



# EMCOS s.r.o.

## STYKOS

---

### THYRISTOR-CONTROLLED DETUNED POWER FACTOR CORRECTION EQUIPMENTS



POWER FACTOR CORRECTION EQUIPMENTS - MEASUREMENT - PRODUCTION - PROJECTS - SERVICE

## USE

Some inductive appliances show fast variations in compensation power - often even in intervals of several periods of mains frequency. This load cannot be effectively compensated with usual compensation equipments with mechanical contactors.

It is necessary to use a special regulator with fast evaluation of power factor and some thyristor switching of capacitor banks. This combination shows a fast speed of regulation, switching and disconnecting do not produce any interfering transients and overcompensation is eliminated. Capacitor banks are used exclusively with detuned filters, as the inductive appliances with fast variations of load are always sources of harmonic interference. The whole equipment is thus highly reliable.

Thyristor-controlled detuned power factor correction equipments regulate very quickly and are resistive against harmonic frequencies.

Thyristor-controlled equipments STYKOS can be used for compensation of various appliances without any problems. It is very suitable to use them in heavy duty circuits with fast variations of load - welding plants, pressing lines, controlled drives, lifts, cranes etc.

It is suitable to install the thyristor-controlled compensators in circuits where it is necessary to eliminate interfering effects of compensation equipments to the distribution system - banks, hospitals, administration centres etc. and where high requirements for accuracy and speed of regulation of power factor are demanded.

## FINISH

The whole equipment is installed in steel-sheet cubicles with degree of protection IP40.

The supply is designed as an independent connection switchboard with a circuit breaker (switch) from 100A to 1250 A.

The capacitors are switched with special three-phase thyristor switches, which eliminate the transient phenomenon with switching of capacitors. In the circuit switch - capacitor, a reactor is installed. The reactor, together with the capacitor, creates a series resonance circuit, which is tuned to 189 Hz ( $p = 7\%$ ). This effectively eliminates the most frequent occurrence of harmonic frequencies (3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup>, 9<sup>th</sup> etc). The speed of switching and disconnecting of switches is given only by the mains frequency (theoretically max. 20 ms/phase) - time of response of the regulator is min. 40 ms (typically 80 ms with adjustable delay of measurement).

The capacitors are of a MKP type (metallised polypropylene foil), self-healing, with safety overpressure disconnecter. A non-leakable impregnant is used (dry capacitors). The impregnant does not contain any PCB substances. The dissipated power of capacitors is max. 0,5 W/kvar, total dissipated power of switchboards is according to the table of power.



The operation of power factor correction equipments is controlled with a special fast microprocessor regulator EMCOS EFR7 with contact-less outputs and a built-in digital phase meter. The regulator enables to control switches independently in individual phases (asymmetrically loaded mains) or simultaneously in all phases (symmetrically loaded mains). The switchboard is delivered in a type for independent control of individual phases, the concrete mode of regulation is set with a service technician with putting of the equipment in operation. The mode of independent regulation requires 3 independent

instrument current transformers in supply cable of the main switchboard.

The needed compensation power is always installed according to the customer's requirement or upon the realised measurement and analysis of consumption.

Standardised power series - see the table.

## TECHNICAL SPECIFICATIONS

Voltage system	3PEN AC 50 Hz 400V/TN-C (3NPE AC 50Hz 400V/TN-S)
Current circuit	3 (1) pieces transformers x/5A, max. consumption 2 VA
Degree of damping	$p=7\%$ ( $f_0=189$ Hz)
Degree of protection	IP40
Ambient temperature	indoor type $-5^{\circ}\text{C}$ až $+40^{\circ}\text{C}$ (average temp. for 24 h max. $35^{\circ}\text{C}$ )
Dimensions	according to table of power
Surface finish	electrophoresis paint, shade RAL 7032

