RQ B SERIES REACTIVE POWER CONTROL RELAY

RQ B Series reactive power control relays are designed to operate for the reactive power compensation of LV distribution systems .

The logic to operate the steps is completely different from other relays. The logic is designed so that the compensation is achieved very quickly with most reliable operation.

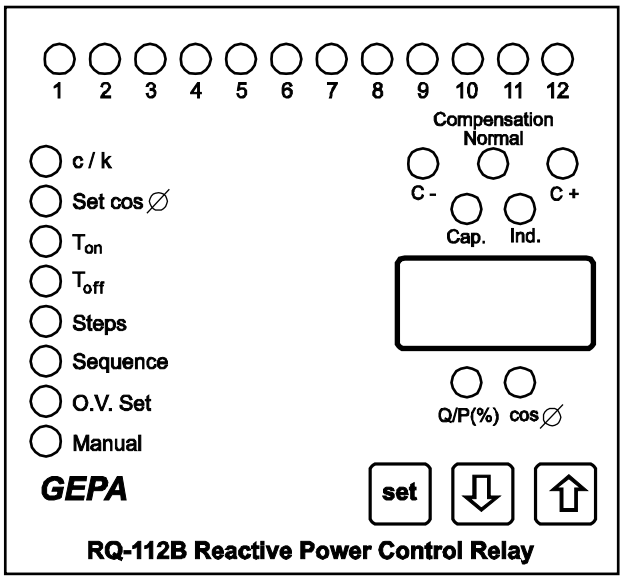


Figure 1

Basic Properties:

* Automatic or manual setting of c/k

* Set Cosø is adjustable between 0,90 and 0,99

* Re-connection or Re-isolation periods are adjustable independently

* Selection of number of steps,

* 6 different sequence logic,

* Reactive / Active power ratio is displayed on the screen,

* Under voltage, over voltage and compensation failed alarms,

* Easy programming,

* Harmonic free operation,

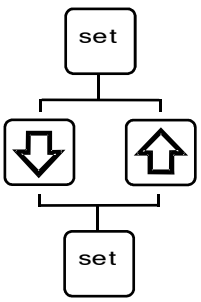
* Easy installation with socket mount

* Automatic polarity sensors,

SETTINGS

Relay should be set properly according to the properties of the systems. In order to achieve best relay operation, all settings should be done properly and the oeration of all signal leds must be read carefully. The front view of the relay is at Figure 1.

1-C/k Setting:



Press Set button until “c/k” led is on .

Set c/k value to the desired value using up or down buttons

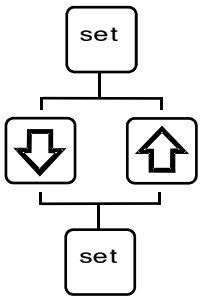
Press Set button again and c/k value will be stored in the memory and Set Cosø led will be on.

In case no additional buttons are pressed , the relay will operate automatically within 10 seconds as programmed..

C/k is adjustable between 0,03 and 1,15 with 0,01 steps

If "oto" is displayed on the screen, c/k was set automatically and the relay will set c/k value by itself automatically.

2-Seting Cosø :



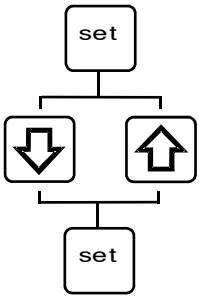
Press Set button until "Set Cosø" led is on.

Adjust Set Cosø to the desired value using up and down buttons.

Press Set button again, Set Cosø will be stored in the memory and "T_{on}" led will be on.
In case no additional buttons are pressed, the relay will operate automatically within 10 seconds as programmed

Set Cosø is adjustable between 0,90 and 0,99 with 0,01 steps.

3-T_{on} (re-connect delay) setting:



Press Set button until "T_{on}" led is on.

