REACTIVE POWER REGULATOR

Computer-6 b

&

Computer-6 c

INSTRUCTION MANUAL

(M 981 140 / 96-002)

1.- BASIC INSTRUCTIONS

1.1.- Delivery spot check

This manual is issued to help all the **Computer 6b & 6c** users to install and use it in order to get the best from it. After receiving the unit please check the following points:

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

1.2.- Connection procedures 

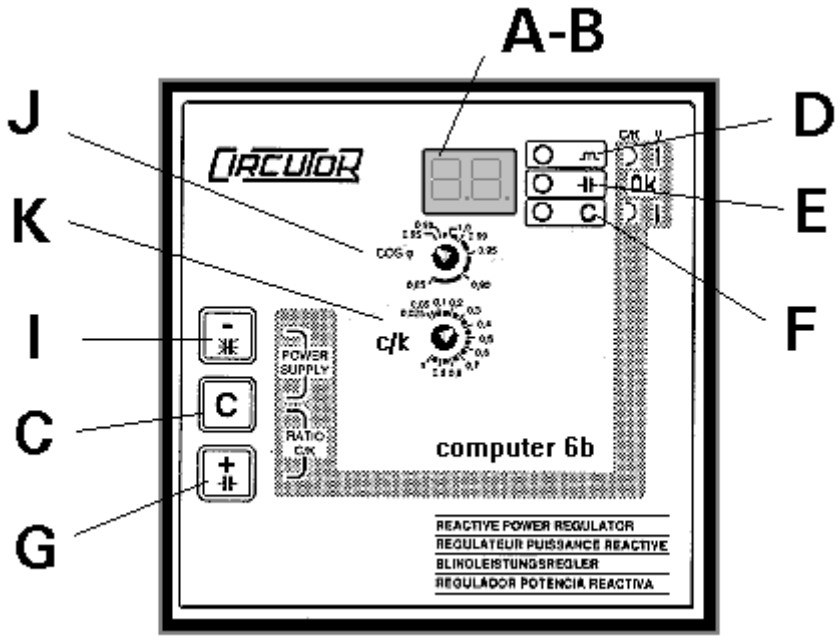
The manual you hold in your hands contains information and warnings that the user should respect in order to guarantee a proper operation of all the instrument functions and keep its safety conditions.

Before connecting the instrument to the mains see all the installation specification described at the previous chapters named INSTALLATION AND STARTUP, INSTALLATION MODES and TECHNICAL CHARACTERISTICS.

2.- REACTIVE POWER REGULATOR COMPUTER 6b and COMPUTER 6c

The **computer 6b** regulators (Front mounted knobs) and **Computer 6c** regulators (rear mounted knobs) control the connection and disconnection of capacitor steps, depending on the consumed reactive current, in order to keep the power factor within a desired value. These devices have a front display indicating the cos φ measured value.

Based on microelectronics technology CIRCUTOR designed the FCP control system (Fast Computerized Program). The regulator uses the microprocessor intelligence to take complex decisions which need a high calculation capacity.



3.- DISPLAY AND LED SIGNS

The **front part** of the regulator has the following control signs :

A-B	numerical display	- Shows the cos φ example: 95 means that measured cos φ is 0,95 - The sign "——" indicates that the measured current is below the limits to enable correct reading. In such condition there is no connection of new capacitor steps
D	Led	Lights on when cos φ is inductive.
E	Led	Lights on when cos φ is capacitive.
F	Led	Lights on when the display (**A-B**) shows the rumber of capacitor steps connected (lights on when pushing button **C**) .

4.- ADJUSTMENTS and PUSH BUTTONS :

C	Push button	To read the number of capacitor steps connected at that time. When C is released , the A-B display returns to its normal cosφ indication
G	Push button	for manual switching ON of capacitors. Increases the number of steps connected.
I	Push button	for manual switching OFF of capacitors. Reduces the number of steps connected.
J	cos φ control	Cos φ setting control from 0.85 ind. to 0.95 Cap.
K	C/K control	- Reactive current setting - May be manual or automatic. - **C/ K :** current of the first capacitor step divided for the transformer ratio.

5.- INSTALLATION AND STARTUP 

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.

