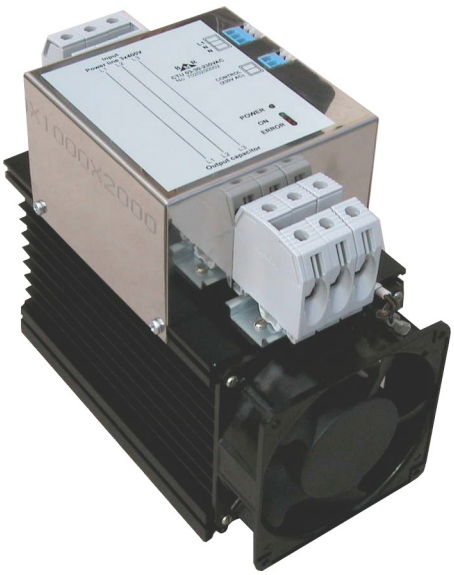
BMR CTU 02

Thyristor switching module for fast PF compensation

User manual



version 1.9

Content

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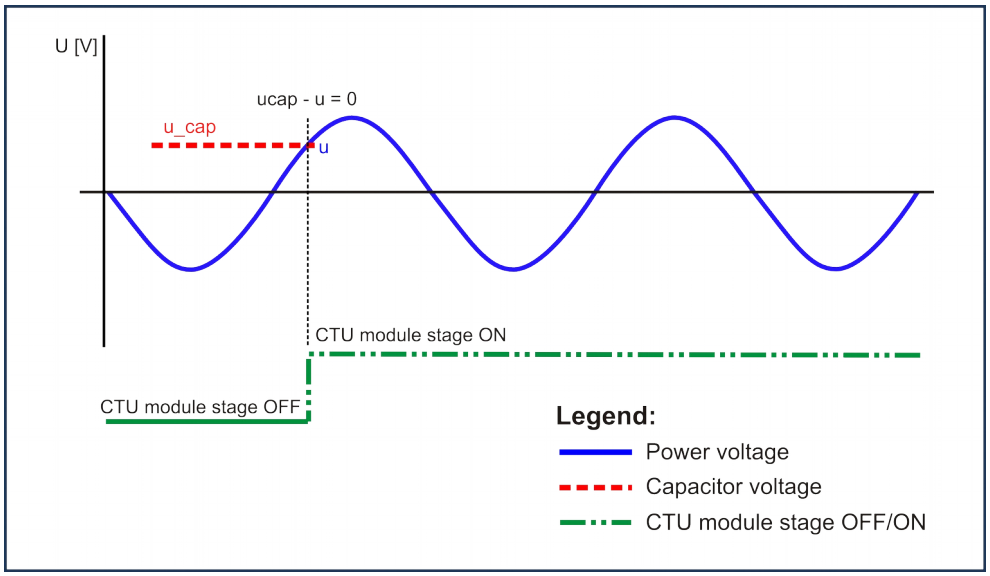
1. Function description

Contact-less thyristor modules of CTU02 range are designed for smooth and fast switching of power capacitors, especially for switching of L – C circuits with dominant capacity factor (detuned capacitor stages). CTU02 modules are suitable for power factor compensation in application with fast load changes.

The advantage of CTU02 modules usage, comparing to the standard switching of capacitor stages by mechanical contactors, is immediate capacitor connection and fast disconnection without any disturbances to the network.

Fast compensation in CTU02 and three-phase capacitor, gives possibility of smooth and fast connection of capacitor without any disturbances to the network. Smooth disturbance less operation is very important for sensitive application like, for example, hospitals, bank offices, army and similar. This smooth and fast compensation reaction is possible thanks to CTU02 module special construction and switching operation principle. CTU02 module can switch capacitor immediately at the moment when the difference between capacitor voltage and system voltage equals zero. With power factor controllers of GCR06 / GCR12 and FCR06 / FCR12 range the speed of switching can be up to 25 operation per second.



Picture 1. Principles of switching in "zero":

Result of smooth thyristor compensation by CTU02 modules is the high reduction of current peaks in the system. This is important feature that protects electronic appliances against the damage or interference.

