



SUPPLY NETWORK ANALYZER

CVM-BC SERIES

INSTRUCTION MANUAL

(M 981 318 / 00A)

(c) CIRCUTOR S.A.

CVM-BC SUPPLY NETWORK ANALYZER - USER'S MANUAL

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1.- DELIVERY SPOT CHECK

This manual is issued to help all the CVM-96-SP users to install and use it in order get the best from it. After receiving the unit, please check the following points:

- (a) Does this device correspond to your order specifications?
- (b) Check if any damage was done during the shipment process.
- (c) Verify that it includes the correct instruction manual.



The manual you hold in your hands contains information and warnings about the **CVM-BC** that the user should respect in order to guarantee a proper operation of all the instrument functions and keep its safety conditions.

Before powering the instrument for the first time, verify following points:

(a) **Power supply: see rear part of your CVM-BC**

- Standard: 230 V a.c.** Single-phase, Frequency: 50 ... 60 Hz
- Other supply voltages, on request.

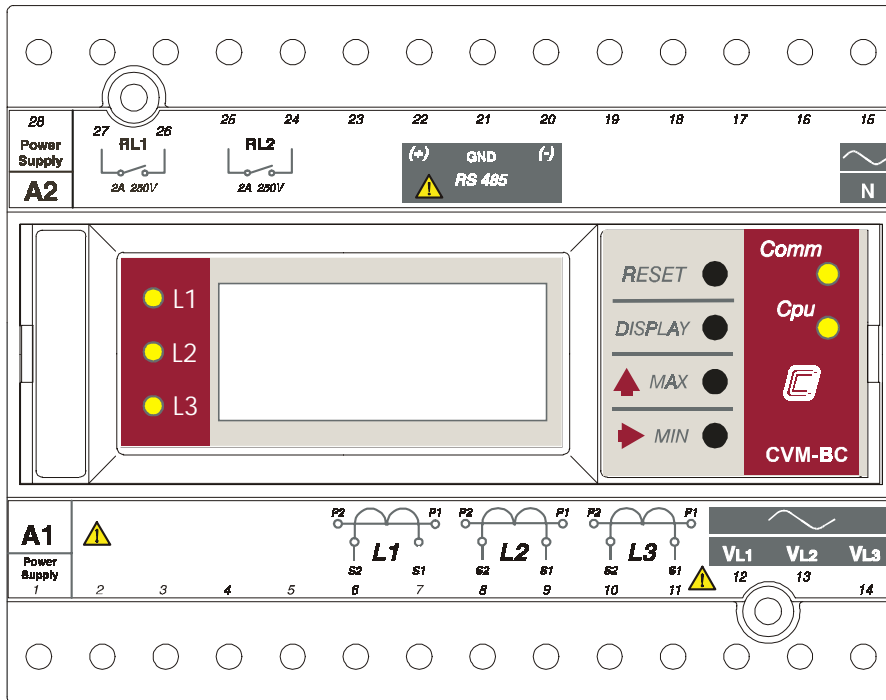
(b) Maximum measuring voltage:

- Standard : 300 V a.c. Phase-to-Neutral / 520 V a.c. Phase-to-Phase**
- Other models: on request
 - *CVM-BC-measuring 500V: 500 Va.c. Phase-to-Neutral / 866 Va.c. Phase-to- Phase*

(c) Maximum measurable current: Current transformer of In / 5 A a.c.

2.- MAIN FEATURES

The CVM-BC power meter is a programmable measuring instrument, offering several operation possibilities selectable in its SET-UP option. Before power supplying the instrument, read the **CONNECTIONS** and **SET-UP** sections and choose the most suitable operation mode for getting your desired data.



The CVM-BC is an instrument which measures, calculates and displays all the main electrical parameters at any electrical network (balanced or not). The measuring is true RMS value, through three a.c. voltage inputs and three a.c. current inputs (from Current Transformers .../ 5A).

By means of an internal microprocessor it simultaneously measures:

<i>Parameter</i>	<i>Symbol</i>	<i>L1</i>	<i>L2</i>	<i>L3</i>	<i>Average</i>
Voltage (phase-neutral)	V	x	x	x	
Voltage (phase-phase)	V	x	x	x	
Current	A	x	x	x	
Active power	kW	x	x	x	x
Power factor	PF	x	x	x	x
Reactive power L	kvaL	x	x	x	x
Reactive power C	kvaC	x	x	x	x
Voltage THD	har-V	x	x	x	
Current THD	har-A	x	x	x	
Frequency	Hz	x			
Power demand	Md				x
kW.h	kWh				x
kvarh.L	kvaLh				x

The CVM-BC delivers readouts of all above listed parameters by means a two-row LCD display that simultaneously shows two parameters in every screen. A total of 32 parameter readouts can be visualized in 8 rotary screens.

OTHER FEATURES

- Low size instrument for DIN rail mounting.
- True R.M.S. measuring system.
- Instantaneous, maximum and minimum values of each measured parameter.
- Energy measurement .
- RS-485 type communication to a PC (according to the model)
- Harmonic distortion measurement (THD-V & THD-A).

3.- INSTALLATION AND START-UP



The manual you hold in your hands contains information and warnings that the user should respect in order to guarantee a proper operation of all the instrument functions and keep its safety conditions. The instrument must not be powered and used until its definitive assembly on the cabinet's door.

Whether the instrument is not used as manufacturer's specifications, the protection of the instrument can be damaged.

When any protection failure is suspected to exist (for example, it presents external visible damages), the instrument must be immediately powered off. In this case contact a qualified service representative.

3.1.- Installation.

Before powering the instrument for the first time, verify following points:

a.- **Power supply: see rear part of your CVM-BC**

- Standard supply** : *Single-phase 230 V ~ (a.c.)*
- On request: other voltages*

- *Frequency* : *50 - 60 Hz*
- *Supply voltage tolerance* : *- 10 % / + 15*
- *Connection terminal* : *Terminals 1 - 28 (Power supply)*
- *Burden* : *5 VA*

b.- Maximum voltage at the voltage measuring circuit:

- Standard** : **300 V a.c. phase-to-neutral / 520 V a.c. phase-to-phase**
35 to 65 Hz
- Other models on request :*
-CVM-BC -measuring 500 V: 500 Va.c. phase-to-neutral /866 Va.c. phase-to-phase


c.- Maximum allowable current : Current Transformer of In / 5 A a.c.


d.- Operation conditions :

- Operation temperature range: -10 to +50 °C
- Humidity : 5 to 95 % RH non-condensing
- Height : until 2000 m

e.- Safety:

- Designed to meet protection class III- 300 V a.c. as (EN 61010).