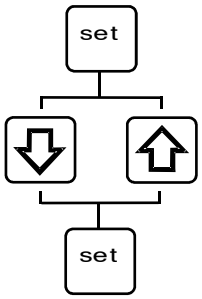
Adjust T_{on} to the desired value using up and down buttons.

Press Set button again, T_{on} will be stored in the memory and "T_{off}" led will be on.

In case no additional buttons are pressed, the relay will operate automatically within 10 seconds as programmed

T_{on} (re-connect delay) is adjustable between 1 and 250 seconds

4-T_{off} (re-isolation delay) setting:



Press Set button until "Toff" led is on.

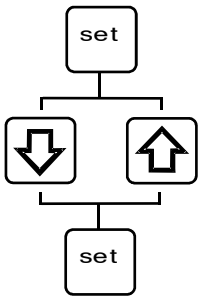
Adjust T_{off} to the desired value using up and down buttons.

Press Set button again, T_{off} will be stored in the memory and "Steps" led will be on.

In case no additional buttons are pressed, the relay will operate automatically within 10 seconds as programmed

T_{off} (re-isolation delay) is adjustable between 1 and 100 seconds

5-Steps setting:



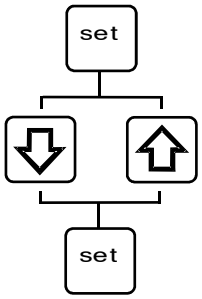
Press Set button until " Steps" led is on

Adjust the number of Steps to the desired value using up and down buttons.

Press Set button again, Steps will be stored in the memory and "Sequencel" led will be on.

In case no additional buttons are pressed, the relay will operate automatically within 10 seconds as programmed

6-Sequence:



Press Set button until " Sequence" led is on

Adjust Sequence to the desired value using up and down buttons.

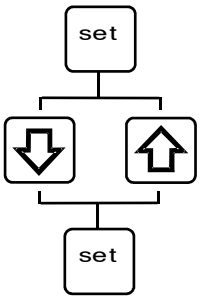
Press Set button again, Sequence will be stored in the memory and "O.V.set" led will be on.

In case no additional buttons are pressed, the relay will operate automatically within 10 seconds as programmed

Relay has 6 different sequence logic.

a)1.1.1.1.1.... .....1 system, displayed as 1.1.1.
b)1.2.2.2.2.....2 system, displayed as 1.2.2.
c)1.2.3.3.3.....3 system, displayed as 1.2.3.
d)1.2.4.4.4.....4 system, displayed as 1.2.4.
e)1.2.3.6.6.....6 system, displayed as 1.2.6.
f) f)1.2.4.8.8.....8 system, displayed as 1.2.8.

7-O.V. Set: (Over voltage setting):



Press Set button until " O.V.set" led is on.

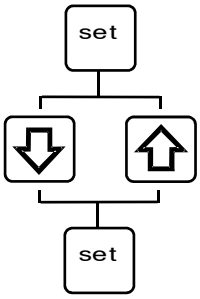
Adjust O.V.set to the desired value using up and down buttons.

Press Set button again, O.V.set will be stored in the memory and "Manuel" led will be on.

In case no additional buttons are pressed, the relay will operate automatically within 10 seconds as programmed

O.V.set is adjustable between 250 and 299 seconds

8-Manual / Automatic selection:



Press Set button until " Manuel" led is on.

Using up and down buttons, you can adjust manual mode "**001**" or "**000**" on the display for automatic operation.

Press Set button again, manual / automatic selection will be stored in the memory and relay will start functioning.

At manual mode, "Manuel" led starts blinking that means manual operation is on.
At manual mode, you can connect the capacitor steps using up button and disconnect the capacitor steps using down button.

In order to connect one step, press up button for a while and "C+" led' will be on, according to the adjusted "T_{on}" , the desired step will start to operate properly. In order to connect an additional step, same operation is repeated.

In the same logic, in order to disconnect a set, pres down button for a while and "C –" led will be on, after the adjusted "T_{off}", the step will be disconnected.

