



**Aunilec**<sup>®</sup>  
Onduleurs • Redresseurs • Batteries

Automatic and fixed  
power factor correction

Certified



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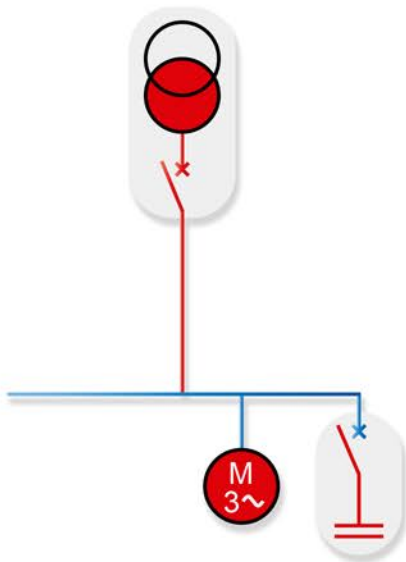
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# How to choose compensation battery for the reactive power

## Capacitor bank without regulation known as fixed compensation

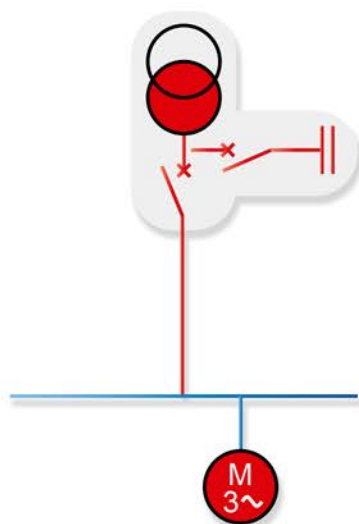
- Used when reactive power to compensate is constant and when the load is working 24h / 24h.
- Used when reactive power is to compensate for low power. Also standardized by the coefficient QC (Compensation to install in KVAR) / SN (Transformer power in KVA) is generally <15%. This threshold of 15% is indicative and we recommend it to avoid to overcompensate the charge power vacuum.
- Used to directly compensate the asynchronous motor, load losses of the line head transformer.

Table of the approximate maximum reactive power to be installed on a motor



Max. power of the motor		Max. speed rpm		
		3000	1500	1000
ch	kW	Max. power in kVAr		
11	8	2	2	3
15	11	3	4	5
20	15	4	5	6
25	18	5	7	7,5
30	22	6	8	9
40	30	7,5	10	11
50	37	9	11	12,5
60	45	11	13	14
100	75	17	22	25
150	110	24	29	33
180	132	31	36	38
218	160	35	41	44
274	200	43	47	53
340	250	52	57	63
380	280	57	63	70
482	355	67	76	86

Table of the approximate maximum reactive power to be installed on a transformer

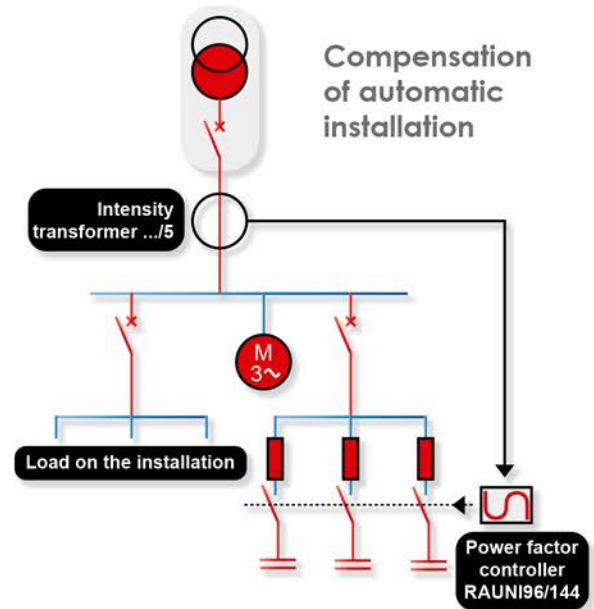


Nominal power of the transformer kVA	kVAr power to provide for internal transformer consumption		
	Operation		
	empty	75% load	Full load
200	4	9	12
250	5	11	15
315	6	15	20
400	8	20	25
500	10	25	30
630	12	30	40
800	20	40	55
1000	25	50	70
1250	30	70	90
2000	50	100	150
2500	60	150	200
3150	90	200	250
4000	160	250	320
5000	200	300	425