- Protection against electric shock by class II double insulation 

Installation : 

The instrument is to be fit onto a DIN 46277 (EN 50022) rail . All connections keep inside the cabinet.

Note that with the instrument powered on, the terminals could be dangerous to touching and cover opening actions or elements removal may allow accessing dangerous parts. Therefore, the instrument must not be used until this is completely installed.

The instrument must be connected to a power supply circuit protected with gl type (IEC 269) or M type fuses rated between 0.5 and 2 A. This circuit should be provided with a circuit breaker or any equivalent element to connect (ON) or disconnect (OFF) the instrument from the power supply network. The supply and measuring voltage circuits will be both connected through a wire with a minimum cross-section of 1 mm².

The line of the current transformer secondary will have a minimum cross-section of 2,5 mm².

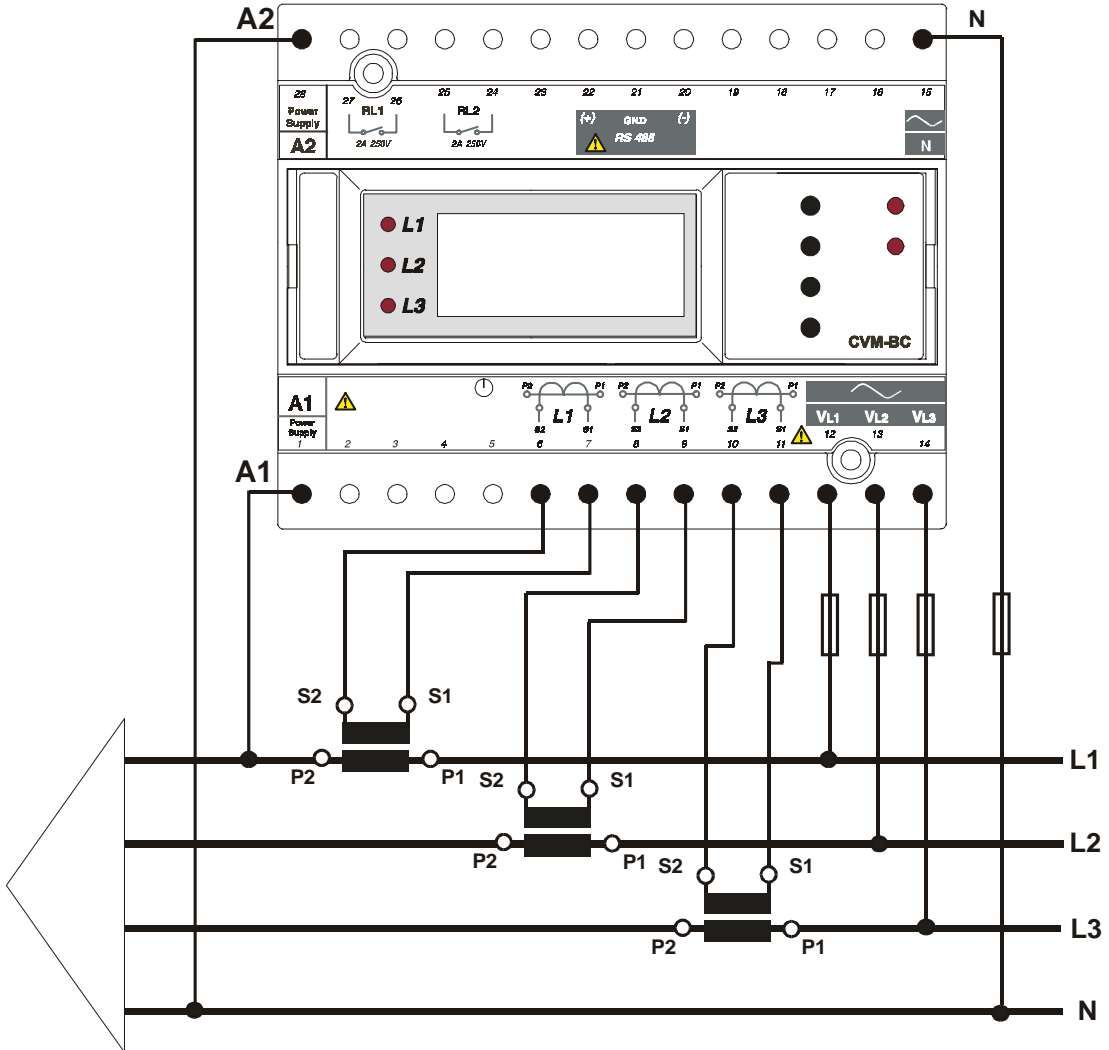
3.2.- CVM-BC Connection terminal (see table on the rear part)

Terminal No.	Denomination	Concept
1 - 28	Power Supply A1 - A2	Power supply at 230 V a.c.
27 - 26	Acc. the model	Relay No. 1 output
25 - 24	Acc. the model	Relay No. 2 output
22 21 20	(+) GND (--)	COM1 CVM-BC : RS-485 link to PC. 22 + -----> 1 (+) 21 GND -----> 5 RS-485/RS-232 20 -- -----> 2 (--) converter
15	N	NEUTRAL
14	VL3	Voltage signal from phase L3
13	VL2	Voltage signal from phase L2
12	VL1	Voltage signal from phase L1
11 - 10	I L3: s1 - s2	Current signal from phase L3 .../ 5 A
9 - 8	I L2: s1 - s2	Current signal from phase L2 .../ 5 A
7 - 6	I L1: s1 - s2	Current signal from phase L1 .../ 5 A