SIGNALS

On the top of the front panel, there are equal number of leds to the number of steps. Therefore, it's easy to follow which steps are connected. The functionn of the other leds are as follows:

"C +" led is on means the system need capacitors and after Ton period, the following capacitor step will be connected

"C –" led is on means the system is over compensated and at the end of Toff period, the proper capacitor step will be disconnected

"Normal" led is on means the system is well compensated.

"Cap." led is on means the load is capacitive

"İnd." led is on means the load is inductive

"Cosø" led is on displaying the present cosø (power factor)

"Q/P (%)" led is on displaying the present ratio of reactive power to active power

For example, the display reading "0,25" and "ind" led' is on, it means the present ratio of reactive power to active power is 25%.. In similar manner, the display reading "0.10" and "Cap." Led' is on, it means the present ratio of reactive to active power is capacitive 10%
In order to read "Q/P (%)" press any up or down button for a while. (Relay should be in automatic mode)

At normal display, the screen will show present cosø . In order to read the ratio of reactive power to active power, press any up or down button for a while and the display will read Q/P(%) for about 10 seconds. After 10 seconds cosø value will be displayed automatically. In order to return reading cosø , pres any up or down button for while

SWITCHING

The switching logic of the relay depends on the selectedsequence type, either rotating systems or double rotating system. In this logic, the capacitor steps will be switched equally for long periods .

1.1.1.....1 system rotating system

1.2.2.....2 system rotating system.

1.2.3.3 .....3 system double rotating systems

1.2.4.4.....4 system double rotating system

1.2.3.6.....6 system double rotating system

1.2.4.8.8.....8 system double rotating system

Let's explain a double rotating system.

For example 1.2.3.6.....6 system is selected . In this case the first 3 steps 1.2.3 are rotating internally and the other steps are rotating internally. Ton is adjustable between 1 and 250 seconds and Toff is adjustable between 1 and 100 seconds.

But there's internal protection so that no step is re-connected before 45-50 seconds since this period is required for the capacitor unit to discharge. Otherwirse there'll be over voltages on the capacitor unit which wiill cause damages.

In the same logic, no step is connected before 45-50 seconds if the supply voltage (system voltage) is off and on again.

In the switching logic, the amount of the reactive power required as well as the rotating system logic are also important . The relay will decide to connect or disconnect the proper step according to the power required.

OVER and UNDER VOLTAGE PROTECTION

If the supply voltage exceeds an adjusted value between 250 Volt and 299 Volt, the "O.V.set" led will start blinking. İf the over voltage continues longer than 2-3 seconds, the relay will disconnect all steps. And the display will read "AGr " blinking meaning that there was over voltage.
If the supply voltage is approximately 5V below the set value, "AGr " will be cleared and the display will start reading the present cosø value.The relay will start to operate properly and if necessary, it'll start to connect the capacitor stpes.
If the supply voltage is below 160 Volts, all steps are disconnected automatiically and the display will read "dgr " meaning under voltage
If the supply voltage is over 165 Volts again,"dgr" will disappear on the screen and the present cosø value will start reading on the display. The realy will start to operate properly and if necessary, it'll start to connect the capacitor steps.

AUTOMATIC POLARITY ADJUSTMENT :

In case the terminals "k" and "l" of the current transformer are not connected in the proper sequence , the relay will sense and corrects this mistake .
But it's important to connect the supply voltage and the current transformer from the same phase of the network.
If the supply voltage and the current transformer are at different phases, the polarity adjustment will not operate and the relay will not function properly since the input datas are not correct.

ALARM:

If normal led is off within 5 minutes after all capacitors are in operation or all capacitors are disconnected, that means a problem with compensation. In this case, "Alr " is displayed and starts blinking . At the same time, alarm relay operates, and alarm contacts will function. After the system becomes normal, "Alr " is cleared on the screen and cosø value is displayed again.

CONNECTION AND COMMISSIONING :

The connection of the relay is at Figurel 2. As a sample, 7-step relay connection is included in the figure. Every relay has its own connection diagram at the rear panel .