5.1.- INSTALLATION

Before applying AC power to the, check following points :

a.- **Supply voltage : see rear part of your 6b & 6c**
(According Computer-6 model)

- *Frequency : 50 / 60 Hz*
- *Supply tolerance : + 10 % / --15 %*
- *Connection terminals : Terminals 3 -4 or 3 - 5*
- *Instrument burden : 5 VA*

b.- Maximum admissible current : Transformer of In / 5 A a.c.

c.- Operation conditions :

- Operating temperature : 0 to 50ºC
- Humidity : 25 to 80 % R.H. noncondensing

d.- Safety : Designed to meet protection class II as per EN 61010.

5.2.- CONNECTIONS

 Instrument is to be mounted on panel (cut-out 138^{+1} x 138^{+1} mm, as per DIN 43 700). All connections keep inside the cabinet.

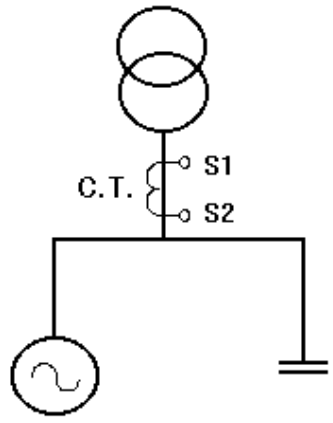
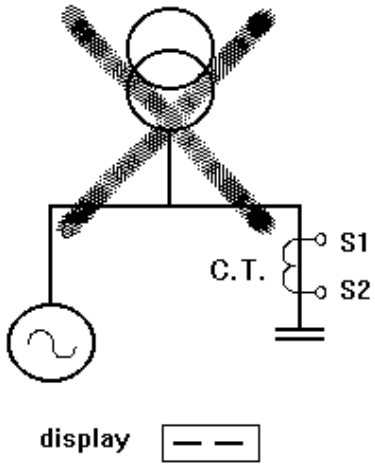
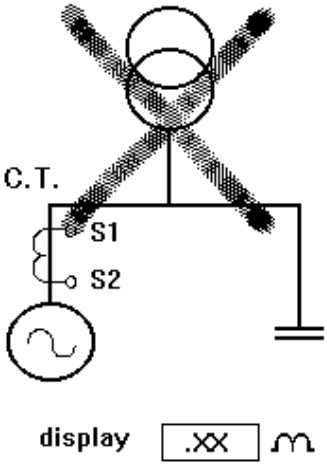
Note that with the instrument powered on, the terminals could be dangerous to touching and cover opening actions or elements removal may allow accessing dangerous parts. Therefore, the instrument must not be used until this is completely installed.

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 an automatic switch or any equivalent element to disconnect 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 mm^2. The line of the current transformer secondary will have a minimum cross-section of 2,5 mm^2.

Connect the equipment according to the connection schema at the outside part of the regulator :

- For the start-up it is necessary to install a current transformer **(normally In / 5 A**). The transformer has to be chosen according to the maximum current of the equipment. The secundary line of the current transformer has to be the section according with the distances to regulator.

- The current transformer has to be installed in a connection point where the total current of the equipments is flowing, including the own capacitor current

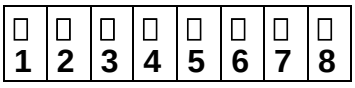
CORRECT	WRONG	
		
- The current transformer must be fitted line-side of the battery and loads (motors, ...)	- No capacitor connections because no current information is delivered by the CT. - Insure that the CT is not short circuited , or installation out of load.	- All the capacitors connects and no regulation takes places in relation with the load of the main supply. Risk of an over compensation on a main-supply without load.

- The supply of the regulator has to be connected **between two phases.** (except when specifically is dealt with a single-phase regulator). The phase in which the transformer has been installed can not coincide with any of the phases that is used for the supply of the regulator**.**

- Connect the secondary side of the current transformer (S1-S2) at the plug in connector marked S1-S2. If the regulator display shows "**01 cap**" , means that the phase rotation is not respected : inverted the voltage phase connections (or S1-S2 of the current transformer have to be inverted) .

-The display showing "——" , indicates that there is not sufficient current signal , and the power factor can not be measured. In case there is load in the equipment, check whether the current circuit is not open (or short-circuited in some point).

