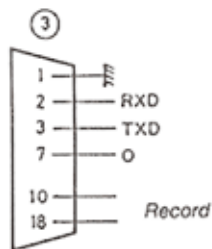
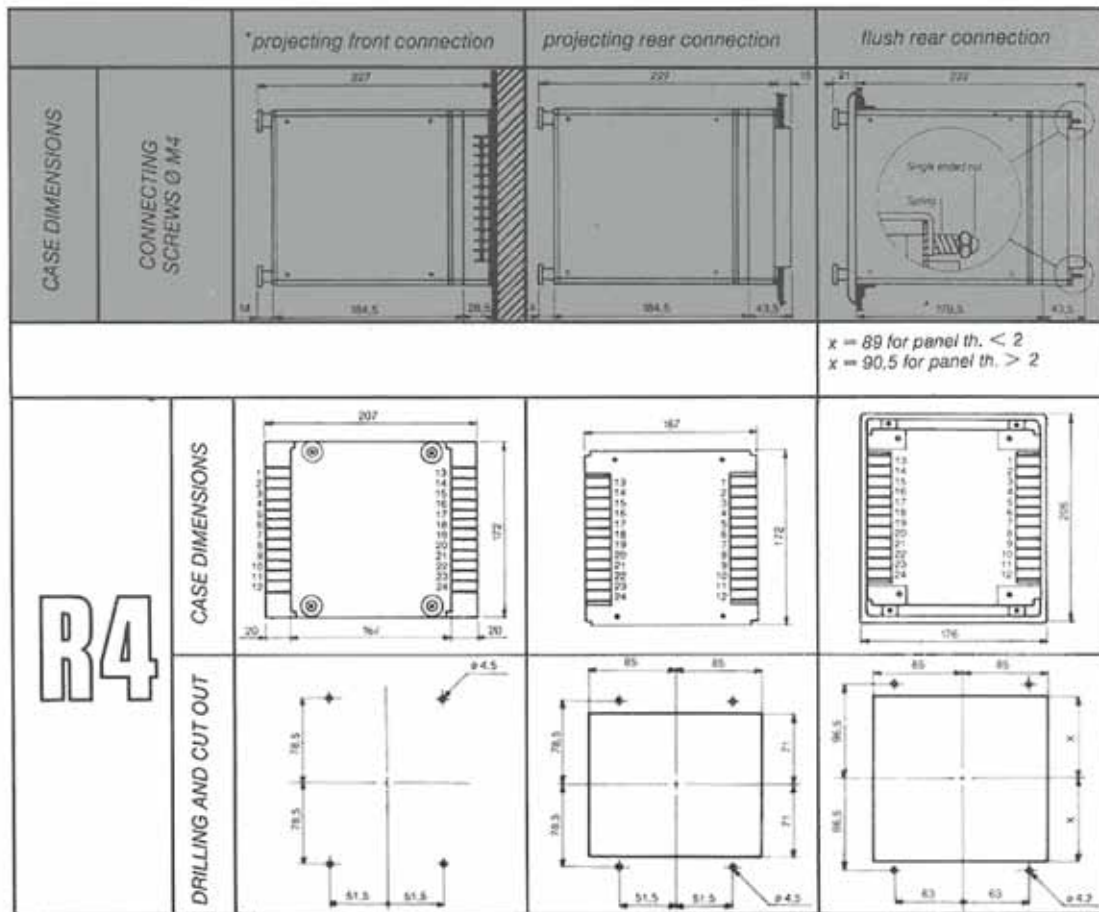


Fig. 2 Communication network and wiring diagram

CASE TYPE R4



*Only without communication



Set of 3 PROCOM cases mounted in 19" RACK with microcomputer connection.