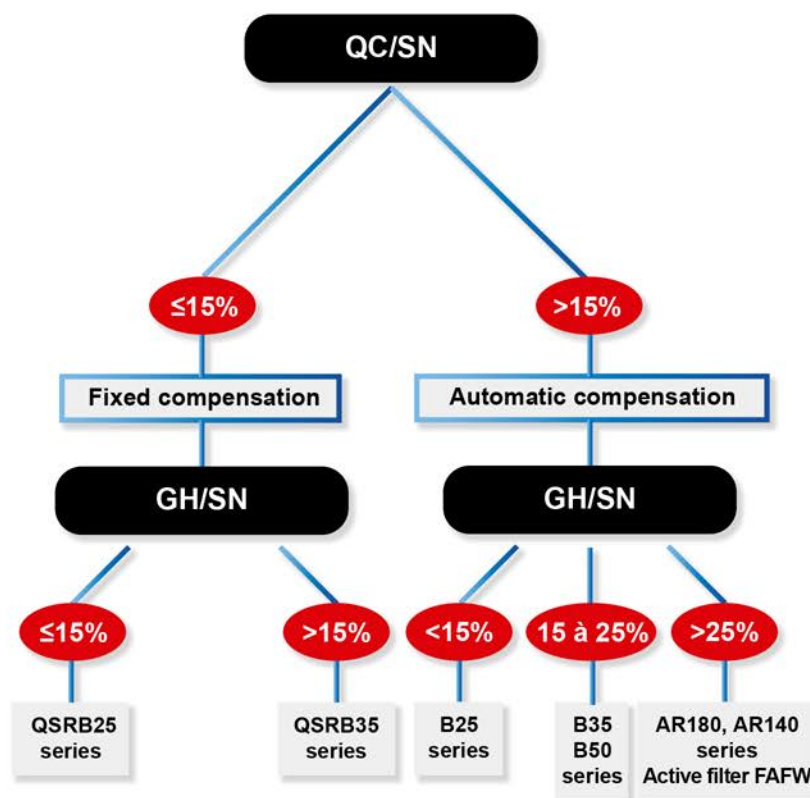
# How to choose the compensation battery of the reactive power

## Capacitor banks with regulation also called automatic compensation

- Used when the load changes on the installation and the need to compensate the reactive power is enabled through switched capacitor modules in or out service by the digital power factor controller Aunilec type RAUNI96 or RAUNI144
- Used for main switchboard (Low Voltage General Table) or from main departure of the factory
- The power varying more or less rapidly can play an important role in choosing the automatic capacitor bank.
- Either by electromechanical contactors if the rate of change of the load of the system is greater than one second with the series B25, B35, B50, AR180 and AR140.
- By electronically commutated thyristors also known as static compensation with the AST series. This innovative technology allows unlimited switching and removes transients.



Power of capacitor bank to install in KVAR (QC) following the transformer in kVA (SN) and the apparent power of the harmonic generators in kVA (GH).



$QC = P \times (Tg\phi_{i1} - Tg\phi_{i2})$   
 QC = Power of the capacitor bank  
 P = Active power in KW  
 Tgphi1 = Tangent phi measured on installing  
 Tgphi2 = Tangent phi to obtain (0.4 is the optimal value to avoid penalization by the electricity supplier)

**Selection table for protections and cables for three phase capacitors - Voltage 400V**

**Selection table for current transformers (TI) for three phase capacitors - Voltage 400V**

Capacitors Power in KVAR	Switch Caliber/settings in A	Cables* Section MINI in CU
10	32/18	4
20	40/38	6
30	63/57	10
40	80/75	16
50	100/95	25
60	125/115	35
70	160/135	50
80	160/150	50
100	200/190	70
120	250/225	95
140	315/265	120
150	315/285	150
160	315/300	150
180	400/340	185
200	400/375	240
210	500/395	240
220	500/415	240
240	500/450	2x95
250	500/470	2x120
280	630/530	2x120
300	630/565	2x150
320	630/605	2x150
340	800/640	2x185
360	800/680	2x185
400	800/755	2x240
440	1000/830	2x240
480	1000/905	4x95
500	1000/940	4x120
520	1250/980	4x120
560	1250/1055	4x120
600	1250/1130	4x150
680	1600/1280	4x185
760	1600/1430	4x185
840	2000/1580	4x240
920	2000/1730	4x240