The important points for the connection are as follows;
The voltage supply and the current transformer should be on the same phase. In case the voltage supply and CT phase don't match, the cosø value on the display will be wrong and the relay will not function properly..

The current transformer should be connected at the load before the capacitor units, the CT current should read both the load and capacitor currents.

The phase voltage should be connected to the terminal no.2 of the relay via 6A fuse, the neutral of the supply voltage should be connected to terminal no.1 on the relay .

As described in the Setting section, , "c/k" , "Set Cosø " , "T_{on}" , "T_{off}" , "Steps, " "Sequence " and "O.V.set" values are adjusted properly. If C/k set is at automatic setting, the relay will choose the proper c/k and start to function.

In case c/k set value is to be adjusted manually, please use selection Table 1.

Even the factory setting are not changed, in most cases the result and functionality is successfull. In case the load is variable, too low , too much, it's advised to choose sequence 1.2.3.6.....6 or 1.2.4.8.....8 for beter results.

TECHNICAL PROPERTIES

Supply Voltage	: 220V AC ± %15 50 Hz
Rated Current	: ...../5A
Power consumption	: 5W
Current circuit consumption	: 0,2VA I=5A'de
Over current Withstand	: Continuous 10A, 50A for 1 sec.
Over voltage Protection	: 250-299V adjustable. : 3 sec. delay
Under Voltage Protection	: 160V
No voltage Protection	: All steps are disconnected for no voltage more than 50 msec.
c/k set	: 0,03 – 1,15 or automatic c/k set
Set Cosø	: 0,90 – 0,99
Sequences	: 1.1.1. ..... 1 1.2.2. ..... 2 1.2.3. ..... 3 1.2.4. ..... 4 1.2.3.6.....6 1.2.4.8.....8
Contacts	: Same as number of steps
Contact capacity	: 250 VAC 8A (at Cosø=1.00)
Cosømeter range	: 0,01 ind. – 0,01 Cap.
Cosømeter accuracy class	: ± %1,5 ± 2 count
Q/P measuring range	: % 0 - % 100
Q/P error accuracy	: ± %1,5 ± 2 count
Ambient temperature	: -10ºC ; + 50ºC
Dimensions	: 144x144x90
Panel drill dimensions	: 138x138mm
Net Weight	: 1,2 Kg.

