

RKR-1T12C Hi-Tech REACTIVE POWER CONTROLLER

USER GUIDE

1. INTRODUCTION

Reactive Power Compensation is as of “ Reactive Power being required for the Inductive Loads in the A.C. Systems is supplied by different techniques / methods “. The most common method is well-arranged capacitor groups accompanied by one Reactive Power Controller which measures $\cos\phi$ value ; switches on and off capacitor groups according to required capacitor power, in a central compensation system. RKR-1T12C Hi-TECH is microprocessor-based Power Factor Controller (Regulator) with Digital LCD screen for Hi-technological control of capacitor banks at 12 control contacts.

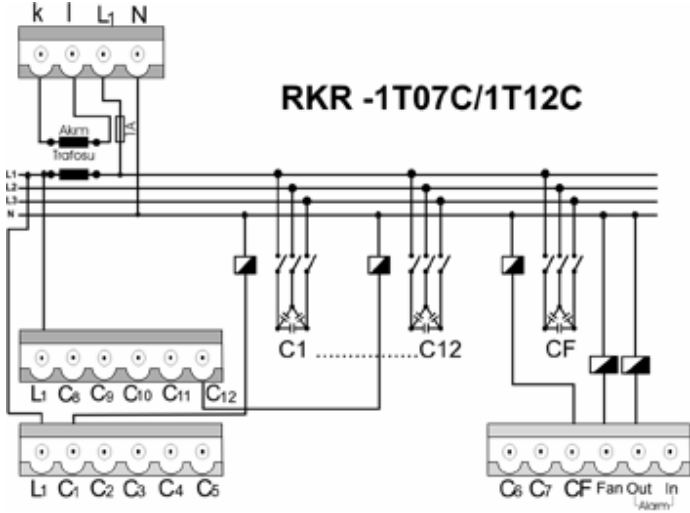
2. TECHNICAL FEATURES

- Automatic & Manual Operating Functions
- Initial precised – computation of Capacitor powers.
- Automatic adjustment (identification) of threshold current (c/k value).
- Inverse – Connectibility of C.T. terminals (k-1).
- Adjustable Power Factor ($\cos\phi$) value between 0.80 ind. and 1.0 cap.
- Adjustable Over Voltage Protection Limits.
- Adjustable Over Temperature Protection Limits.
- Adjustable Capacitor “ switch ON and OFF “ time settings .
- Monitoring, Measuring, and Display of Harmonics (from V3 to V13 and Efficient Protection Capability against High Harmonics)
- Smooth Digital LCD display of key momentary values and setting (operating) parameters of Power Factor ($\cos\phi$) , Apparent RMS ,Frequency ,Temperature and of Total Capacitive Power as in KVAR required to meet target power setting.
- Adjustable time- setting limit for shifting “Manuel Operation” into “Auto Operation”
- Potential-free individual Alarm identification on LCD display.
- All in 12 steps configuration with auto self- step selection ability upon system requirement.
- Auto-determination of “Current Flow Direction” (Polarisation)
- Direct Capacitors Switching On and Off Function upon Sytem Requirement
- Programmable Time Setting Required for Pausing in Harmonic Protection.

Alarm Signals :

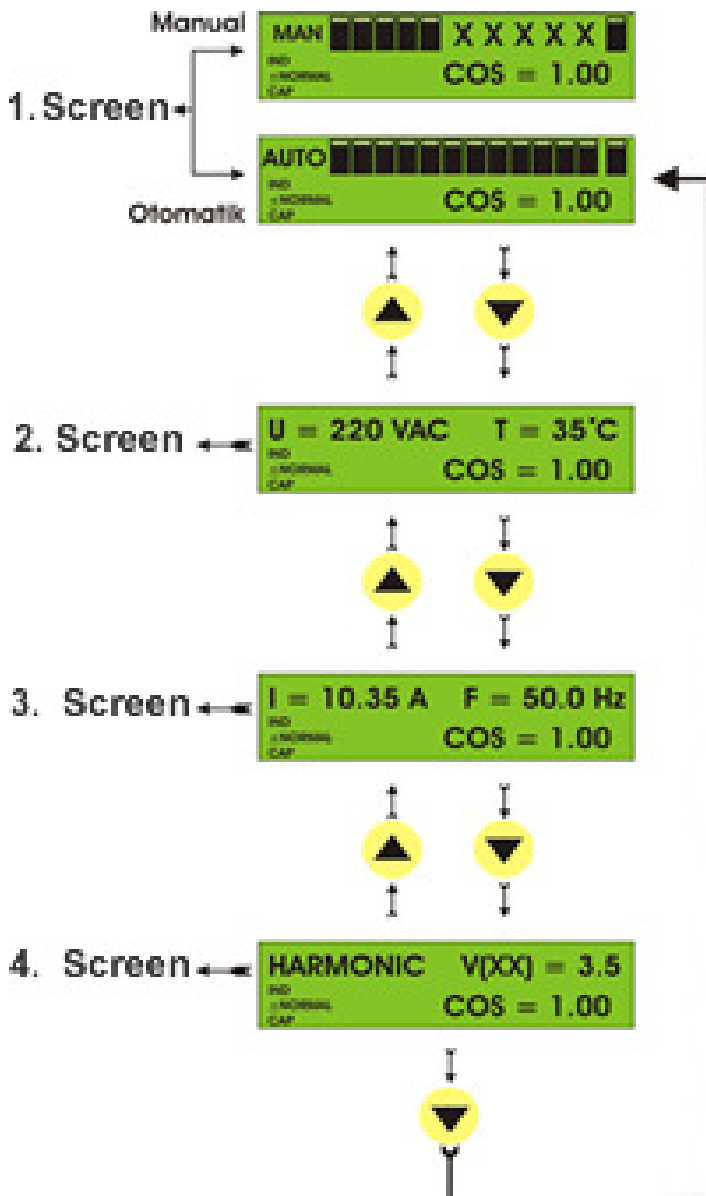
- Over / Under Compensation Alarm
- Over Temperature Warning .
- High Harmonic Level Alarm.
- Over Voltage Alarm.