Transformer power	Primary current in amps (A)	Normalized value of TI/5A
100 kVA	150	150
150 kVA	215	250
200 kVA	300	300
250 kVA	360	400
300 kVA	450	500
350 kVA	510	600
400 kVA	580	600
450 kVA	650	650
500 kVA	730	750
550 kVA	800	800
600 kVA	900	1000
650 kVA	940	1000
700 kVA	1015	1200
750 kVA	1085	1200
800 kVA	1150	1200
850 kVA	1230	1250
900 kVA	1300	1500
950 kVA	1375	1500
1000 kVA	1450	1500
1050 kVA	1520	2000
1100 kVA	1590	2000
1150 kVA	1665	2000
1200 kVA	1735	2000
1250 kVA	1810	2000
1300 kVA	1880	2000
1350 kVA	1950	2000
1400 kVA	2025	2500
1450 kVA	2095	2500
1500 kVA	2170	2500
1550 kVA	2240	2500
1600 kVA	2315	2500
1650 kVA	2385	2500
1700 kVA	2460	2500
1750 kVA	2530	3000
1800 kVA	2600	3000
1850 kVA	2680	3000
1900 kVA	2745	3000
1950 kVA	2820	3000
2000 kVA	2890	3000

\* With EPR insulation, temperature 30°C (unit mm<sup>2</sup>)

We recommend to install an opening TI in order to save time for the implementation and therefore reduce installation costs. Available with opening of 20 \* 30 to 80 \* 160mm.

# Energy saving Increasing energy efficiency



## General informations

Industrial plants where the load varies greatly throughout normal operation will require automatic power factor controller in order to connect the necessary capacitive power.

### Why power factor should be improved?

The benefits are the following:

- Reduce utility charges
- Increase system capacity
- Improve voltage
- Reduce circuit losses

### Reduce utility charges

Thermal capacity considerations force the Utilities to overbuild its distribution system in order to serve a facility with low power factor.

The Utilities force the customer to install capacitors for reducing the reactive energy.

### Increase system capacity

The thermal power of generators, transformers and cables limits the kVA that can be supplied by the system. Reducing the KVAR demand from existing load by installing capacitors, allows additional load to be added to the system.

### Improve voltage

High demand of reactive power increases the voltage drops across transformers, cables and other system components. The result is a decreased utilization voltage.

The voltage drops can be limited by increasing the power factor.

### Reduce circuit losses

Since current is reduced in direct proportion to the increase in power factor, the resistive losses, in the circuit, are inversely proportional to the power factor. The increase of power factor allows a losses reduction with substantial benefits for the system.

# Compensation

## Improving power factor

### Operating conditions

#### Nominal voltage

The nominal voltage of the capacitor bank is the voltage at which the product was designed and to which the test voltages refer.

For safe conditions, the operating voltage must not exceed the rated capacitor banks voltage.

#### Working temperature

Working temperature is a fundamental parameter for the safe functioning of Power Factor Correction Equipment. Consequently, it is very important to have sufficient heat dissipation inside the Power Factor Correction Equipment cubicle. Ventilation should be adequate to prevent that the temperature rise exceeding the limits of the capacitor design.

The capacitors are designed in accordance to CEI EN 60831-1 Standards. In hot weather, it is advisable that ventilation and/or air-conditioning are fitted where the Power Factor Correction Equipment is installed.

The exceeding of the temperature limits prescribed could reduce the life of the Power Factor Correction Equipment.

#### Special ambient conditions

Standard Power Factor Correction Equipment are not suitable to be used in places where the following special conditions occur:

- Quick creation of mildew
- Corrosive and saline atmosphere
- Presence of explosive or highly flammable materials
- Vibrations

In such particular cases, please, contact the Technical Department of AUNILEC.

### Choice of P.F.C. (Power Factor Correction) equipment in presence of non-linear loads

The ever-increasing use of static converters, rectifiers and other generators of harmonic current and voltage distortion on the supply network make it essential to carefully evaluate the installation of Power Factor Correction equipment. In order not to create a resonance condition, which amplifies overcurrent and overvoltage, becoming dangerous for the capacitors and other connected loads.

The choice of the right Power Factor Correction equipment is related to the power of the non-linear loads and the apparent power of the transformer. AUNILEC provides a complete range of Power Factor Correction equipment which can meet all these requirements. Our experienced Technical Department is at the disposal of the customers for advising them about the best possible solution.





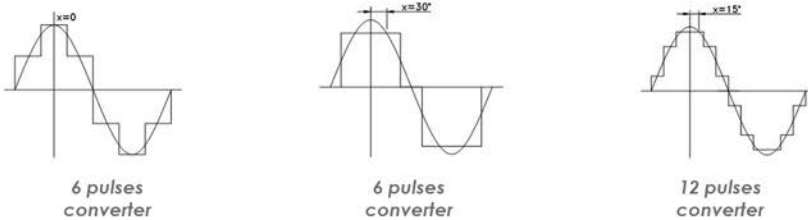
# Automatic capacitor banks - general

## Power Factor correction in presence of harmonics

In recent years, Power Factor Correction has evolved greatly due to the presence of generated harmonics by the loads.