For appropriate function and longer working time it is recommended use CTU02 thyristor modules with current limiting reactors JTC or detuned reactors.

Module itself is protected against overheating by electronic thermostat that switches the module off when the temperature exceeds 80ºC.

2. Device description and indication features

CTU02 is a compact module which mechanical base consists of cooling aluminium profile to which power thyristors, power terminals and control unit are mounted. Modules for power 50 kvar and higher are equipped by fan.

In the CTU02 module there are five signal LED's.

POWER green LED	Presence of power supply voltage
ERROR red LED	Temperature error of thyristor module
ON3 green LED	Phase 3 operation switched on
ON2 green LED	Phase 2 operation switched on
ON1 green LED	Phase 1 operation switched on

CTU02 modules are produced in the following types of power and control voltage:

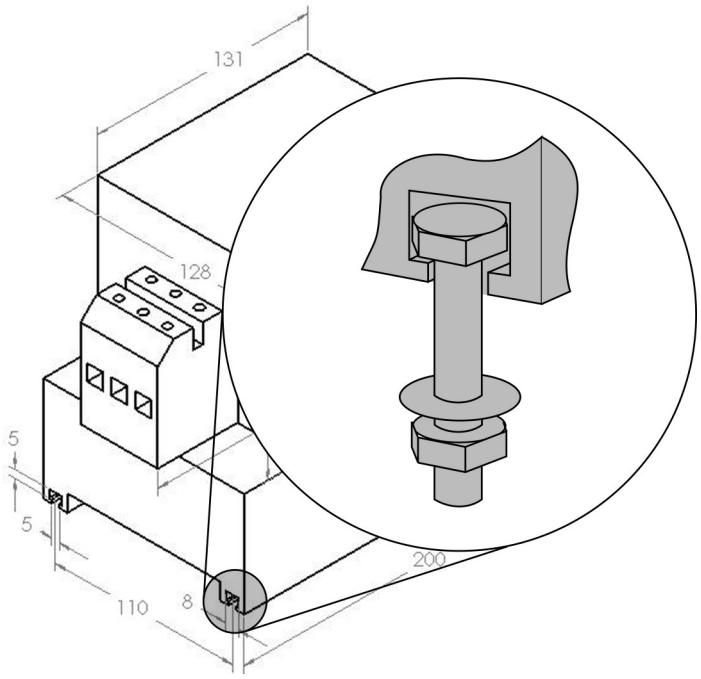
Type	Maximum capacitor power	System voltage	Control voltage
CTU 02-400-15	15 kVAr	400 V $_{AC}$	24 V $_{DC}$ or 230 V $_{AC}$
CTU 02-400-30	30 kVAr	400 V $_{AC}$	24 V $_{DC}$ or 230 V $_{AC}$
CTU 02-400-50	50 kVAr	400 V $_{AC}$	24 V $_{DC}$ or 230 V $_{AC}$
CTU 02-400-72	72 kVAr	400 V $_{AC}$	24 V $_{DC}$ or 230 V $_{AC}$

Important

CTU02 modules can be operated by control voltage 230 V_{AC} 50 Hz or 24 V_{DC}. For the application where only thyristor modules are used used, 24 V_{DC} control voltage is recommended.

3. Mounting

The module has to be installed in vertical position in the switchboard by four screws. Vertical position is important for well cooling of heat-sink. Power conductors and cables from capacitors are connected to power connectors of power thyristor module in the way as it is described on the scheme on the label.

