

Just That Easy: Reactive Power Compensation using the Controller CR4.0

Installation:

Attach 230V AC to the U_B power supply pins 5/6 (in any order) of the 24-pin long connector strip. Separately connect the U_M voltage measurement pins 1/3 to the capacitor bank feeding (L-L delta voltage any phase, any order). At three-phase systems with 400V AC you may alternatively bridge U_M to U_B to measure the 230V L-N star (wye) voltage. Attach the current transducer to the I_M current measurement pins 8/9 (in any order); remove the current transducer short (if any). Now half the work is done - the controller CR4.0 is empowered to gauge the net configuration.

One after another attach the branch lines to the capacitor bank to the outputs K1 to K8, pins 11 to 18 of the connector strip (in any order). Attach the phase pole of the 230V AC supply for the contactors inside the capacitor bank to the COM common output pin 10 (-8K controller variant: or COM2, pin19) and the corresponding neutral to the return paths from the contactors. Now the Reactive Power Controller CR4.0 hardware is ready to compensate the reactive currents in your system by activating the capacitors of the bank.

Commissioning:

When powering up (turn in the controller fuse resp. switch on the circuit breaker) all lamps of the Reactive Power Controller CR4.0 light for a few seconds (lamp test). Then the controller is ready for commissioning. The green LED "U(V)" lights and the numerical 7-segment display shows the voltage actually measured. By the arrow down "↓" key you may proceed to the next LED "I(A)" to display the actual current through the current loop transducer <--> controller (0..5A). The numerical display is blinking because the current transducer ratio (ctr) is still unknown (the shown value bases on 5A:5A).

Start the Automatic Self Commissioning process by a long keystroke (3 seconds) on both green arrow keys " \downarrow " and " \rightarrow " (=reset) or by selecting the "Set" menu item "In. 2", activated by keystroke on "SET". While the commissioning process is running the CR4.0 controller switches several times steps of the capacitor bank. It determines from the changes in strength and phasing of current and voltage the net configuration as well as the capacitors reactive powers. That process may take about 5 to 15 minutes. In the meantime the controller displays clocked in sequence "SELF" / "InIt" / "...".

Commissioning is finished when the displayed sequence changes to "SELF" / "InIt" / "donE" followed by lighting all lamps during change to the Automatic Regulation Mode by reset.

If not turned off the sequence "SELF" / "InIt" / "... " is two or three times intercepted by displaying the results of the commissioning process each starting with "APPr" (for "approve!"); for details refer to the Menu Structure (short form guide) resp. to the chapters in the verbose Operations Instructions manual. You may speed up the result display by " \rightarrow " or stop it by "SET".

If you want to track the single actions of the commissioning process you may select that prior to process start ("detail info"). Refer to the verbose detailed Operating Instructions manual. It also comprises the statements necessary for non-standard commissioning.

Automatic Regulation Mode Operation:

While compensating the reactive power in automatic mode operation your controller CR4.0 shows the resulting power factor $\cos \phi$ at the numerical 7-segment display. The green LED "**cos phi**" indicates that all works nice. The more the $\cos \phi$ approaches 1.00 the less your mains is stressed by reactive current. But note that at low active load the power factor $\cos \phi$ may achieve any value without relevance because the reactive power is low, too; low load conditions are indicated by no or only one small capacitor being switched on.

The green "Steps" LEDs show which steps of the capacitor bank are actually switched on.

During automatic mode operation the mains conditions and the system utilization are tracked by the controller. That gives an extensive collection of actually measured values with their minimum and maximum to be obtained by using the menu tree "Info". The menu tree "Set" offers a multiplicity of settings due to adapt operation, error detection and alarming to your requirements.