3. CONNECTION DIAGRAM



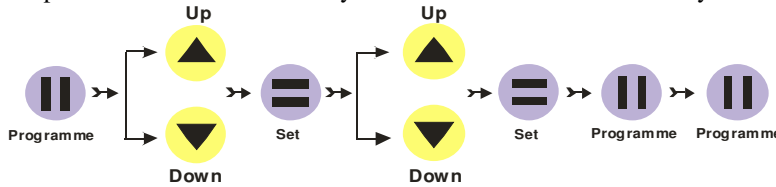
4. DISPLAY MODES

Voltage, Current, Frequency, $\cos\phi$ values, state of capacitor groups (if stages are empty, which capacitor is switched on or off), operation mode (AUT,MAN), state of line (NORMAL, INDUCTIVE or CAPACITIVE) and harmonic levels are displayed on LCD as of four main screens. When device is set to automatic mode user can monitor four different main screens via the use of “Up” and “Down” keys. However, In manual mode only the first screen can be monitored.



5. PROGRAMING MENU

RKR-1T12C Hi-TECH can be programmable via 3 main menus. Four buttons on front side of device are used for programming. All required parameters can be entered by these menus are saved in memory.



5.1. OPERATION MODE

Press “**Programme**” button to enter in “Menu”. Move until “**Operation Mode**” appear on the screen. Press “**Set**” button to enter into the submenus. Select desired operation mode via “**Up**” and “**Down**” buttons (**AUTO/MAN**). Press “**Set**” button again in order to save parameter in memory. Press “**Programme**” button again to exit the menu.

- **AUTOMATIC MODE:** Device is switching on and off capacitors due to meeting the required capacitive power and set-parameters
- **MANUAL MODE:** User may switch on (“Up” key) and off (“Down” key) capacitors by himself. Device shall not change the state of capacitors.

5.2. PARAMATERS

Press “**Programme**” button to enter in menus. Move until “**Parameters**” appear on screen. Press “**Set**” button to enter into the submenus. Select desired parameter via “**Up**” and “**Down**” buttons. Press “**Set**” key to enter into submenus. Adjust parameter(s) upon requirement. Press “**Set**” button in order to save the data into memory. Press “**Programme**” button twice to exit from “programme menu”. All parameters are shown in Table-1;

Table-1. Parameters

Nu	Parameter	Default Value	Adjustment Range	Description
1	$\text{Cos}\phi$	0.99	0.80-1.00	Adjusted value is target value.
2	t_{on}	5	1-120seconds	Capacitor Group Switch on Delay
3	t_{off}	5	1-120seconds	Capacitor Group Switch off Delay
4	U_{ov}	260V	240-300V	Overtoltage Protection Value Device always measures voltage of line. When voltage exceeds the set-value for 4 seconds alarm output is switched on and capacitors are switched off for the protection purpose. When voltage drops 10 Volts below the set-value for 4 seconds device will start working normally.
5	T_{ov}	45°C	40°C-85°C	Overtemperature Protection Value Device always measures temperature between -20°C..+99°C. When temperature exceeds adjusted value for 10 seconds fan output is switched on until temperature drops back to the set-value for 10 seconds. While temperature is out of set-range then the warning is displayed on screen in an on-off flashing manner .
6	K_{ctr}	75/5	5/5-5000/5	Current Transformer Ratio
7	t_{dh}	1 minute	1-30 minutes	Harmonic Protection to Normal Operation Delay Time
8	t_{abk}	24 hours	1-96 hours	Manual to Automatic Mode Delay Time

