



**AUTOMATIC CAPACITOR BANK
FOR LOW VOLTAGE NETWORKS**

INSTRUCTION MANUAL

COMMISSIONING AND OPERATION MANUAL FOR LOW VOLTAGE AUTOMATIC CAPACITOR BANKS

1. DESCRIPTION

The automatic capacitor banks manufactured by LIFASA are used for the automatic power factor correction, to a user adjustable value in low voltage installations.

The capacitor banks are delivered fully assembled and tested at factory. They are made up by a group of capacitors with their protections, contactors and a power factor controller, all mounted in a cabinet of sheet steel.

2. INSTALLATION

For the use of the capacitor bank it is only necessary to install one or three appropriate current transformer, depending on the controller, for the total power of the installation, to connect the capacitor bank to the mains and to the earth terminal using supply and protection cables of enough cross section.

The capacitors shall be protected against possible leakage by earth leakage relay with adjustable delay time and sensitivity.

Location

The capacitor banks are for indoor installation and in well ventilated places, away from heat sources.

For a correct ventilation it is necessary to leave enough space in the lateral sides and to avoid blocking the ventilation grills.

Preparation

- Check that the rated voltage of the bank is adequate for the mains voltage to which is going to be connected
- Open the door of the control cabinet
- Switch off the circuit breaker of the control circuit

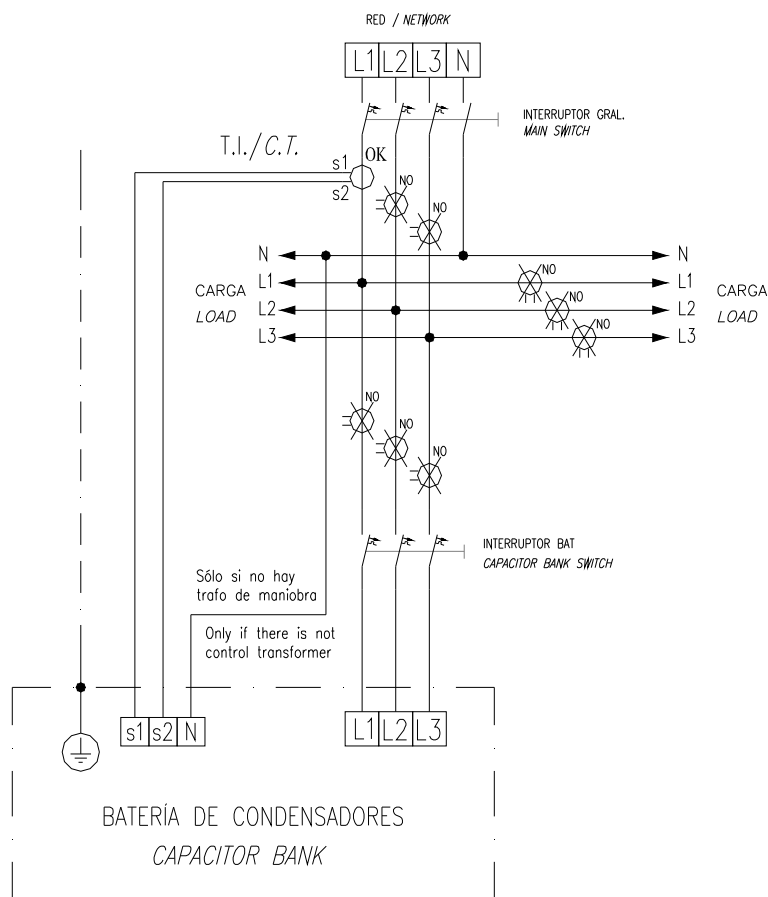
Connection of the protection conductor and the power circuit

- Connect protection conductor to the ground terminal
- Connect the three power terminals (L1, L2 and L3) using a cable of appropriate cross section for the total power of the bank. The rating plate of the bank gives the total current of the equipment.
- It is recommended that the bank terminal L1 is powered from the same phase on which the current transformer is installed or is going to be installed (see next section and the wiring diagram).