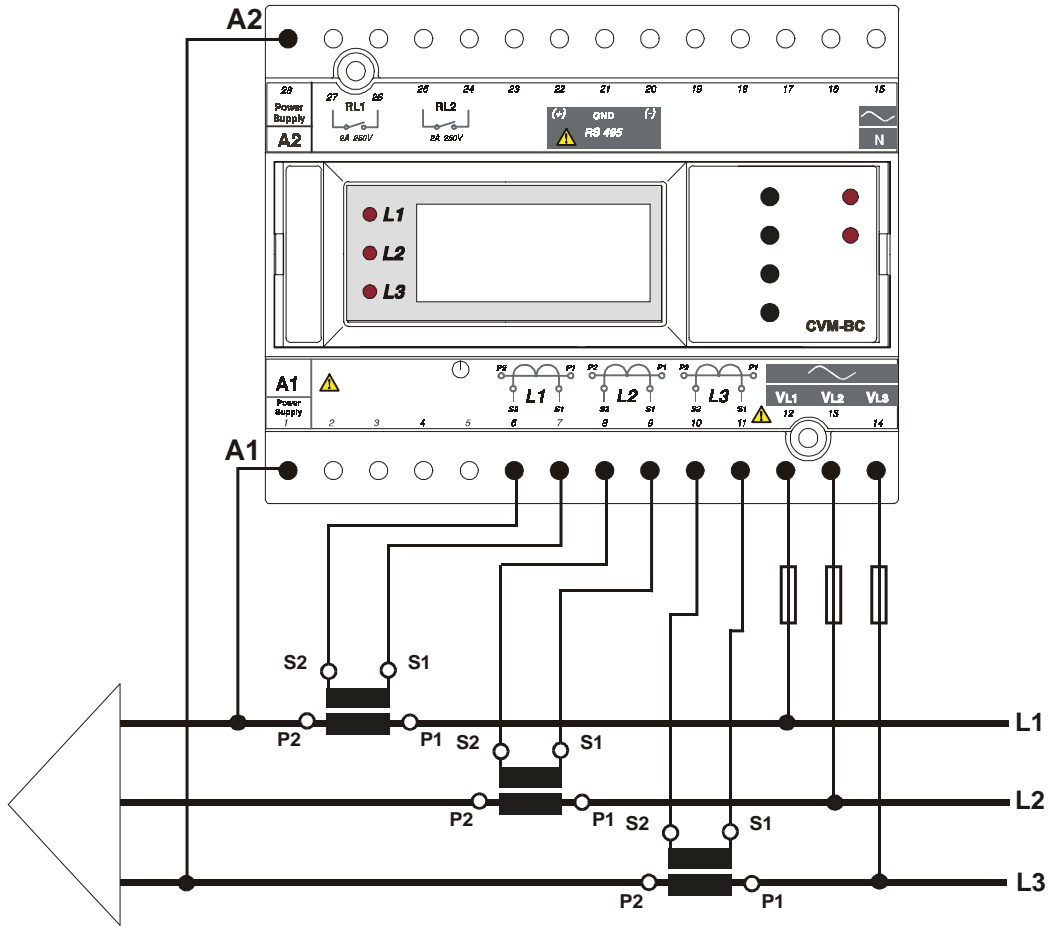
NOTE: ... / 5 A current inputs are isolated for the ITF model.

3.3.- Connection drawing for the CVM-BC :

a.- Three-phase network.- 4 wires (low voltage) :



b.-Three-phase network – 3 wires (low voltage):

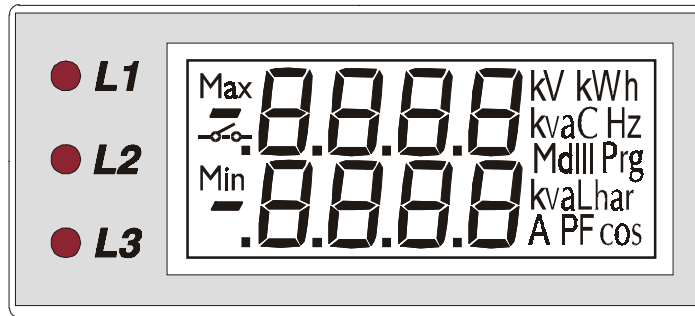


IMPORTANT REMARK! If power = -0.01 is shown for any of the phases (codes 03, 09 and 15) and voltage and current are not zero for this phase, check out following points:

- Assure that L1, L2 and L3 phases coincide in voltage and current.
- Correct polarity? Reverse the current transformer placed at this phase.

4.- OPERATION MODE

The power meter is equipped with a 2-row LCD display:



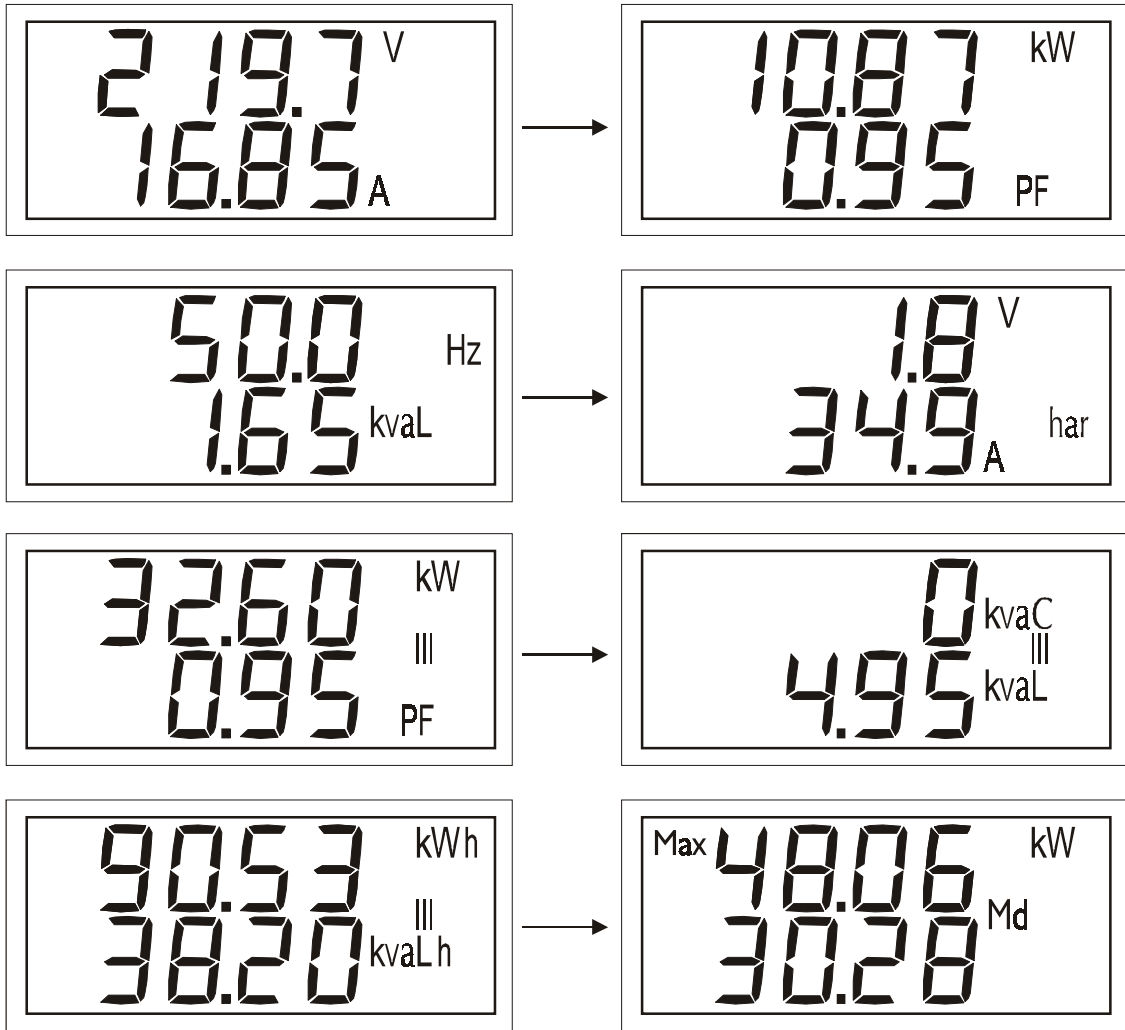
When the CVM-BC is powered up, the display shows " xxxx ", so informing about the program version and the set-up. After some seconds, the analyzer is ready for operation and shows one of the available screens. A led next to the shown parameter is on.

