

## TSM – LC10

### Thyristor-Module for dynamic Power Factor Correction (PFC)

Version 1.0

#### Description

The TSM-LC10 for Dynamic PFC is a fast electronically controlled self-observing thyristor switch for capacitive loads up to max. 12,5 kvar (400V) which is capable to switch PFC capacitors within a few milliseconds as often and as long as required without abrasion. Triggering can be done by means of dynamic power factor controllers, programmable logic controllers (PLC) or directly out of the technologic process.

#### Features

- Component for the design of Dynamic PFC-systems in 400V-grids
- Micro-processor controlled alignment to tuned or de-tuned capacitor branches (up to 14%) for optimized switching behaviour.
- For capacitive loads up to 10 kvar at 400V
- Monitoring of voltage and phase sequence; display of status via LED
- No system perturbation due to switching operations (transients)
- Switching without delay
- Maintenance free
- Long useful service life
- No noise emission during switching operation
- Compact module ready for connection



#### Applications:

Dynamic („real time“) PFC for fast processes, e.g.

- pressing
  - welding machines
  - elevators
  - cranes
  - wind turbines etc.
- with fast changing and high fluctuating loads.

#### Installation and connection

The mechanical mounting is done directly on a mounting plate. The main terminals are designed as clamps and can be directly connected to the branch fuse resp. to the capacitor.

Connection is done according picture 1. It is mandatory to use superfast electronic fuses as branch fuses of the TSM-module to protect the semiconductor device! Basics of dimensioning must be obeyed!

Triggering of the module is taking place without any time delay by a 10 – 24 VDC signal (coming from the PFC-controller or an adequate control system) fed in at the connection X1 (signal).

## **Putting into operation**

After switching on the net voltage (engaging of the branch fuse) the thyristor module is ready for operation.

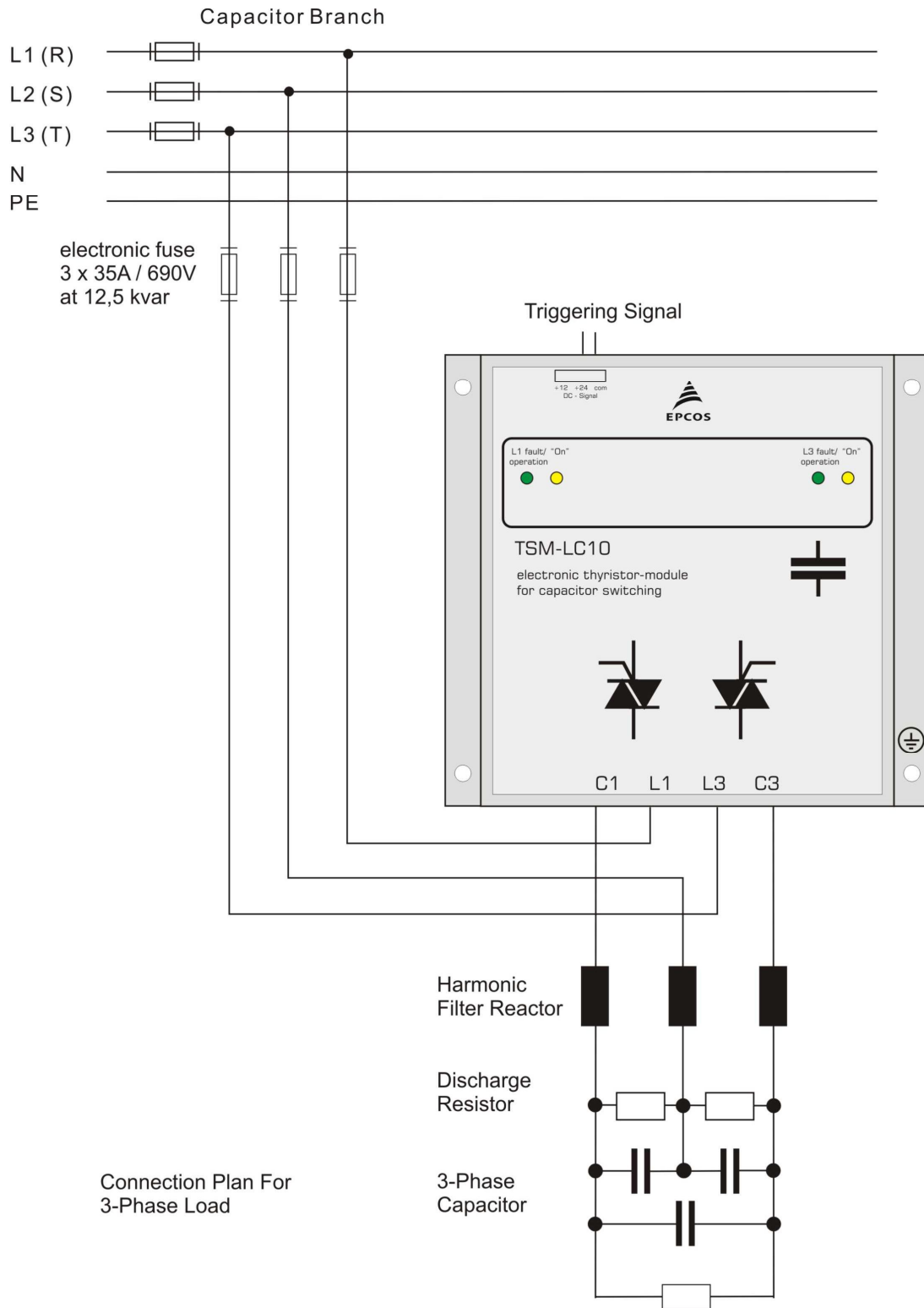
For each phase the thyristor module has 2 status-LEDs with the following meaning:

green:	operating voltage activated, thyristor module standby
red is flashing:	phase voltage L1-L3 too low (undervoltage <300V)
permanent red:	phase 2 is missing or under-voltage or phase L1 or L3 is missing or capacitor without capacitance or not existent
LED "On" (yellow):	"Module ON"

## **Technical Data**

Net voltage:	380 ... 400 V – 50/60Hz
Switching capability:	Nominal output 10 kvar at 400 V 12.5 kvar at 400 V with ambient temperature < 40 °C
Activation:	10...24 VDC ( appr.20mA ), via terminal clamp; internally insulated
Switching time:	appr. 5 ms
Re-switching time:	depending on degree of detuning and dimension of discharge resistor
Display:	via 4 LEDs : operation/error each phase, triggering signal
Monitoring:	permanent monitoring of net voltage and operation status
Power circuit:	direct connection 4-pole clamps, ( D = 6mm <sup>2</sup> resp. 4 mm <sup>2</sup> ) Connection from bottom
Power dissipation:	$P_v ( W ) = 2.0 \times I ( \text{ in A } )$ ; at 400V / 12.5 kvar typical 35 W therm.
Fuses:	3 x electronic fuse „superfast“ ( NH00 AC 690V ) 12.5 kvar: 35 A (e.g. SIBA Art.No.: 20 477 20-35 )
Dimensions:	162 x 150 x 75 (w x h x d)
Mounting position :	vertical, minimum 100mm distance upwards and downwards
Weight :	1.75 kg
Assembling :	direct mounting on mounting plate
Operating ambient temperature with nominal load:	-10°C ... 55°C

Pic 1:  
 Connection diagramm: Three-phase load (standard)



## *Attention: Please follow SAFETY INSTRUCTIONS !*

### **GENERAL:**

- Thyristor-modules may only be used for the purpose they have been designed for.
- Thyristor-modules may only be used in combination with appropriate safety devices (e.g. superfast fuses).
- Thyristor-modules have to be projected in such a way that in case of any failure no uncontrolled high current and voltages may occur.
- The devices have to be protected against moisture and dust – a sufficient cooling has to be assured.
- Thyristor-modules must only be switched to the net if any harm or danger to human beings or the PFC-system is eliminated.

### **Attention**

Due to the switching principle of the thyristor module the power-capacitors are permanently loaded to the peak value of the grid voltage (DC voltage) even when switched off! Therefore, following rules have to be obeyed in any case:

- For standard PFC-systems (without reactors) power capacitors of 440 V nominal voltage have to be used; for detuned systems PFC capacitors of 525 V nominal voltage have to be used.
- In dynamic PFC-systems with TSM-modules no fast discharge reactors may be used (reactor = DC-wise short circuit.)
- For tuned PFC-systems (without harmonic filter reactors) per thyristor module 2 current limitation reactors are mandatory! Available as accessory (BD100).
- Thyristor-modules in general have to be protected by superfast electronic fuses. Principles for dimensioning have to be considered. Fuses in the system have to be marked!
- Due to the special switching, the PFC-capacitors are fully loaded even when the particular step has been switched off. Protection against contact has to be guaranteed. Warning signals in the system are required!
- Even in switched off state no electrical isolation is achieved for electronic switches. Therefore parts of the systems may not be touched after switching off the complete system before the capacitors have been completely discharged.
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FAILURE TO FOLLOW CAUTIONS MAY RESULT, WORST CASE, IN PREMATURE FAILURES OR PHYSICAL INJURY.

### **MAINTENANCE, REPAIR**

The thyristor-switch has to be deactivated for maintenance purpose and main circuit breaker must be released. It must be assured that it cannot be switched on during maintenance. It must be checked that there is no voltage at all. Maintenance must only be executed by specially skilled personnel.

In case any repairs are needed, this must only be done from the manufacturers of the TSM-thyristor-module!