6.- THE REAR PART OF THE REGULATOR : SWITCHES CONFIGURATION



☑ **1- 2** : Frequency selection 50 / 60 Hz

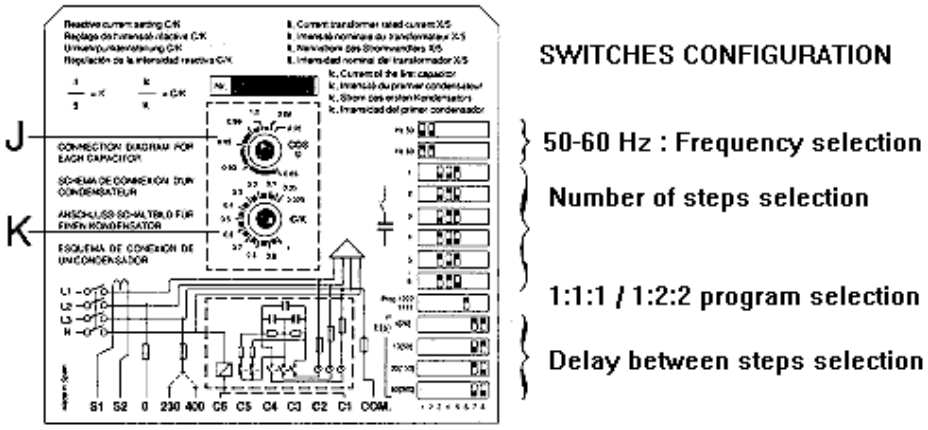
☑ **3- 4 - 5** : Adjust the number of relays that really are connected.
By selecting the actual number of steps the regulator makes the calculations to distribute the operations between the used steps.

☑ **6** : Check the working program of the regulator :

1.1.1.1	All the capacitors are the same power value
1.2.2.2	The power value of the first capacitor is half of the power value of the others

☑ **7 - 8** : Connection or disconnection times of successive steps

☞ **!** To make the regulator recognize any change in the chosen program, it is necessary to reset the power supply of the regulator.

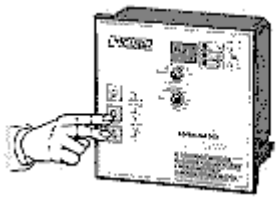


7.- DOUBLE FUNCTION CONTROLS

7.1.- REACTIVE CURRENT (C/K SETTING)

a.- Automatic system

With installation under "No-load" conditions, push simultaneousland the buttons [**G]** and **[C].** To make this setting, the regulator will connect the first step of its**,** after the safety time delay.



- The display will show " I ", and one of the led **D, E or F** will light up :

- ☑ The correct position of the C/K control will be obtained when the led E lights up.
- ☑ When the led D lights up, turn the C/K setting control to the right
- ☑ When the led Flights up, turn the C/K setting control to the left until the led E lights up

- If the digits AB continue showing " **t I** " , the current transformer is not properly installed. Phase between voltage and current is not correct or current transformer has to be inverted.

b.- Manual system

This control can also be set by calculation with the following formula :

Transformer ratio $\frac{It}{5} = K$

Reactive current adjustment $C / K = \frac{Ic}{K}$

with : It = primary current of C.T. transformer.
Ic = Current of the firs capacitor step

Example:

Transformer ratio : $\frac{500}{5} = K = 100$

First capacitor : 60 kvar / 400 V ≡ 86,7 A

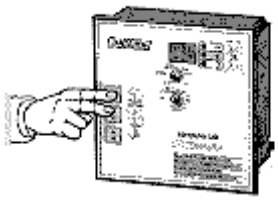
Setting of the C/K current control $C / K = \frac{Ic}{K} = \frac{86,7}{100} = 0.867$

IMPORTANT :

- If the adjustment of the C/K is too low: the regulator repeats connecting and disconnecting a step several times.
- If the adjustment of the C/K is too high : The regulator does not connect more steps in spite of not having reached the fixed cos φ.

7.2.- TESTING THE MAIN VOLTAGE

When pressing simultaneously buttons [**C]** and [**I**] the display will show the sign " U " and one of the led **D, E** or **F** will light up :



led D	when the voltage is 10 % higher than the rated one.
led E	when the voltage is correct
led F	when the voltage is 15% lower or less than the rated one.

8.- DELAY OF CONNECTING AND DISCONNECTING

The time (Tr) between the connection or disconnection of successive steps may be changed by means of dip switches (**7- 8**) on the rear side of the regulator.

Tr	Connection time delay between two program step	**4, 10 , 30, 60 s**
Ts	Safety time delay between the disconnection and the reconnection of a capacitor (s) . The safety time is 5 times the connection time between two steps **Ts = 5 Tr**	**20, 50, 150, 300**

⌛ When you connect the regulator to the main, it wait the safety time (Ts) to connect the first step.