Display

Parameters on display can be switch by pressing the key "Display". Units of active parameters shown by display can also be read in the screen.

When values in display are values referred to one phase, an automatic rotation of three screens occurs in order to shown individual values for each phase, being leds on the left side (L1, L2 ó L3) alternatively lit on to indicate the reference phase, that is, when the first led (L1) is on, values on screen are readout from PHASE L1.

Pressing again the key "Display", two following parameter readouts will be shown in screen, and successively so.



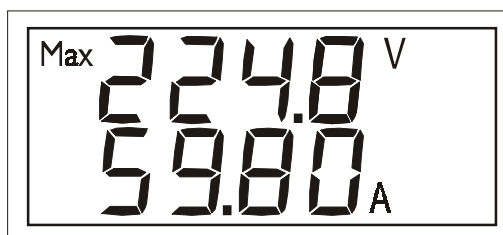
max

min

Pressing the "**max**" or "**min**" key, maximum or minimum values for the parameters being shown by display, respectively, appear in screen.

This function is only valid while you keep pressing the "**max**" or "**min**" key. If you stop pressing the key the instantaneous values will appear again after 5 seconds.

When maximum or minimum readouts are shown by display, the indication "Max" or "Min" will accordingly appear in screen.



reset

Pressing the "**reset**" key the system is reset. This is equivalent to switch off the power supply of the instrument. The maximum and minimum values recorded will be automatically deleted from the internal memory.

If you are in the set-up process and press the "**reset**" key, you exit it without saving any modification that you might have done (this event will depend on the set-up section that is accessed when the reset action is carried out) and reset of the system occurs.

5.- SET-UP PROCEDURE

The set-up procedure of the CVM-BC is performed by means of several SET-UP options.



For accessing the **set-up menu** the keys **max & min** must be simultaneously pressed once the instrument is at the main screen.

When accessing the **SET-UP**, the message "**SET-UP unloc**" (1) is shown for some seconds on screen, or, otherwise, the message "**SET-UP loc**" (2).

(1) **Set-up UNLOC** (SET-UP unlocked) : when the SET-UP is accessed, configuration parameters can be either visualized and modified.

(2) **Set-up LOC** (SET-UP locked) : when the SET-UP is accessed, configuration parameters can be visualized but cannot be modified .

Once into the SET-UP, use the keyboard to select different options and enter required variables:

- The key **Display** validates de value and pass to the next menu.
- The key **MAX** permits to select among different options in a menu, or to increase a digit when a variable is being entered.
- The key **MIN** permits to move the cursor along the digits.

Different options are following shown in a sequential mode:

- 1.- Choice of visualization of phase-to-neutral or phase-to-phase voltages
- 2.- Value of the current transformer primary : 1 a 10000 A
- 3.- Maximum power demand
 - 3.1.- Maximum power demand reference parameter : (kW or kVA)
 - 3.2.- Integration period for maximum power demand determination
 - 3.3.- Deleting the maximum power demand peak value
- 4.- Choice of default initial screen
- 5.- Deleting energy counters
- 6.- Choice of harmonic distortion determination mode: d% or THD%
- 7.- Setting alarms : RELAY 1 (OUT 1) & RELAY 2 (OUT 2)

5.1.- Phase-to-Phase or Phase-to-Neutral voltages

After the word "**set**" you will see on the three displays the voltages of the phases L1, L2, L3.

Volt P-n

Volt P-P

- Phase to Neutral Voltages: U1, U2, U3
- Phase to Phase Voltages : U12, U23, U31

a.- To select one of the voltage options just press the green key "**max**" and both options will appear alternately.

b.- When you get in the display the desired option just press the "**Display**" key to validate it and access to the next set-up option.

5.2.- Current Transformer Primary

"SET A P" and five digits appear on screen allowing us to set the primary of the current transformer.

PA00 005

a.- To enter or modify the value of the C.T.'s primary, just repeatedly press "**max**" to increase the value of the blinking digit.

b.- When the value in screen is the required, pass to the next digit by pressing "**min**", so that the whole value can be set.

c.- When the last digit blinks, pressing then "**min**" the first digit is again accessed, so that set value can be modified if required.

d.- To access next set-up option press "**Display**".

NOTES:

- The maximum programmable value is 10.000
- The secondary of the current transformers is not programmable. It is automatically set at 5 A (... / 5 A ac)

5.3.- Setting power demand utility screens.

The CVM-BC also incorporates the power demand monitoring function: the accumulated power demand is measured along a determined demand period.

This functions permits to set the parameter to be controlled (active power **kW** or apparent power **kVA**) and the demand integrating period (from 1 to 60 min).

This power demand function works with sliding window: shows the accumulated demand over the last period from "now"

Within the **Set1** menu, by pressing the key " **Display** ", following options successively appear in the CVM-BC screen:

1.- PARAMETER TO CONTROL ("Pd Code xx")

None		00
Three phase active power	kW III	16
Three phase apparent power	kVA III	34

Value of power integrated during the programmed demand period.