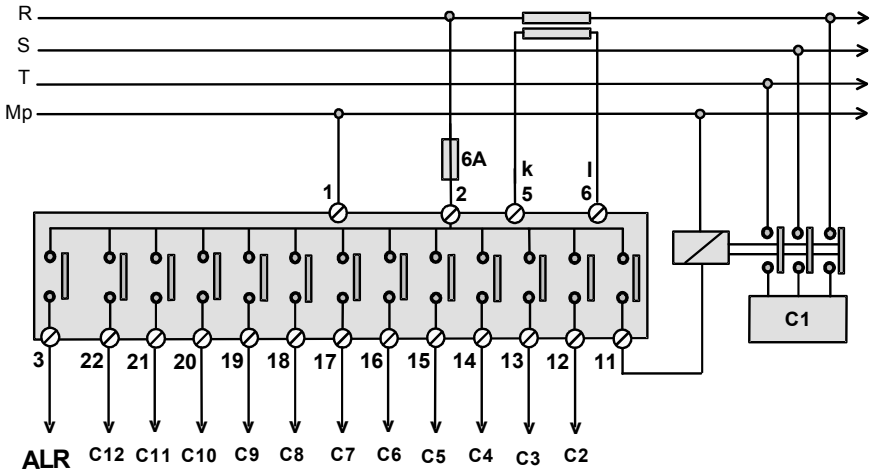
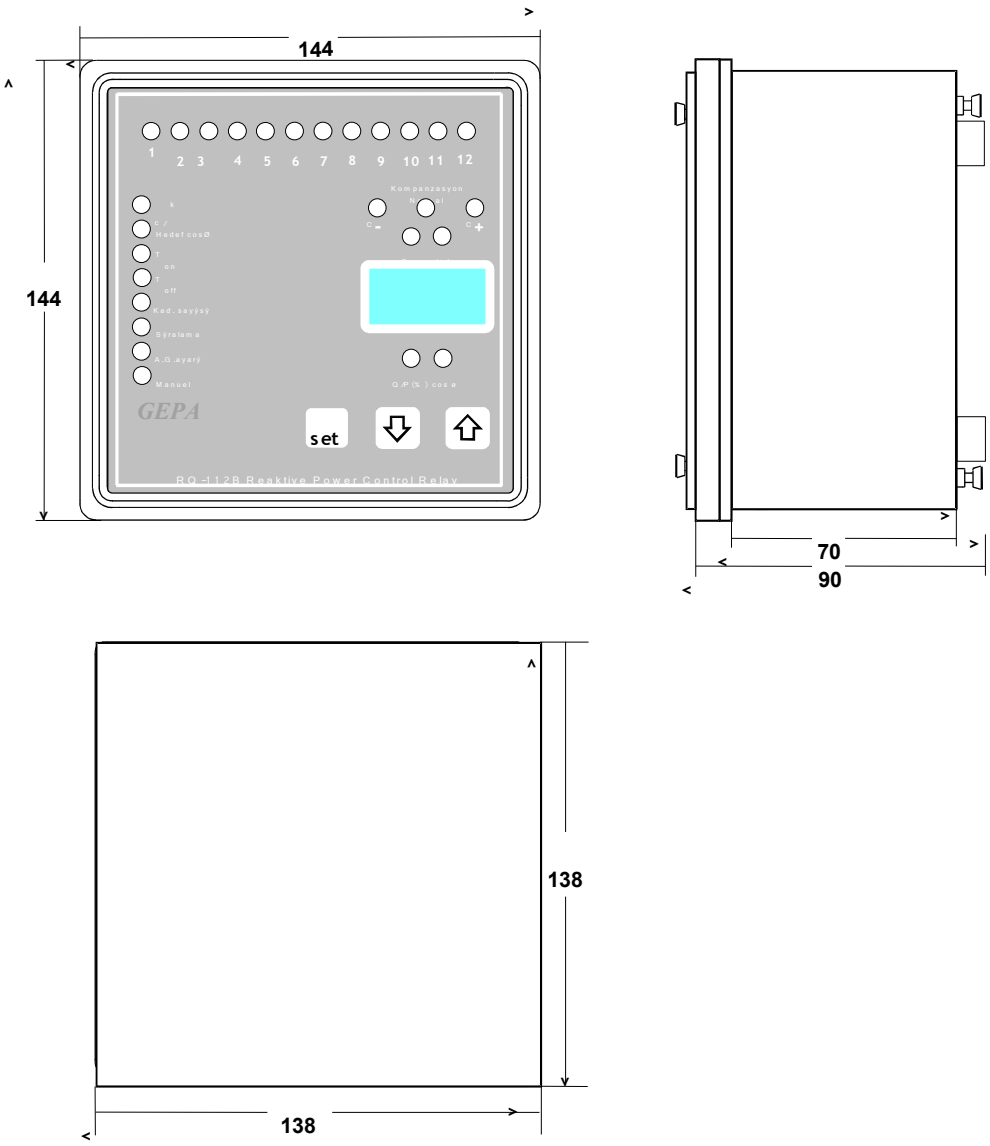