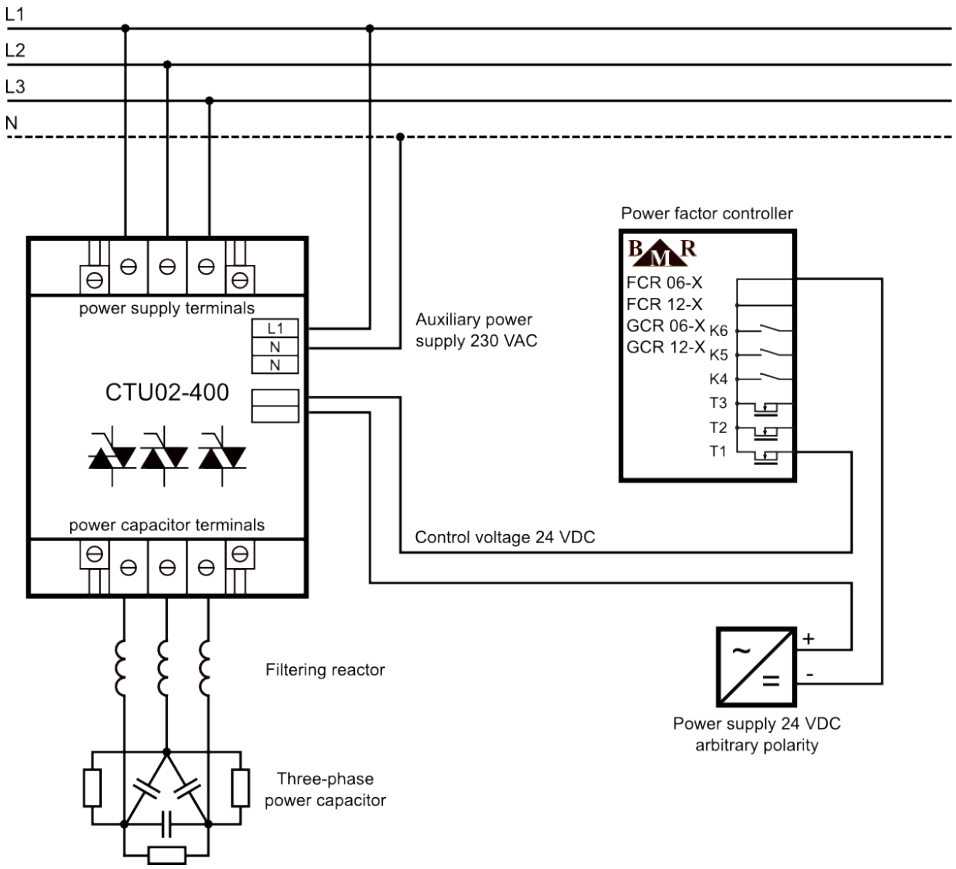


Picture 2. Mounting points

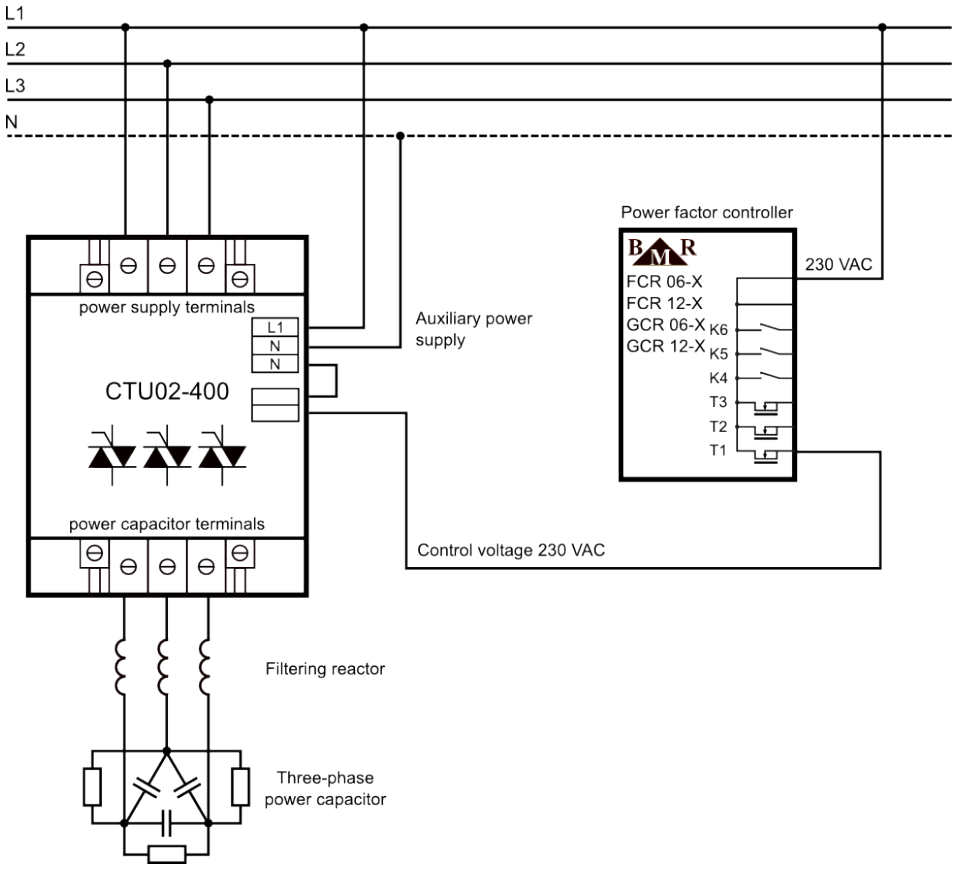
4. Connection

The board with control unit is power supplied from the individual circuit 230 V AC / 50 Hz, 2 VA and it shall be protected by a circuit breaker of max. 6 A. If the voltage of 230 V AC is supplied to control the stage, it is necessary to assure that the auxiliary power supply voltage of CTU02 module and controlling voltage from the power factor regulator will be from the same phase.

Switching module has to be protected by fuse gR characteristic with the body size 00 in the open design for better cooling. It is important select the proper fuse according the I^2t_c (A^2s) parameter to be not higher than 10 kA. Only that way chosen fuse protects semiconductor in correct way.