2.- DEMAND PERIOD (**1 to 60 min.**) ("Pd Per xx")

3.- CLEAR MAXIMUM VALUE IN MEMORY

("CLr Pd xx") **no** or **YES**

PROGRAMMING MODE:

- "**max**" key: allows choosing the different available options.
- "**min**" key: allows the validation of the blinking digit and go forward to the next digit (only for the "Pd Per xx" option).
- To pass to the next option press " **Display**".

If you don't want to modify anything, just press the " **Display**" key three times without modifying any value.

- **Visualization:** Once a parameter to be monitored have been selected (**kW or kVA**), the screen for the power demand readout is shown as follows:



- *MAXIMUM accumulated demand (from the last reset to zero action)*
- *Present power demand value (**sliding window**, accordingly the preset demand period) being refreshed every second.*

5.4.- Initial screen setting

Set here the initial screen to be shown by display when the CVM-BC is powered up (or a reset action is carried out) among available 8 screens.

Different pages are identified by means of parameters shown in the right side of the display:

dEF
PAGE

- The key "**max**": permits to modify the selected page.
- Press "**Display**" to validate the choice.

5.5.- Clearing energy counters

Use this option to delete the value of energy counters (active and reactive) .

On display we see "**CLR** kWh / kvaL h no" (Clear energy counters).

- "**max**": To select "YES" or "no".
- "**Display**": To validate the choice and pass to the following set-up option.

Display: If any of the energies is programmed (kWh or kvarh), it is displayed as follows:

Display	kW.h
[max]	MW.h
[min]	W.h

Example : If the accumulated energy is 32.534,810 kWh, it will be displayed as follows:

3	2	MW.h		
2	5	3	4	kW.h
8	1	0	W.h	

Display	2534 kW.h
[max]	32 MW.h
[min]	810 W.h

Note : the energy counter range is limited at **999.999.999 Wh** , that is, when the value of **1 GWh** is reached, the counter is reset to zero.

5.6.- THD or D setting

dHAR d

dHAR Thd

Two modes for the harmonic distortion calculation can be selected:

- **d %** : total value of the harmonic distortion referred to the fundamental value.
- **Thd %** : total value of the harmonic distortion referred to the R.M.S. value.

The selected option will be the one shown on screen.

a.- To select any option just press "**max**" to switch between the two available options.

b.- Press "**Display**" to validate the choice. Since all set-up options have been completed, the set-up is exited, all modifications are saved in memory, and the running mode automatically starts up.

5.7.- Additional screens when RELAY OUTPUTS (2 relays) are equipped

With these outputs the CVM-BC...C2 can be set to deliver:

A.- **Pulse every certain kWh or kvarh (ENERGY)**. You can define the value corresponding to the energy consumed for generating a pulse (0.5 s long): kWh / 1 pulse or kvarh / 1 pulse

B.- **ALARM conditions**: the parameter to be controlled, the maximum value, the minimum value and the delay are user-definable for each relay output.

On the CVM-BC screen following messages appear at this SET-UP option:

OUT 1	RELAY 1	CODE 00	☞	Parameter No. (1)
-------	---------	------------	---	-------------------

☞ *Depending on the selected variable we will pass to a.- or b.- sections*

In case that no parameter is wanted to be programmed set *par. No.* = 00.

Parameter	Symbol phase L1	Code	Symbol phase L2	Code	Symbol phase L3	Code
Single voltage	V - L1	01	V - L2	06	V - L3	11
Current	A - L1	02	A - L2	07	A - L3	12
Active power	kW- L1	03	kW- L2	08	kW- L3	13
Reactive power Inductive/ Capacitive	kvarL - L1 kvarC - L1	04	kvarL - L2 kvarC - L2	09	kvarL - L3 kvarC - L3	14
Power factor	PF - L1	05	PF - L2	10	PF - L3	15
% THD V	THD V - L1	25	THD V - L2	26	THD V - L3	27
% THD A	THD A - L1	28	THD A - L2	29	THD A - L3	30

Three-phase active power	kW III	16	Three-phase cos φ	Cos φ	19
Three-phase inductive power	kvarL III	17	Three-phase power factor	PF III	20
Three-phase capacitive power	kvarC III	18	Frequency	Hz	21
Active energy	kWh	31	Ph-Ph voltage L1- L2	V 12	22
Reactive energy (inductive)	kvarh. L	32	Ph-Ph voltage L2 - L3	V 23	23
Reactive energy (capacitive)	kvarh. C	33	Ph-Ph voltage L3 - L1	V 31	24
Three phase apparent power	kVA III	34			
Power demand	Pd	35			

a.- If an ENERGY parameter is chosen: kW.h (31), kvarh.L (32) or kvarh.C(33)



(1) Value of energy in kW.h : four digits with floating decimal point

- Set-up procedure:

- "**max**" key: to modify the value of the blinking value.
Every time it is pressed the value is increased.

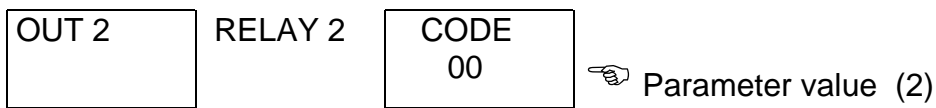
- "**min**" key: to validate the blinking value and go to the next digit.

NOTE : When the last digit is reached, the position of the decimal can be move point with the "**max**" key.

Example for setting a 500 W.h / 1 pulse:

*Firstly we enter the value, 0500, and following we place the decimal point at the right position with the "**max**" key → 0.500 kW.h*

- For accessing to the next option, press "**Display** ": set-up options for the second relay will appear (only with CVM-BC...-C2).



Act as before. Pressing again "**Display** " the set-up mode is exited.

b.- ALARM conditions (1 condition for each relay): If any other parameter (1 to 30) is selected at (1), two outputs can be configured as alarms. For each output it is possible to set:

① Any of the parameters measured by the CVM-BC
② MAXIMUM value
③ MINIMUM value
④ Delay for the conditions

These screens are successively displayed by the CVM-BC once the parameter has been selected (for the set-up of each option proceed as in the Section a.-):

b.1.- Programming the maximum value to be controlled:

AL HI 0.000	RELAY 1 ☞ Maximum value
----------------	----------------------------

The key "**max**" will increase the value of the blinking digit (0,1...9, sign --). Use the key "**min**" to pass to the following digit.

b.2.- Programming the minimum value to be controlled:

AL LO 0.000	RELAY 1 ☞ Minimum value
----------------	----------------------------

b.3.- Programming the delay:

d SEC 0000	Delay in seconds ☞ maximum 9999 s
---------------	--------------------------------------

THD parameters can also be selected as alarm conditions.