These loads produce harmonic currents and voltage which distorts the network waveforms. The main sources of harmonics are generated by AC/DC static converters and UPS systems. For these reasons it is essential that any installation of Power Factor Correction equipment must be carefully evaluated.

The possible presence of harmonic currents in the network could create conditions of parallel resonance between the inductance of the network and the capacitors, generating overcurrents and overvoltages, which would cause premature failure of the power factor correction capacitors. The ideal power factor correction solution for any system must be determined by examination of the system parameters and harmonic spectrum.



Automatic capacitor banks

## Level of current harmonic distortion allowed in the equipment

THDI <sub>c</sub> % on the capacitors	THDI <sub>l</sub> % on the network	Capacitor banks
≤ 25	≤ 10*	B25PF/R
≤ 35	≤ 15*	B35PF/S
≤ 50	≤ 20*	B50PF/XS
≤ 85	≤ 50**	AR180PF/A
≤ 100	≤ 100**	AR140PF/HA

The new RAUNI regulators are equipped with alarm threshold, which disconnects the equipment if the ALARM THDi is exceeded. Equipments with blocking inductance have this threshold detection disconnected because there is no resonance risk.  
\* Resonance not allowed \*\* THDv max 6%

# Automatic capacitor banks

**B25 series**

Automatic capacitor banks  
Serie B25 THDI ≤ 25%



## Technical characteristics

### Rated voltage:

400Vac

### Rated frequency:

50Hz (60Hz on request)

### Voltage of auxiliary circuits:

110Vac

### Working temperature range:

-10°C/+50°C

### Cubicle:

20/10mm sheet steel, protected against corrosion by a phosphating treatment.

Epoxy powder painted, RAL 7035 color (other colors on request)

External Protection Degree:

IP30 (type S-M), IP40 (Type L)

Locking system:

by screw for cubicle type S and type M type

by key for cubicle type L

### Ventilation:

Forced

### Isolating switch:

Three-pole with door interlocking device

### Supplying:

Type S: entry of the cable from the top/bottom

Type M: entry of the cable from the top

Type L: entry of the cable from the bottom

### Wiring:

By N07VK CEI 20-22 flame retardant cables.

Auxiliary circuits are identified as in the electrical drawing

### Contactors:

Each capacitor banks is controlled by a three-pole contactor. To limit the overcurrent peaks, each contactor is provided with insertion resistors. Rated voltage of auxiliary circuits: 110 Vac, 50 Hz .

### Fuses:

Each capacitor banks is protected by a set of three fuses (NH00 type) with high breaking capacity. Also the auxiliary circuits are protected by fuses.

### Capacitors B25 440 Vac Series

Single phase of type self-healing, made up of metalized polypropylene, equipped with overpressure safety device and discharge resistor. Filling: biodegradable non toxic dry type, PCB free. Manufactured using new technologies of metallization.

Delta connection.

Capacitance tolerance: -5% +10%

Dielectric losses: <0.3W/kvar

Temperature class: -25°C (55°C)

### Regulators:

Varmetric measurement by means of a C.T. (Current Transformer)(secondary 5A) not supplied