5.3. HARMONICS

Press “**Programme**” button to enter in the menu. Move until “**Harmonics**” menu is displayed. Press “**Set**” button to enter into submenu. Select desired harmonic (V_1, V_3, \dots, V_{13}) . Press “**Set**” button in order to edit the settings. Adjust ratio of harmonic with the desired value. Press “**Set**” button again to save its value in memory. Press “**Programme**” button to exit from menus. Harmonics and their adjustments are given in Table-2. **Important Note:** The harmonic protection is inactive when the harmonic value is set as of “**0.0%**”

Table-2. Harmonics

Nu	Harmonics	Default Value	Adjustment Range
1	V_3	0.0%	0.0-25.0 %
2	V_5	0.0%	0.0-25.0 %
3	V_7	0.0%	0.0-25.0 %
4	V_9	0.0%	0.0-25.0 %
5	V_{11}	0.0%	0.0-25.0 %
6	V_{13}	0.0%	0.0-25.0 %

5.4. CAPACITOR POWERS

Press “**Programme**” button to enter into menu. Move until “**Capacitor Powers**” is displayed on screen. Press “**Set**” button to enter in submenus. User can monitor the connected capacitor powers as in KVAR by using “**Up**” and “**Down**” keys. Press “**Programme**” button to exit from menu. All of the Capacitor Power Values in this menu are determined during **Auto-Test Procedure** and only the CONNECTED CAPACITORS are shown in menu.

7. FUNCTIONS

7.1. TEST MODE

Proceed the electrical (wiring) connections in comply with the Connection Diagram given here off . Aplly for power. Adjust for all the required parameters being mentioned as per in item 5. Press “**Up**” and “**Down**” buttons at the same time. A flashing “**_T_E_S_T_**” text will then be displayed on screen. This means that the device is in test mode in where it will switch all the capacitors on and off and will determine their power respectively. Device may test each capacitor more than one time. After having tested , the Connected Capacitor Values will be saved in memory and thus, the empty stages (Disconnected ones) will be marked as of “**X**”. These parameters and capacitor powers will be saved even if the power’s been switched off.

7.2. CAPACITOR SWITCHING (ON AND OFF) PROCEDURE

Device is function allocated with very complexed capacitor measurement and power determination algorithm. Capacitor switching on and off is performed in accordance with the previously determined reactive power. Device effectively detects where and which of the capacitor is connected because of the required compansation is reached very fastly. Capacitor connection is not depend on any particular switching order. Switchin on and off times are determined by t_{on} and t_{off} times respectively. User should need to perform a new test whenever any change in capacitors groups or in their order is in subject.

6. ALARMS & SIGNALS

6.1. OVER-VOLTAGE ALARM

If the voltage of line exceeds the value determined by U_{ov} for 4 seconds, device will switched off all the capacitors in a way to protect against possible damages. While the device is in alarm the voltage will blink on the screen and then the alarm output will be switched on. Alarm LED also will be on. If the voltage drops 10V below of U_{ov} for 4 seconds device will go out of alarm status and will continue the operation normally.

6.2. HARMONIC ALARM

If harmonic values exceed the adjusted percentage for 4 seconds the alarm will occur. Device will switch off all the capacitors, turn on the alarm output and LED. Alarm source will blink on and off on the display to warn the user. After the end of the adjusted t_{dh} time device will return back to normal operation if harmonic levels are sensed normal.

6.3. UNDER-COMPANSATION ALARM

If the device switches on all capacitors while $\cos\phi$ value is still under the adjusted target **cos ϕ** value for 3 minutes the alarm signal will be produced. Alarm relay and LED will be switched on and followingly, the flashing “**IND**”text will be displayed. Returning back to the normal operation will switch the alarm off. Note that the alarm is activated only in automatic mode.