- Press "**Display**" to pass to the next option: the set-up for the second relay is then shown:

OUT 2	RELAY 2	CODE 00	Parameter No. (1)
-------	---------	------------	-------------------

Proceed as before. Pressing again "**Display**" the set-up option exited.

ALARM ACTIVATION: Alarms operation depend on the set values of MAXIMUM and MINIMUM.

MIN +	MAX + max > min	
MIN +	MAX + max < min	
MIN --	MAX +	
MIN +	MAX --	
MIN --	MAX -- max > min	
MIN --	MAX -- max < min	

ON = alarm activated -----> relay closed

OFF = alarm deactivated -----> relay open

The **DELAY** set value is applied either to the connection or the disconnection when the alarm conditions occur.

User-definable units for the different parameters are:

Parameter	Format	Example
Voltage	V	220.5 = 220.5 V
Current	A	0150 = 150 A
Powers	kW, kvarL, kvarC	0.540 = 540 W 250.5 = 250.5 kW
Energies	kW.h , kvarh.L , kvarh.C	0.500 kW.h
Power factor	+ / - x.xx	- 0.70
Frequency	xx.x	50.0 = 50 Hz



Output relay connection lay-out CVM-BC...-C2 (2 relays)

Out1	Terminals	Signal
RELAY 1	26 - 27	N.O.

Out2	Terminal s	Signal
RELAY 2	24 - 25	N.O.

6.- SPECIFICATIONS

Power supply : see specifications on the rear part of the CVM-BC

- **CVM-BC** : Single-phase 230 V a.c.
Voltage tolerance: -10 % / +15 %
Frequency: 50 ... 60 Hz

Burden 5 VA
Operation temperature -10 to 50 °C

Measuring Circuits :

Rated voltage 300 V a.c. Phase-to-Neutral / 520 V a.c. Phase-to-Phase
Frequency 35 to 65 Hz
Rated current In / 5 A (**isolated inputs in the CVM-BC-ITF... model**)
Permanent overload1.2 In
Current input burden0.75 VA

Accuracy :

Voltage 0.5 % of readout \pm 2 digits
Current 0.5 % of readout \pm 2 digits
Powers 1 % of readout \pm 2 digits

Test conditions :

- Errors due to C.T. are not included and direct voltage measurement
 - Temperature between + 5 °C and + 45 °C
 - Power factor between 0.5 and 1
 - Measured values between 5 % ... 100 %
-

Mechanical characteristics:

- Case type: Modular, self-extinguishing, plastic casing
 - Connection : Metallic terminals with "posidraft" screws
 - Fixing : Fitted onto symmetrical DIN 46277 (EN 50022) rail
Possible screw fixing (Passing hole for fixing of \varnothing 4,2 mm).
 - Frontal cover : Lexan
 - Protection Built-in relay : IP 41
Terminals : IP 20
 - Dimensions : 140 x 70 x 110 mm (8 modules relay as per DIN 43 880)
 - Weight : 0,560 kg
-

Relays characteristics: according to model


- Maximum switching load : 2500 VA
- Maximum switching voltage : 400 V a.c.
- Maximum switching current : 10 A

- Mechanical endurance : 3×10^7 operations
- Energy / alarms pulses : max. 1 pulse / s

At full load: (250 V a.c. / 10 A)

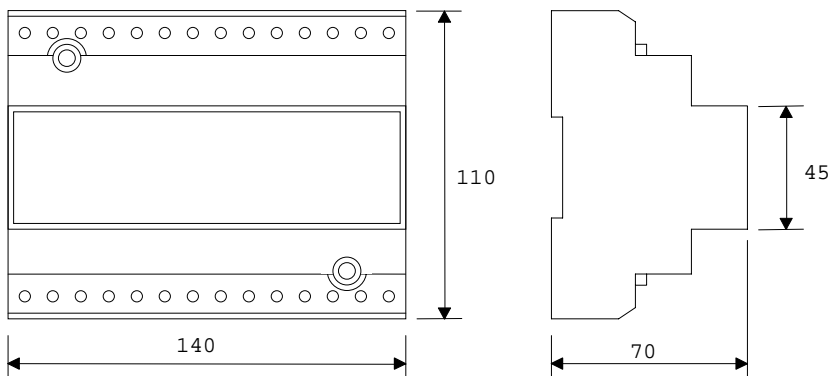
- Electrical endurance : 1×10^5 operations
- Maximum operation cadence : 450 oper. / hour

- Safety Category III - 300 V a.c. / 520 a.c., as per EN-61010

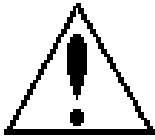
- Protection against electric shock by class II double-isolation 

Standards : IEC 664, VDE 0110, UL 94 , IEC 801 , IEC 348 , IEC 571-1
EN 50081-1, EN 50082-1 , EN-61010-1

Dimensions :



7.- SAFETY CONSIDERATIONS



All installation specification described at the previous chapters named INSTALLATION AND STARTUP, INSTALLATION MODES and SPECIFICATIONS.

Note that with the instrument powered on, the terminals could be dangerous to touching and cover opening actions or elements removal may allow accessing dangerous parts. This instrument is factory-shipped at proper operation condition.

8.- MAINTENANCE

The CVM-BC does not require any special maintenance. No adjustment, maintenance or repairing action should be done over the instrument open and powered and, should those actions are essential, high-qualified operators must perform them.

Before any adjustment, replacement, maintenance or repairing operation is carried out, the instrument must be disconnected from any power supply source.

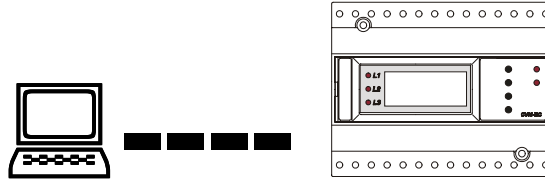
When any protection failure is suspected to exist, the instrument must be immediately put out of service. The instrument's design allow a quick replacement in case of any failure.