Wiring of control circuit

- The current transformer must be installed in a point of the line supplying all the current drawn by the installation, including the capacitors. **SEE WIRING DIAGRAM 1.**
- The current transformer must be chosen according to the maximum current of the installation and should have a secondary .../5 A.
- It is recommended that the current transformer is installed on the phase supplying the bank terminal L1, when only one C.T. is used.
- The secondary line of the current transformer should have a minimum cross section of 2.5 mm². For distances greater than 25 m between the C.T. and the capacitor bank, is recommended to increase the section.
- Connect the secondary winding of the current transformer to the terminals marked S1-S2 (k-l) **and remove the jumper, if any.**
- Connect the Neutral wire to the terminal marked N. If the capacitor bank has a control voltage transformer, Neutral wire is not necessary.

WIRING DIAGRAM 1



3. SETTINGS OF THE CONTROLLER

Some parameters are preset at the factory (working program, switching delay, number of steps).

Other parameters must be set during commissioning, following the instructions in the manual.

Desired $\cos \varphi$ (default 1)
 C/K (see SETTING TABLES C/K)
 Phase

Switch on the circuit breaker of the control circuit, and the control switch controller.

In order to adjust the different parameters enter in the SET-UP mode of the controller, following the instructions of the manual.

SETTING TABLES C/K

For capacitors rated voltage 400 V

Ip	kvar - first step of the capacitor bank													
	2,5	5	6,25	7,5	10	12,5	15	20	25	30	40	50	60	80
50	0,36	0,72	0,90	---	---	---	---	---	---	---	---	---	---	---
75	0,24	0,48	0,60	0,72	0,96	---	---	---	---	---	---	---	---	---
100	0,18	0,36	0,45	0,54	0,72	0,90	---	---	---	---	---	---	---	---
150	0,12	0,24	0,30	0,36	0,48	0,60	0,72	0,96	---	---	---	---	---	---
200	0,09	0,18	0,23	0,27	0,36	0,45	0,54	0,72	0,90	---	---	---	---	---
250	0,07	0,14	0,18	0,22	0,29	0,36	0,43	0,58	0,72	0,87	---	---	---	---
300	0,06	0,12	0,15	0,18	0,24	0,30	0,36	0,48	0,60	0,72	0,96	---	---	---
400	---	0,09	0,11	0,14	0,18	0,23	0,27	0,36	0,45	0,54	0,72	0,90	---	---
500	---	0,07	0,09	0,11	0,14	0,18	0,22	0,29	0,36	0,43	0,58	0,72	0,87	---
600	---	0,06	0,08	0,09	0,12	0,15	0,18	0,24	0,30	0,36	0,48	0,60	0,72	0,96
750	---	---	0,06	0,07	0,10	0,12	0,14	0,19	0,24	0,29	0,38	0,48	0,58	0,77
800	---	---	0,06	0,07	0,09	0,11	0,14	0,18	0,23	0,27	0,36	0,45	0,54	0,72
1000	---	---	---	0,05	0,07	0,09	0,11	0,14	0,18	0,22	0,29	0,36	0,43	0,58
1200	---	---	---	---	0,06	0,08	0,09	0,12	0,15	0,18	0,24	0,30	0,36	0,48
1250	---	---	---	---	0,06	0,07	0,09	0,12	0,14	0,17	0,23	0,29	0,35	0,46
1500	---	---	---	---	---	0,06	0,07	0,10	0,12	0,14	0,19	0,24	0,29	0,38
2000	---	---	---	---	---	---	0,05	0,07	0,09	0,11	0,14	0,18	0,22	0,29
2500	---	---	---	---	---	---	---	0,06	0,07	0,09	0,12	0,14	0,17	0,23