Technical Data

Measuring System

Type of measuring system single phase, electronic

Measuring Voltage 58V..700V AC {-100V variant 50V..250V AC}, max, 780V AC
Resolution raw approx. 1,0V {0,4V}; filtered approx.0,2V {0,1V}
Accuracy repeat accuracy approx. 0,6%; abs. approx. 1,5%
Input impedance high impedance, <50 μ A
Fusing max. 4A
Harmonics Fourier analysis, filtered 1. .. 31. harmonics

Measuring Current 0 .. 5A AC, max. 7.7A (-1A variant 0 .. 1A AC, max. 2A)
Resolution raw approx. 10mA {2mA}; filtered approx. 3mA {1mA}
Accuracy repeat accuracy approx. 0,6%; abs. approx. 1,5%
Input impedance 0,3VA @ 5A =12m Ω (90mVA @ 1A =90m Ω)
Harmonics Fourier analysis, filtered 1. .. 31. harmonics

Regulation bases on the filtered measuring readings
(-8K) resp. on the raw measuring values (-8T, -4T4K)

Frequency Range 45Hz .. 65Hz (lock-in range); 41Hz .. 69Hz (pull-in r.)
Temperature Measur. about -20°C ... +70°C

Power Supply

Supply Voltage 230V AC, 50/60Hz
Power consumption <15VA
Fusing max. 4A
Ambient Temperature -10°C .. +60°C

Steps Outputs

Number of Outputs / 8, Relays for contactors (-8K) or Transistors for
Output Types thyristor switches (-8T), in variant -4T4K mixed
Smallest Step Power -8K: 12var (L-L), 21var (L-N) x current transducer ratio ctr
Relay Output for contactors: 250V AC, max. 4A, in total max. 4A
Fusing max. 4A
Transistor Output for thyristor switches 10V DC, max. 150mA (single / Σ)
external power supply (variants -E) 8..16V DC (abs.max. 20V), Σ max. 1.2A
Alarms / Fan relay 250V AC, max.4A
Fusing max.4A

Panel Mounting

Case Panel-mounting case 144mm x 144mm
acc. DIN IEC 61554 approx.
Panel Opening 138mm x 138mm
Case Depth 60mm

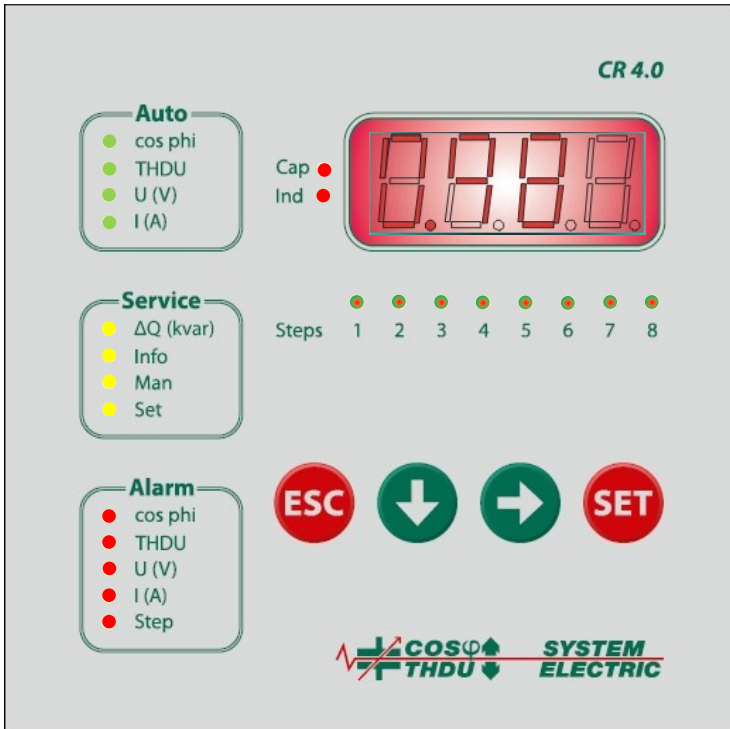


Figure 1

Front Panel of the Reactive Power Controller CR4.0

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