9.- TECHNICAL SERVICE

For any inquiry about the instrument performance or whether any failure happens, contact to CIRCUTOR's technical service.

*CIRCUTOR S.A. - After-sales service
c / Lepanto , 49
08223 - TERRASSA
Tel - + 34 93 745 29 00
fax - + 34 93 745 29 14
E-mail : central@circutor.es*

10.- CVM-BC... COMMUNICATIONS



One or some CVM-BC... can be connected to a P.C.. With this system we can get all the parameters in one central point of reading. The CVM-BC..., has a serial RS-485 type output. If we connect more than one device to the same communication line, we have to assign to each of them a different code or direction (from 01 to 99), since the P.C. needs the identification of every measuring point.

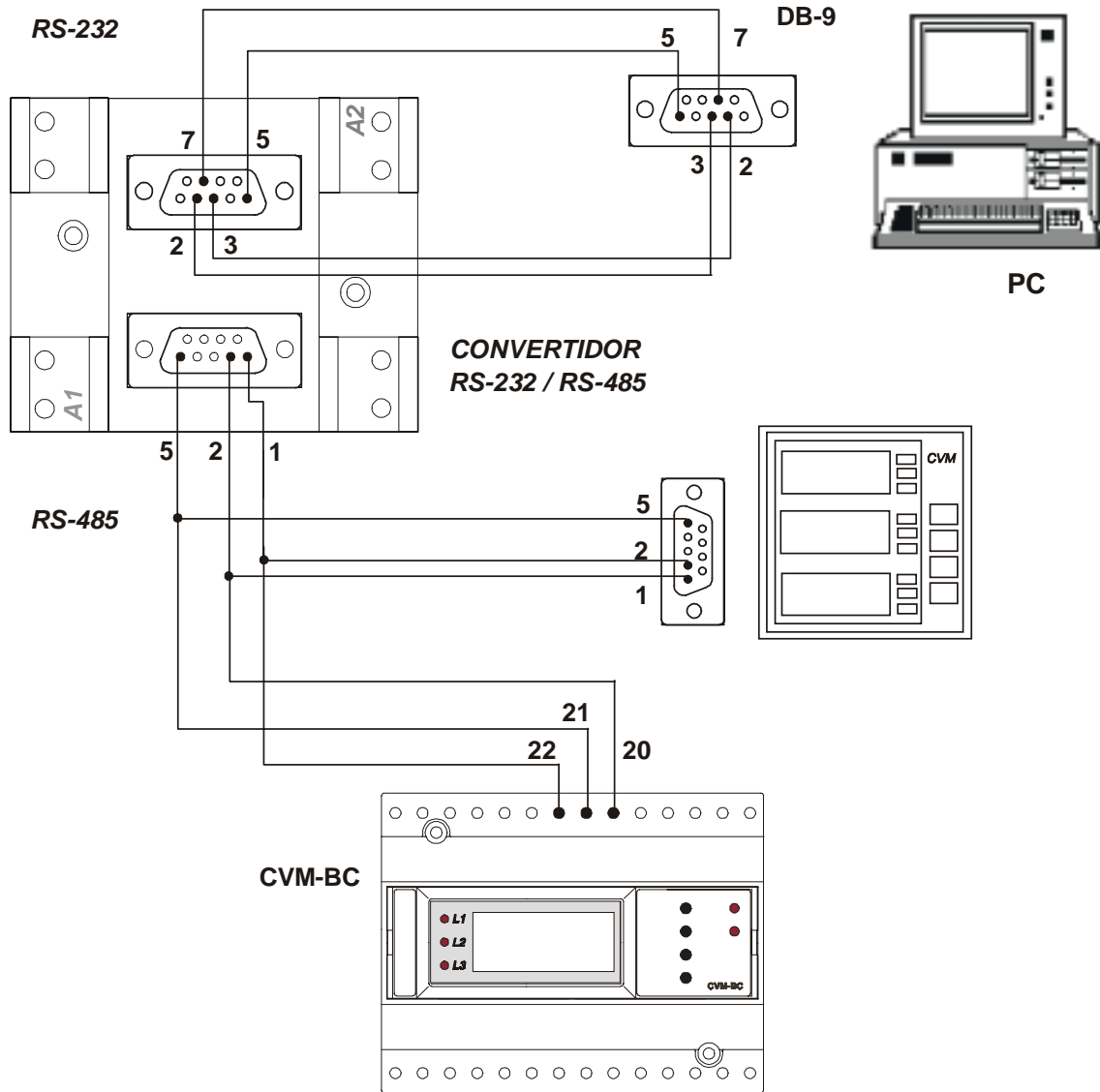
10.1.- ! To take into account:

- **PROTOCOL:** MODBUS © (Question / Answer)
- **CVM-BC DEFAULT CONFIGURATION :** 001 / 9.600 / 8 bits / N / 1 bit
- Available baud rates: 1.200 - 2.400 - 4.800 - 9.600 - 19.200 bauds
- **RS-485 type output:**

<i>Terminal No.</i>	<i>Signal</i>
22	----- TX +
20	----- TX --
21	----- GND

-RS-485 connection will be carried out by means of a **twisted and screened cable**, with a minimum of 3 wires, with a maximum distance between the CVM-BC and the last peripheral of 1.200 m. The CVM-BC uses a RS-485 communication bus allowing up to a **maximum of 32 devices in parallel (Multi-point bus) per port used in the PC.**

10.2.- RS-485 TYPE CONNECTION TO A RS-232 TYPE INPUT OF A PC



10.3.- MODBUS © protocol

The CVM-BC analyzer can communicate by means of the **MODBUS ©** protocol, as it is following described:

When the CVM-BC communicates with MODBUS protocol, it uses the **RTU mode** (Remote Terminal Unit). Each 8-bits byte in a message contains two 4-bits hexadecimal characters.

The format for each byte in RTU mode is :

- * *Code* : **8-bits binary**, hexadecimal 0-9, A-F
Two hexadecimal characters
contained in each 8-bits field of the message.
- * *Bits per Byte* : 8 data bits
- * *Error Check Field* : Cyclical Redundancy Check (**CRC**) .