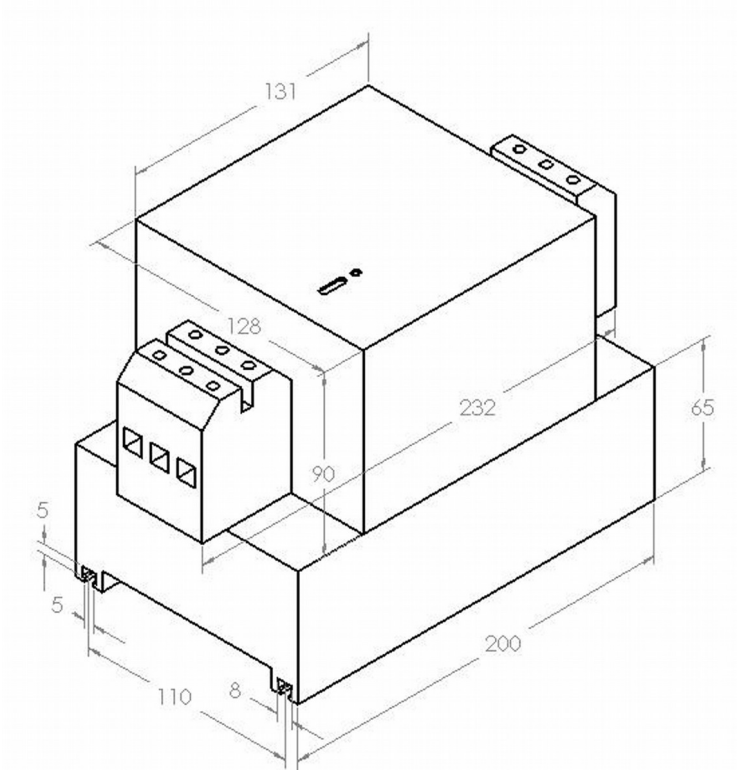


Picture 3. Connection diagram with 24 V DC control voltage

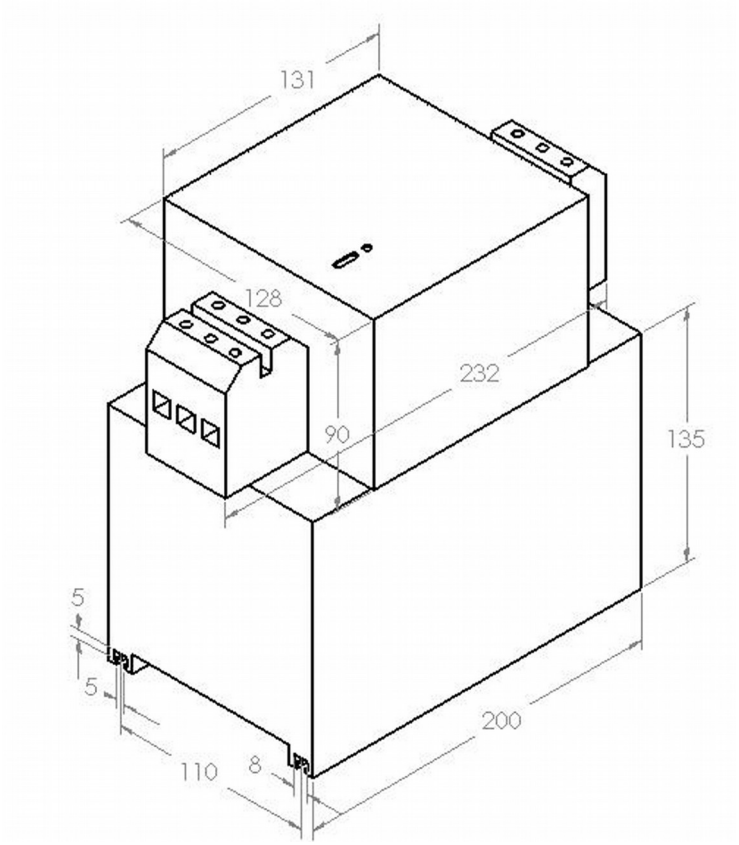


Picture 4. Connection diagram with 230 V AC control voltage

5. Dimensions



Picture 5. Dimensions of CTU 02-400-15 module



Picture 6. Dimensions of CTU 02-400-30 module

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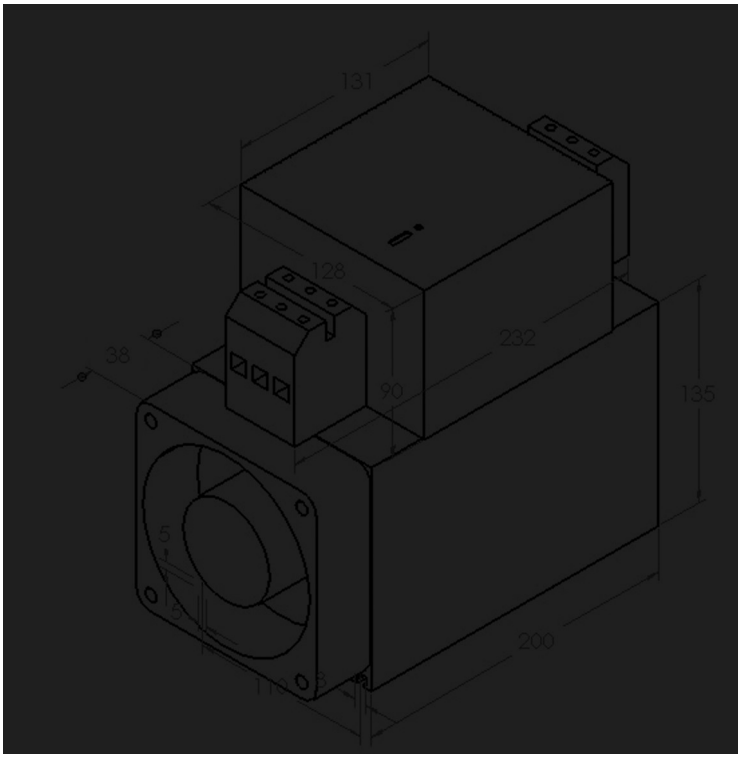