6.4. OVER-COMPANSATION ALARM

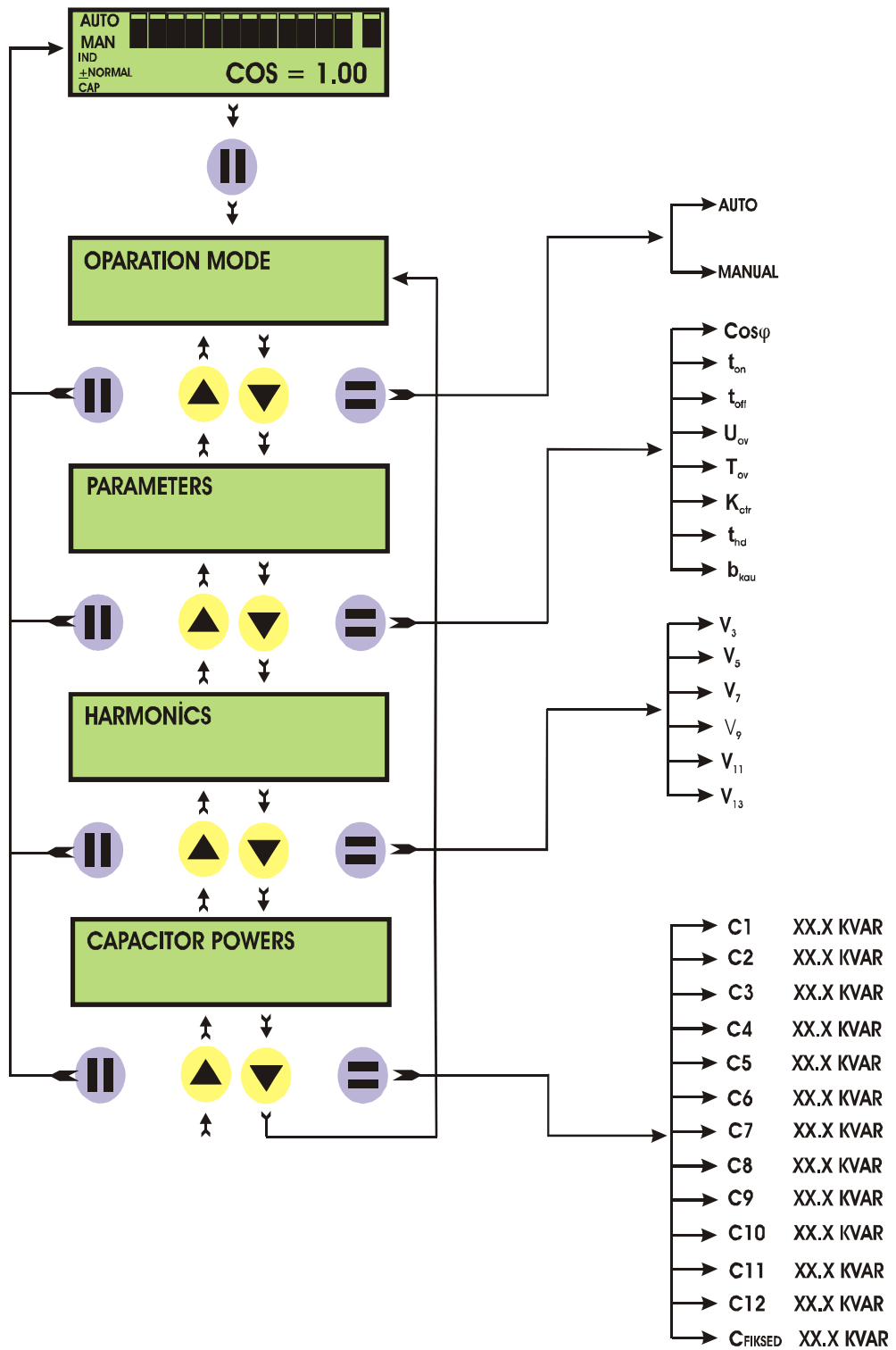
If device switches off all capacitors while $\cos\phi$ value is still higher than of the set-target **cos ϕ** value for 3 minutes the alarm signal will be produced. Alarm relay and LED will be switched on and followingly, the flashing “**CAP**”text will be displayed.. Returning back to the normal operation will switch the alarm off. Note that the alarm is activated only in automatic mode

6.5. OVER-TEMPERATURE SIGNAL (BLINK ON-OFF)

Device always measures temperature between -20°C - $+99^{\circ}\text{C}$. When temperature exceeds the adjusted T_{Ov} value for 10 seconds the fan output is switched on and remained so until the temperature goes below of the set-value for 10 seconds. While the temperature is out of setting range an over-temperature warning as in on-off flashing is displayed on the screen but however the device is in this alarm mode will continue its operation normally.

6.6. UNDER (LOW) CURRENT ALARM

Under-Current Alarm will be activated provided that the secondary current of current transformer goes below of 0.02A or in case of any broken current path in the system is found. In following to that, “**NO CURRENT**” signal is displayed on screen with flashing character and device will start switching off the capacitors with 1 second delay. If the current returns to its normal device also will start operating normally.



8. TECHNICAL SPECIFICATIONS

Supply Voltage:	220 VAC \pm 20%
Line Frequency:	50-60 Hz
Line Current:/5A
Line Current Range:	0.02A-5.5A (Max 10A)
Current Transformer Ratio:	5/5A.....5000/5A
Current Transformer Direction (Polarization):	Automatic
c/k Adjustment:	Automatic
Stage Number:	1 upto 12 + 1 Fixed Group
Output Contact:	250V/5A AC
Alarm Output:	250V/5A AC
Cooling Fan Output:	250V/5A AC
Screen:	2x16 LCD

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