Figure 2

CT Ratio	Capacitor Size (kVAr)											
	1	2,5	5	10	15	20	25	30	40	50	60	100
30/5	0,16	0,41	0,83									
50/5	0,1	0,25	0,5	1								
75/5	0,06	0,16	0,33	0,66	1							
100/5	0,05	0,12	0,25	0,5	0,75	1						
150/5	0,03	0,08	0,16	0,33	0,5	0,66	0,83	1				
200/5		0,06	0,13	0,25	0,37	0,5	0,62	0,75	1			
250/5		0,05	0,1	0,2	0,3	0,4	0,5	0,6	0,8	1		
300/5		0,04	0,08	0,16	0,25	0,33	0,41	0,5	0,66	0,83	1	
400/5		0,03	0,06	0,12	0,18	0,25	0,31	0,37	0,5	0,62	0,75	
500/5			0,05	0,1	0,15	0,2	0,25	0,3	0,4	0,5	0,6	1
600/5			0,04	0,08	0,12	16	0,2	0,25	0,33	0,41	0,5	0,83
800/5			0,03	0,06	0,09	0,12	0,15	0,18	0,25	0,31	0,37	0,62
1000/5				0,05	0,07	0,1	0,12	0,15	0,2	0,25	0,3	0,5
1200/5				0,04	0,06	0,08	0,1	0,12	0,16	0,2	0,25	0,41
1500/5				0,03	0,05	0,06	0,08	0,1	0,13	0,16	0,2	0,33
2000/5					0,03	0,05	0,06	0,07	0,1	0,12	0,15	0,25

Table:
1 c/k set selection table



Panel window with

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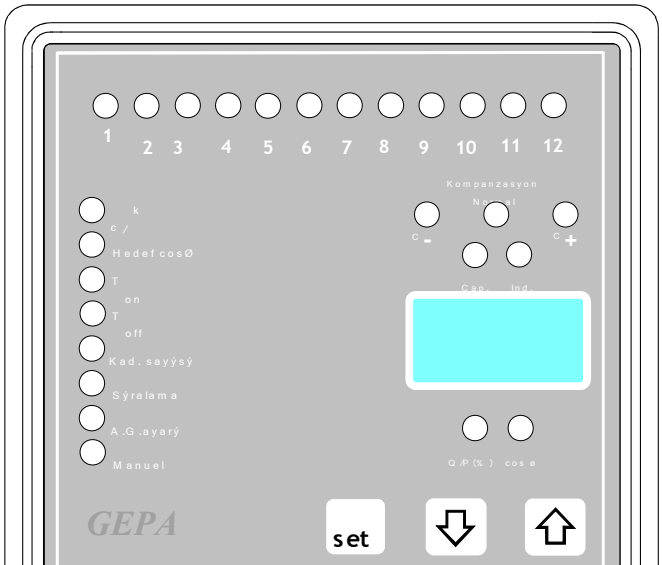

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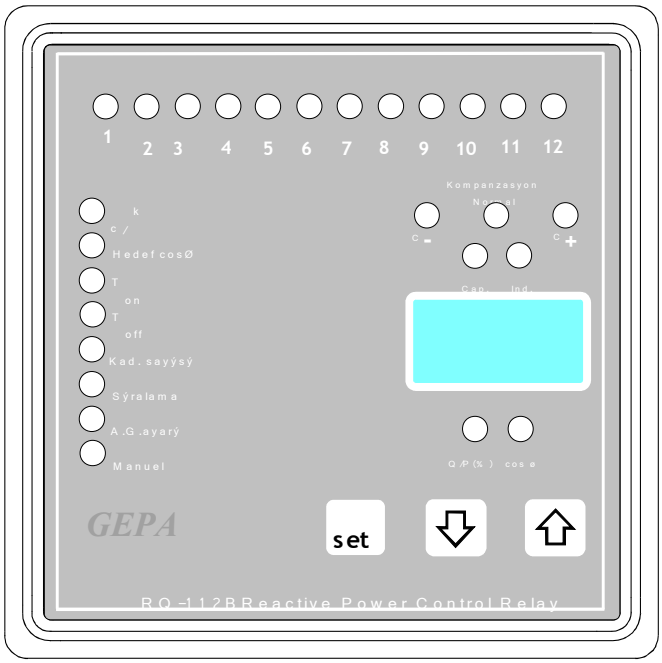

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