Picture 7. Dimensions of CTU 02-400-50 and CTU 02-400-72 module

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6. Technical features

Parameter	CTU02-400-15	CTU02-400-30	CTU02-400-50	CTU02-400-72
System voltage	400 V_{AC} 50 Hz (+10%,-15%)			
Reverse blocking voltage	1600 ... 2200 V			
Power of three-phase capacitor	15 kvar	30 kvar	50 kvar	72 kvar
Rated phase current	22 A	43 A	72 A	104 A
Control voltage	24 V_{DC} or 230 V_{AC} 50 Hz			
Control circuit input power	0.24 VA			
Auxiliary power supply input	230 V / 2 VA			
Operating status signalization	LED			
Load type	capacitive, resistive and combined LC			
Maximum power dissipation	60 W	150 W	250 W	300 W
Size of conductor	35 mm^2			
Fan input power	-	-	3 VA	3 VA
Working temperature	-25ºC ... +45ºC			
Weight	3.4 kg	5.0 kg	5.6 kg	6.0 kg
Protection degree	IP00			
Dimensions	see chapter 5. Dimensions			

7. Recommended current limiting reactors

For application where there is no need of detuned (LC) steps usage it is recommended to use current limiting reactors to protect thyristors against current peaks. For such installation the capacitor with 400 V nominal voltage is appropriate choice.

C nominal power at Un=400 V [kVAr]	Capacitor capacitance [µF]	JTC reactor type	Rated phase current [A]	Type of thyristor module
1.00	3 x 6.63	JTC20	1.4	CTU02-400-15
1.50	3 x 9.95	JTC20	2.2	
2.00	3 x 13.26	JTC20	2.9	
2.50	3 x 16.58	JTC20	3.6	
3.15	3 x 20.89	JTC20	4.6	
5.00	3 x 33.16	JTC20	7.2	
6.25	3 x 41.45	JTC20	9.0	
7.50	3 x 49.74	JTC20	10.8	
10.00	3 x 66.31	JTC20	14.5	
12.50	3 x 82.89	JTC85	18.1	
15.00	3 x 99.47	JTC85	21.7	
20.00	3 x 132.63	JTC85	28.9	CTU02-400-30
25.00	3 x 165.79	JTC85	36.1	
30.00	3 x 198.94	JTC85	43.4	
33.3	3 x 220.83	JTC85	48.1	
35.00	3 x 232.10	JTC85	50.6	CTU02-400-50
37.5	3 x 248.68	JTC85	54.2	
40.00	3 x 265.26	JTC85	57.8	
50.00	3 x 331.57	JTC85	72.3	
≤ 72.00	-	JTC110	≤ 104.00	CTU02-400-72

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8. Recommended C and L for detuned steps

Power of LC at 400V [kVAr]	C nominal power at Un=440 V [kVAr]	Capacitor capacitance [µF]	Inductance of detuned reactor [mH]	Rated current [A]	Type of thyristor module
0.89	1.00	3 x 5.48	43.137	1.28	CTU02-400-10
1.33	1.50	3 x 8.22	28.758	1.92	
1.78	2.00	3 x 10.96	21.569	2,57	
2.22	2.50	3 x 13.70	17.255	3.21	
2.80	3.15	3 x 17.26	13.694	4.04	
4.40	5.00	3 x 27.40	8.637	6,41	
5.60	6.25	3 x 34.25	6.902	8.02	
6.67	7.50	3 x 41,10	5.752	9.62	
8.89	10.00	3 x 54.81	4.319	1.80	
11.11	12.50	3 x 68.51	3.455	16.00	
13.33	15.00	3 x 82.21	2.876	19.20	
17.77	20.00	3 x 10.61	2.169	25.60	CTU02-400-30
22.20	25.00	3 x 137.01	1.727	32.10	
24.97	28.10	3 x 153.46	1.535	36.00	
26.66	30.00	3 x 164.42	1.438	38.50	
35.55	40.00	3 x 219.22	1,080	51.30	CTU02-400-50
39.99	45.00	3 x 246.62	0.959	57.72	
44.43	50.00	3 x 274.03	0.864	64.10	
49.94	56.20	3 x 306.91	0.770	72.10	
≤ 72.00	≤ 81.00	-	-	≤ 105.00	CTU02-400-72

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