For capacitors rated voltage 440 V in a network of rated voltage 400 V

Ip	kvar - first step of the capacitor bank													
	2,5	5	6,25	7,5	10	12,5	15	20	25	30	40	50	60	80
50	0,30	0,60	0,75	0,89	---	---	---	---	---	---	---	---	---	---
75	0,20	0,40	0,50	0,60	0,80	0,99	---	---	---	---	---	---	---	---
100	0,15	0,30	0,37	0,45	0,60	0,75	0,89	---	---	---	---	---	---	---
150	0,10	0,20	0,25	0,30	0,40	0,50	0,60	0,80	0,99	---	---	---	---	---
200	0,07	0,15	0,19	0,22	0,30	0,37	0,45	0,60	0,75	0,89	---	---	---	---
250	0,06	0,12	0,15	0,18	0,24	0,30	0,36	0,48	0,60	0,72	0,95	---	---	---
300	---	0,10	0,12	0,15	0,20	0,25	0,30	0,40	0,50	0,60	0,80	0,99	---	---
400	---	0,07	0,09	0,11	0,15	0,19	0,22	0,30	0,37	0,45	0,60	0,75	0,89	---
500	---	0,06	0,07	0,09	0,12	0,15	0,18	0,24	0,30	0,36	0,48	0,60	0,72	0,95
600	---	---	0,06	0,07	0,10	0,12	0,15	0,20	0,25	0,30	0,40	0,50	0,60	0,80
750	---	---	---	0,06	0,08	0,10	0,12	0,16	0,20	0,24	0,32	0,40	0,48	0,64
800	---	---	---	0,06	0,07	0,09	0,11	0,15	0,19	0,22	0,30	0,37	0,45	0,60
1000	---	---	---	---	0,06	0,07	0,09	0,12	0,15	0,18	0,24	0,30	0,36	0,48
1200	---	---	---	---	---	0,06	0,07	0,10	0,12	0,15	0,20	0,25	0,30	0,40
1250	---	---	---	---	---	0,06	0,07	0,10	0,12	0,14	0,19	0,24	0,29	0,38
1500	---	---	---	---	---	---	0,06	0,08	0,10	0,12	0,16	0,20	0,24	0,32
2000	---	---	---	---	---	---	---	0,06	0,07	0,09	0,12	0,15	0,18	0,24
2500	---	---	---	---	---	---	---	---	0,06	0,07	0,10	0,12	0,14	0,19

Commissioning

Once checked that installation of the bank is correct, it will be put into service having in mind that the capacitor bank will only operate if, at the same time reactive power is being consumed in the installation.

Check manual operation by switching off some capacitors pressing the disconnection button. When you release it, the controller will connect the capacitors again.

Voltage

Reliable operation of the bank requires that the service voltage does not exceed the rated voltage.

It should be kept in mind that operation under overload conditions shortens considerably the capacitor life.

Current

Current drawn by the capacitor bank can exceed the rated current, due to the presence of harmonics in the mains, or due also to a voltage above the rated voltage. Both circumstances are dangerous for the capacitors.

It should be checked that the RMS current drawn by each capacitor is the rated one and never higher than 1.3 times the rated current. In order to avoid errors in the measurement, only "TRUE RMS" meters should be used to measure the current.

If excessive currents are detected, disconnect the bank and consult **INTERNATIONAL CAPACITORS Technical Assistance Service** in order to find the best solution to the problem.

4. COMMENTS FOR TROUBLE SHOOTING FOR CAPACITOR BANKS

MOST COMMON ERROR MESSAGES		
ERROR	CAUSE	SOLUTION
000 (MCExxADV) E01 (PFCL Elite and Master)	Current transformer connection to the controller (terminals s1-s2) is open circuit <u>or shorted</u>	Review and connect <u>or remove the jumper</u>
	Current transformer installed in the line of the capacitor bank (if the error occurs during initial startup)	Place de current transformer in the output of the main switch of the installation, upstream of the capacitor bank connection
	Current transformer too large for the current flowing to the installation	Change the current transformer to another more adjusted to the maximum current at the installation
	Low current consumption at the installation at this time	It will be corrected when consumption increases
E02 <i>(Overcompensation)</i> with all steps disconnected $\cos \varphi$ is capacitive	Current transformer installed in the wrong phase (if the error occurs during initial startup)	Modify the “Phase”parameter. Setting a value (t-1 ... t-6) in which the controller reads a $\cos \varphi$ inductive and non-negative
	There are other capacitive loads downstream of CT but not controlled by the controller	The capacitive loads should be connected upstream of CT
E03 <i>(undercompensation)</i> with all steps connected $\cos \varphi$ is not the desired	Capacitors down or low capacity	Check and replace those with a current well below its rated current, in some phase
	Some fuses blown or circuit breaker switched off	Check and replace the blown fuses
	Some contactor disconnected, although the controller gives the order for connection	Check the control circuit
	Current transformer installed in the wrong phase (if the error occurs during initial startup)	Modify the “Phase”parameter. Setting a value (t-1 ... t-6) in which the controller reads a $\cos \varphi$ inductive and non-negative
	Current transformer installed downstream of the connection of the capacitor bank. The current of capacitors does not pass through the CT	Install the current transformer upstream of the connection of the capacitor bank. Through the CT must pass all the current of the installation you want to compensate including capacitor bank
	$\cos \varphi$ setting very capacitive	Modify settings to $\cos \varphi$ 1 or greater than 0,95 IND
	Number of steps set, smaller than available	Set the “steps” parameter in the controller
The total power of the capacitor bank is small for the needs of the installation	Increase the power of the capacitor bank	

5. MAINTENANCE

Capacitor banks require only very few maintenance but it is mandatory to follow our recommendations for a reliable operation.