MODBUS FUNCTIONS:

FUNCTION 01 Reading of relay state

FUNCTION 03 or 04 Reading of n Words (16 bits-2 bytes). This function permits to read all the electrical parameters of the CVM-BC. Each parameters is a 32-bits long, hence two words are required to inquiry for a parameter.
(4 bytes - XX XX XX XX).

a.- Registers assigned to different parameters measured by the **CVM-BC** :

PARAMETER	Units	MODBUS REGISTERS HEXA-DECIMAL (longs)		
		PRESENT Value	MAXIMUM Value	MINIMUM Value
Phase voltage - V 1	V x 10	00-01	60-61	C0-C1
Current - A 1	mA	02-03	62-63	C2-C3
Active power - kW1	W	04-05	64-65	C4-C5
Reactive power - kvar 1	var	06-07	66-67	C6-C7
Power factor - PF1	P.F. x 100	08-09	68-69	C8-C9
Phase voltage - V 2	V x 10	0A-0B	6A-6B	CA-CB
Current - A 2	mA	0C-0D	6C-6D	CC-CD
Active power - kW2	W	0E-0F	6E-6F	CE-CF
Reactive power - kvar 2	var	10-11	70-71	D0-D1
Power factor - PF2	P.F. x 100	12-13	72-73	D2-D3
Phase voltage - V 3	V x 10	14-15	74-75	D4-D5
Current - A 3	mA	16-17	76-77	D6-D7
Active power - kW3	W	18-19	78-79	D8-D9
Reactive power - kvar 3	var	1A-1B	7A-7B	DA-DB
Power factor - PF3	P.F. x 100	1C-1D	7C-7D	DC-DD
Three-phase active power – kWIII	W	1E-1F	7E-7F	DE-DF
Three-phase inductive power – kvarL III	var	20-21	80-81	E0-E1
Three-phase capacitive power – kvarC III	var	22-23	82-83	E2-E3
Cos φ III	Cos φ x 100	24-25	84-85	E4-E5
Three-phase power factor - PF III	P.F. x 100	26-27	86-87	E6-E7

PARAMETER	Units	MODBUS REGISTERS HEXA-DECIMAL (longs)		
		PRESENT Value	MAXIMUM Value	MINIMUM Value
Frequency (L1) - Hz	Hz x 10	28-29	88-89	E8-E9
Line voltage L1-L2 - V12	V x 10	2A-2B	8A-8B	EA-EB
Line voltage L2-L3 - V23	V x 10	2C-2D	8C-8D	EC-ED
Line voltage L3-L1 - V31	V x 10	2E-2F	8E-8F	EE-EF
%THD V 1	% x 10	30-31	90-91	F0-F1
%THD V 2	% x 10	32-33	92-93	F2-F3
%THD V 3	% x 10	34-35	94-95	F4-F5
%THD I 1	% x 10	36-37	96-97	F6-F7
%THD I 2	% x 10	38-39	98-99	F8-F9
%THD I 3	% x 10	3A-3B	9A-9B	FA-FB
Active energy – kWh	W. h	3C-3D	9C-9D	FC-FD
Inductive reactive energy - kvarh L	var.h L	3E-3F	9E-9F	FE-FF
Capacitive reactive energy - kvarh C	var.h C	40-41	A0-A1	100-101
Three phase apparent power	VA III	42-43	A2-A3	102-103
Power demand	W / VA	44-45	A4-A5	104-105

EXAMPLE

INQUIRY

0A 04 00 00 00 0A 71 76

0A CVM-BC peripheral number, 10 in decimal
04 Reading function
00 00 Initial address (first register)
00 0A Number of registers to be read
7176 CRC character

ANSWER

**0A 04 14 00 00 08 4D 00 00 23 28 00 00 0F A0 00 00 00
 90 00 00 00 60 CB 2E**

0A CVM-BC number , 10 in decimal
04 Reading function – the one use for the inquiry
14 Bytes received (20)
00 00 08 4D V x10 (register 00 Hex), in decimal 212.5 V
00 00 23 28 mA , in decimal 9000 mA
00 00 0F A0 W , in decimal 4000 W
00 00 00 90 varL , in decimal 144 varL
00 00 00 60 PF x 100, in decimal 96 PF
CB 2E CRC character

b.- Reading digital outputs (relays) - Function 01 :

Inquiry : PP**0100000008**CRC (PP = peripheral No.)
 Answer : PP**0101XX**CRC

Where XX (hexadecimal byte) → translated to binary

b7	b6	b5	b4	b3	b2	b1	b0
----	----	----	----	----	----	-----------	-----------

bit **b0** = relay 1 (1 = ON ; 0 = OFF)
 bit **b1** = relay 2 (1 = ON ; 0 = OFF)

11.- APPENDIX A: Second SET-UP of the CVM-BC

A second SET-UP menu is accessible in order to perform the configuration of the CVM-BC with other features different from factory-supplied ones.

To access this menu proceed as follows:

- Being the CVM-BC powered off, simultaneously press "**Display**", "**max**" and "**min**" keys.
- Holding these keys pressed, powered the CVM-BC on.

Following messages will be then shown on display:

a.- COMMUNICATION PROTOCOL: MODBUS

PROT BUS

Protocol:



MODBUS (c) (BUS) protocol

(* See related section in this manual

- "Display" key: to validate the choice and pass to the next set-up screen:

b.- SETTING COMMUNICATION PARAMETERS

Cdef NO

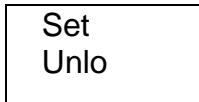
Default configuration



"**max**" key to switch from NO / YES

- If YES is chosen: the configuration is **001 / 9600 / 8 bits / N / 1 bit**
- If NO is chosen, pressing "**Display**" following options successively appear:
 - n PER : Peripheral No. 001 to 255
 - Baud 1 : baud rate 1.200 – 2.400 – 4.800 – 9.600 – 19.200
 - Parity : No, even, odd
 - LEN : (length) 8 bits
 - Stop bits : 1 or 2

c.- SET-UP LOCKING OR UNLOCKING



Loc (locked SET-UP) or **Unloc** (unlocked SET-UP)

Use the key "**max**" to modify the choice.

- Whether **LOC** is set, when the SET-UP is accessed, configuration parameters can be visualized but cannot be modified.
- To modify the previously set option, a **4-figure password** is required to be entered (in case that this password is not correct, this blinks and the previous menu is again accessed).



To exit this set-up mode, the key RESET can be pressed at any moment (WARNING: whether the set-up is exited by pressing the key RESET some last modification might not be saved in memory) or reach the end of this set-up mode.