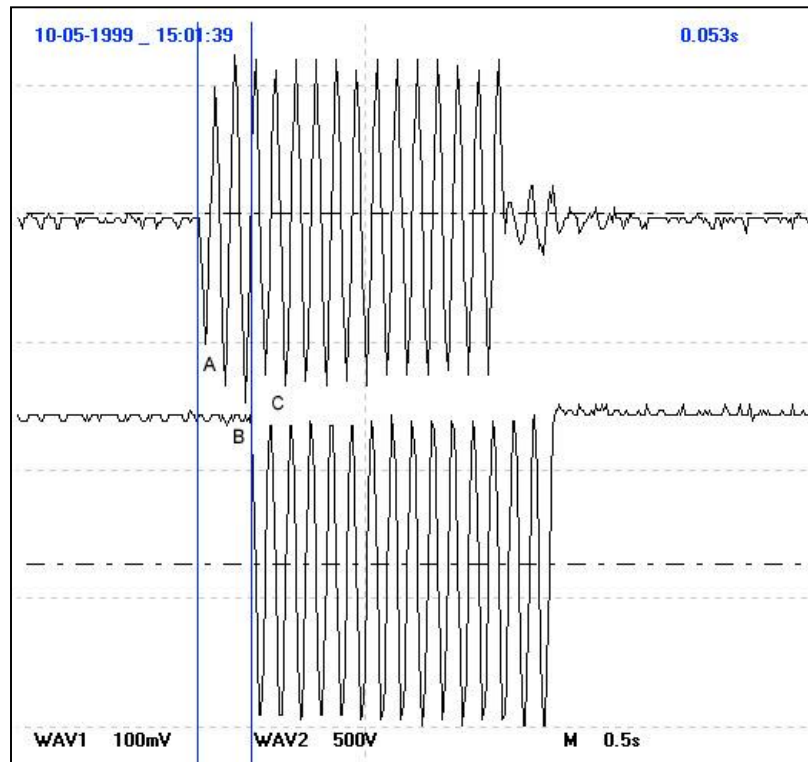
The equipment is manufactured in accordance with EN 60439-1-4 (35 7107)

## FUNCTION

The function of the compensation equipment STYKOS is shown on the picture. There is a welding automatic machine with length of weld approx. 300ms with repeating shorter than 1sec. The regulator EFR7 first measures the signal **A** (20ms), then a mathematical evaluation **B** (18ms) is carried out. It is then followed with a regulating intervention **C**. A programmable delay (1 to 250 periods) is inserted before other measurement to eliminate effects of the transient phenomenon. The capacitors are connected during 3 to 4 periods, similarly after the weld is finished, the capacitors are disconnected within max. 3 periods.

It is proved that this system of fast feedback regulation EFR7 is suitable for processes with time of their lasting at least 10 periods (200ms).

For intervals shorter than 200 ms it is suitable to control switching of capacitors directly with control pulses from the inductive appliance or using a current inductive relay.



**TABLE - switchboards STYKOS**

STYKOS					Connection switchboard		Current [A]
Type	Power [kvar]	Losses [W]	Weight [kg]	Dimensions [mm] (h/w/d)	Type	Dimensions [mm] (h/w/d)	
ES-52/3	52 (3x17,5)	625	320	2150/600/600	PP-125-6	2150/600/600	107
ES-70/8	70 (8x8,75)	760	380	2150/800/600	PP-160-6		144
ES-87/5	87 (5x17,5)	970	400	2150/800/600	PP-200-6		180
ES-105/3	105 (3x35)	1125	360	2150/600/600	PP-250-6		217
ES-123/7	123 (7x17,5)	1315	430	2150/800/600			254
ES-131/15	131 (15x8,75)	1340	520	2150/800/600	PP-315-6		270
ES-158/9	158 (9x17,5)	1370	700	2150/800+600/600	PP-400-6		326
ES-175/5	175 (5x35)	1600	480	2150/800/600			361
ES-193/11	193 (11x17,5)	1785	720	2150/2x 600/600			398
ES-245/7	245 (7x35)	2200	760		PP-500-6		505
ES-263/15	263 (15x17,5)	2385	790	2150/800+600/600	PP-630-6		542
ES-315/9	315 (9x35)	2755	850		PP-800-6		649
ES-333/19	333 (19x17,5)	3120	910	2150/2x 800/600			685
ES-385/11	385 (11x35)	3315	940				793
ES-420/6	420 (6x70)	3525	960		PP-1000-6		865
ES-455/13	455 (13x35)	3810	1160	2150/800+2x600 /600			939
ES-490/14	490 (14x35)	4145	1240	2150/2x800+600 /600			1011
ES-525/15	525 (15x35)	4500	1300	2150/600+2x800 /600	PP-1250-6		1090
ES-560/16	560 (16x35)	4860	1400	2150/3x800 /600			1156
ES-595/17	595 (17x35)	5215	1430				1228
ES-630/9	630 (9x70)	5600	1470		PP-1600-6	1300	
ES-630/18	630 (18x35)	5580	1620	2150/2x600+2x800 /600			



**EMCOS s.r.o.**

Nákladní 1032, 415 01 TEPLICE, CZECH REPUBLIC  
 Tel.: +420 417 533 521, 533 525, Fax +420 417 515860  
 e-mail: emcos@emcos.cz  
 www.emcos.cz