The following operations are recommended:

Monthly

- Check capacitors visually
- Check protection fuses
- Check temperature
- Check service voltage (specially at times of low load)
- Check the current through the capacitors

Annually

- Keep clean capacitor terminals and insulators
- Check that terminal connections are tight
- Check the state of the contactor contacts

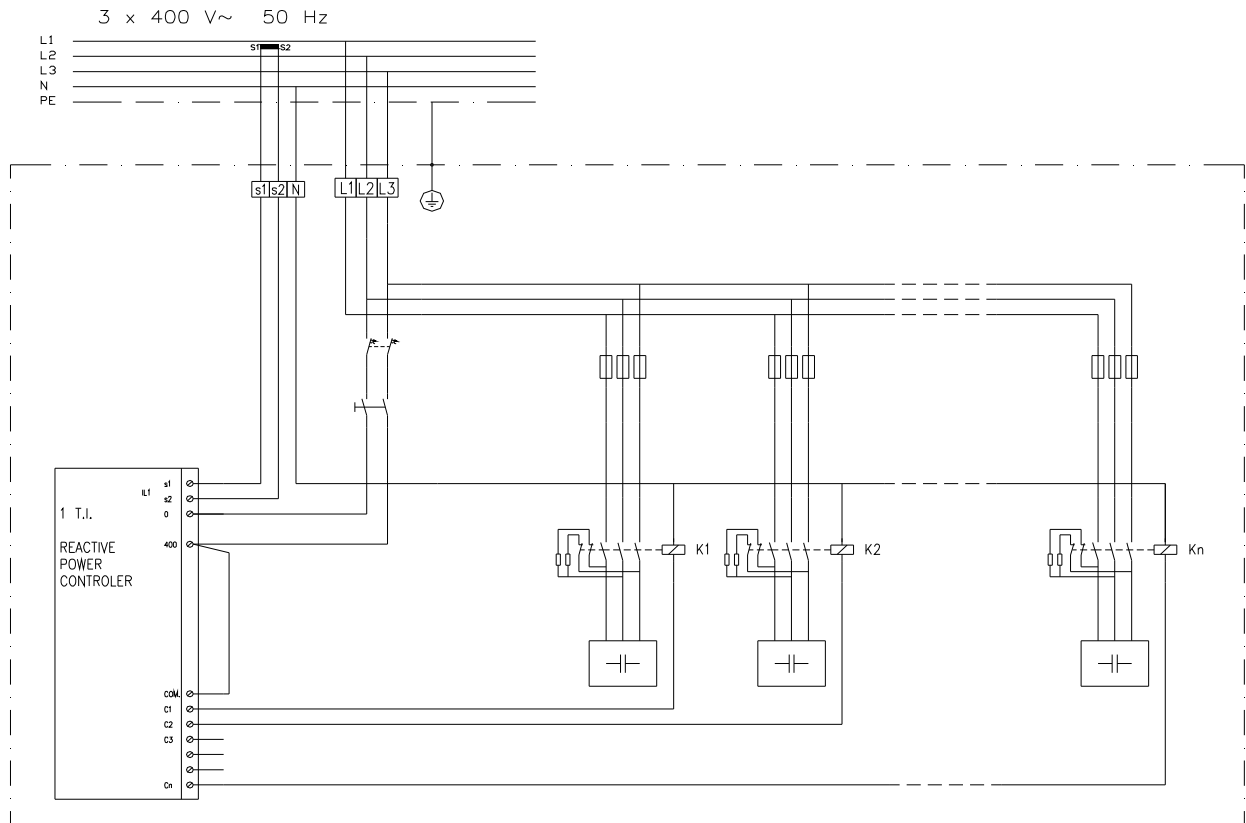
6. SAFETY



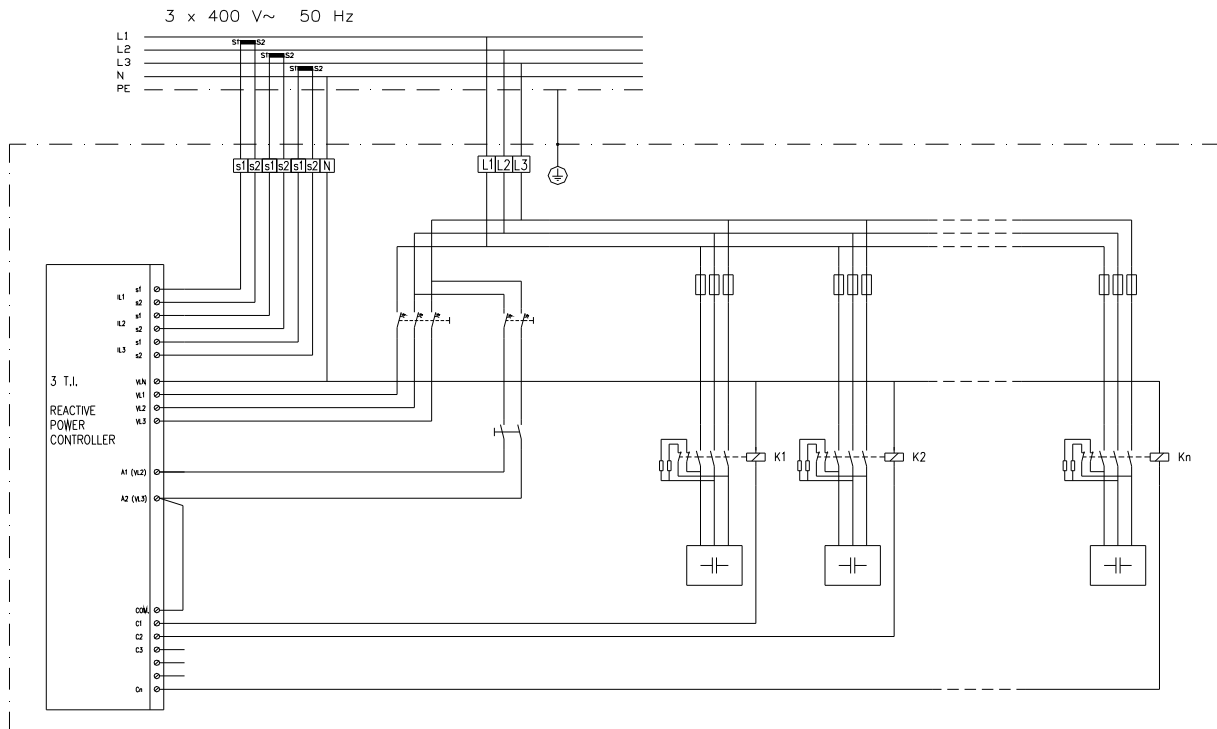
ATTENTION: Before performing any maintenance operation or handling any part of the bank, remove all the power and control fuses and check that capacitors are discharged

Even when the bank is disconnected from the mains, capacitors may still be charged. Therefore, after removing the fuses, wait for three minutes and then short circuit them and earth the terminals or outlet cables of each capacitor.

Standard wiring diagram (with one C.T.)



Standard wiring diagram (with three C.T.)



7. GUARANTEE

INTERNATIONAL CAPACITORS guarantees its products against any manufacturing defects for a period of TWO YEARS from the date of purchase. In no case shall this guarantee last longer than 18 month from the date of manufacture.

In the case of banks with automatic regulation, this guarantee does not neither those protective devices (fuses) nor the components of the operating equipment that are subject to wear and tear.

INTERNATIONAL CAPACITORS will repair or replace, as it deems fit, any defective product that is returned within the term of guarantee.

This guarantee shall be considered null and void if the product installation and maintenance instructions have not been followed or if the apparatus has been misused in any way.

8. TECHNICAL ADVICE AND ASSISTANCE SERVICE

INTERNATIONAL CAPACITORS puts at your disposal its TECHNICAL ASSISTANCE and ADVICE SERVICES to cooperate in the project and installation of capacitors, automatic equipment for power factor improvement and harmonics filters.

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