9.- ALARM RELAY

The regulators have 6 outputs relays, but they may be programmed to used only part of them (see dip switches configuration). In the later case the first not used relay will perform an alarm function as follows: the output contacts is normally closed contact and will open in case that the programmed compensation cannot be achieved.

Example : Computer-6b with four outlets in duty.
El C5 relay will be the alarm relay. This relay will be always connected unless a lack or excess of compensation (1.5 times the capacitor C/K adjusted) is detected during a time longer than 2 times the safety time Ts. (Normally closed contact) This contact enables optical, accustical and other types of external signals which could be activated by means of excesive or defectuous compensation in case of trouble in the regulator function (control fuses blown up, etc.)

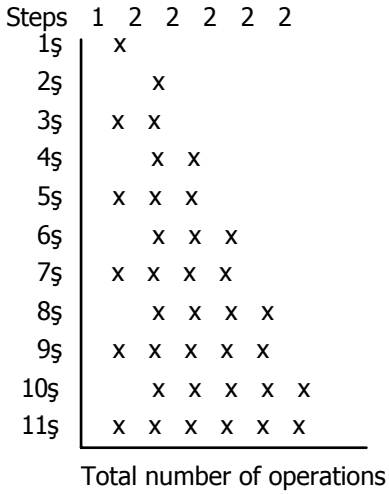
10.- INTERNAL FUNCTIONING OF THE FCP SYSTEM

With the data received from the outside circuit voltage and current, it calculates the phase angle and the capacitor value necessary to reach the preset cos ρ
Once these data have been obtained, the FCP system makes the decision to switch in the corresponding steps.

In program 1.2.2 , it decides in accordance with the data received if the first step has to be connected, with regard to the existing demand (thus avoiding superfluous operations of the firs step and giving a longer life duration to the equipment). In order to get a uniform wear of the equipment , the FCP system memorizes how long each of the capacitors has been disconnected and at a new demand enables the capacitors which has been disconnected the longest to be reinserted, thus obtaining a uniform wear of all capacitors. There is a safety system to avoid a capacitor to be re-connected if the safety lock-out time has not yet elapsed.

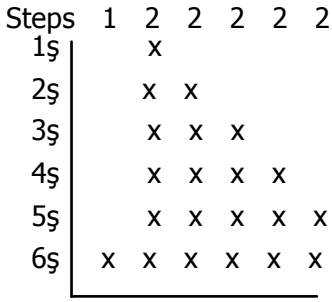
Example : Necessary operations to satisfy a 100 % request from 0 with a 6 steps regulator in program 1:2:2

STANDARD SYSTEM



Total number of operations = 16

FCP System



Total number of operations = 6

11.- TECHNICAL CHARACTERISTICS

Rated supply voltage :	230 / 400 V a.c. Other voltages and frequencies may be supplied .
Voltage circuit : Tolerance Consumption Frequency	 + 10 % / - 15 % 5 VA 50 or 60 Hz
Current circuit : Rated current Permanent overload Short time overload Consumption	Isolated In / 5 A a.c. 1,2 In 10 In during 20 ms 0,5 VA
Control System	FCP
cos φ setting range	0,85 ind .... 0,95 Cap.
cos φ indication	Built in display
C/K setting range	0,05 .... 1 A (Manual or automatic)

Switching programs	1:1:1 or 1:2:2
Output relays	6 relays
Step delay (Tr)	4 / 10 / 30 / 60 s (selectable)
Safety time between successive connections Ts	20 / 50 / 150 / 300 s
Output relays : Isolation voltage Ui Thermal current Ith AC11 Ie / Ue DC11 Ie / Ue Mechanical life Electrical life	 380 V a.c. / 250 V d.c. 10 A 4 A / 240 V a.c. 1 A / 110 V d.c. $30 \cdot 10^6$ operations $2 \cdot 10^5$ operations (full load)
Working temperature	0º to 50 ºC
Mechanical characteristics : Connections Protection class Dimensions Weight	 Plug in connector IP - 41 144 x 144 mm - depth 58 mm see fig. DIN 43 700 0,95 kg
Standards :	IEC 605, IEC 414, IEC 348, IEC 255, UL 94, UNE 20 607, UNE 20 608, UNE 21 349, UNE 20 553, UNE 21 136, VDE 0110
Codes :	**Computer 6b** code 110 021 **Computer 6c** code 110 022

12.- 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.

13.- MAINTENANCE

The **Computer6 b & 6c** 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 our of service. The instrument's design allow a quick replacement in case of any failure.

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

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