### Reference Standards:

Complying with: L.V. 73/23 (93/68) EEC Directive

Capacitors: CEI EN 60831-1/2

Equipments: CEI EN 60439-1, CEI EN 61921-1

### Options (on request):

Automatic switch

Isolator with fuses

Protection degree : IP55

Type M: entry of the cable from bottom

Type L: entry of the cable from the top

**Network:** 400Vac 50Hz THDi ≤10%

Resonance non allowed

**Capacitors:** 440Vac 50Hz, THDi ≤25%



Type WxDxH mm	Power kVAR at 400V	Power of banks kVAR	Steps No	Isolating switch A	Regulator	Current A	Weight kg	Power kVAR at 415V
<b>B25PFSR-13</b> 460x215x480	13	1,875-3,75-7,5	7	63	RAUNI96	18	12	14
<b>B25PFSR-18.5</b> 460x215x480	18,5	3,75-7,5-7,5	5	63	RAUNI96	26	13	20
<b>B25PFSR-20.6</b> 610x215x480	20,6	1,875-3,75-7,5-7,5	11	80	RAUNI96	30	16	22
<b>B25PFSR-26</b> 460x215x480	26	3,75-7,5-15	7	63	RAUNI96	37	14	28
<b>B25PFSR-30</b> 460x215x480	30	7,5-7,5-15	4	63	RAUNI96	43	15	32
<b>B25PFSR-35</b> 610x215x480	35	1,875-3,75-7,5-7,5-15	19	100	RAUNI96	50	22	37,5
<b>B25PFSR-37.5</b> 460x215x480	37,5	7,5-15-15	5	100	RAUNI96	54	16	40
<b>B25PFSR-45</b> 610x215x480	45	7,5-7,5-15-15	6	100	RAUNI96	65	23	48
<b>B25PFSR-52.5</b> 610x215x480	52,5	7,5-15-15-15	7	125	RAUNI96	76	24	56,5
<b>B25PFSR-60</b> 610x215x480	60	7,5-7,5-15-30	8	160	RAUNI96	86	27	65
<b>B25PFSR-67.5</b> 610x215x480	67,5	7,5-15-15-30	9	160	RAUNI96	97	29	72,5
<b>B25PFMR-75</b> 420x380x700	75	7,5-15-22,5-30	10	250	RAUNI96	108	41	80
<b>B25PFMR-105</b> 420x380x920	105	7,5-15-22,5-30-30	14	250	RAUNI96	151	47	112
<b>B25PFMR-127.5</b> 420x380x920	127,5	7,5-15-22,5-30-52,5	17	400	RAUNI96	184	51	138
<b>B25PFMR-150</b> 420x380x920	150	15-30-45-60	10	400	RAUNI96	216	54	162
<b>B25PFMR-180</b> 420x380x1140	180	15-30-60-75	12	400	RAUNI96	259	60	194
<b>B25PFMR-195</b> 420x380x1140	195	15-30-60-90	13	500	RAUNI96	281	65	210
<b>B25PFMR-225</b> 420x380x1140	225	15-30-60-120	15	500	RAUNI96	324	69	242
<b>B25PFLR-255</b> 610x610x1760	255	15-30-30-60-60-60	17	630	RAUNI144	367	260	275
<b>B25PFLR-300</b> 610x610x1760	300	30-30-60-60-60-60	10	800	RAUNI144	432	270	322
<b>B25PFLR-375</b> 610x610x1760	375	37,5-37,5-75-75-75-75	10	800	RAUNI144	540	280	404
<b>B25PFLR-450</b> 610x610x1760	450	45-45-90-90-90-90	10	1000	RAUNI144	648	300	484
<b>B25PFLR-525</b> 610x610x1960	525	52,5-52,5-105-105-105-105	10	1250	RAUNI144	756	340	565
<b>B25PFLR-600</b> 1220x610x1760	600	60-60-120-120-120-120	10	2x800	RAUNI144	864	560	646
<b>B25PFLR-675</b> 1220x610x1760	675	67,5-67,5-135-135-135-135	10	2x800	RAUNI144	972	640	726
<b>B25PFLR-750</b> 1220x610x1760	750	75-75-150-150-150-150	10	2x1250	RAUNI144	1080	660	807
<b>B25PFLR-825</b> 1220x610x1760	825	82,5-82,5-165-165-165-165	10	2x1250	RAUNI144	1188	700	888
<b>B25PFLR-900</b> 1220x610x1760	900	90-90-180-180-180-180	10	2x1250	RAUNI144	1296	720	968
<b>B25PFLR-975</b> 1220x610x1960	975	97,5-97,5-195-195-195-195	10	2x1250	RAUNI144	1404	760	1049
<b>B25PFLR-1050</b> 1220x610x1960	1050	105-105-210-210-210-210	10	2x1250	RAUNI144	1512	800	1130

Automatic capacitor banks  
Serie B25 THDi ≤ 25%

# Automatic capacitor banks

**B35 series**

Automatic capacitor banks  
Serie B35 THDI ≤ 35%



## Technical characteristics

**Rated voltage:**

400Vac

**Rated frequency:**

50Hz (60Hz on request)

**Voltage of auxiliary circuits:**

110Vac

**Working temperature range:**

-10°C/+50°C

**Cubicle:**

20/10mm sheet steel, protected against corrosion by a phosphating treatment.

Epoxy powder painted, RAL 7035 color (other colors on request)

External Protection Degree:

IP30 (type S-M), IP40 (Type L)

Locking system:

by screw for cubicle type S and type M

by key for cubicle type L

**Ventilation:**

Forced

**Isolating switch:**

Three-pole with door interlocking device

**Supply:**

Type S: entry of the cable from the top/bottom

Type M: entry of the cable from the top

Type L: entry of the cable from the bottom

**Wiring:**

By N07VK CEI 20-22 flame retardant cables.

Auxiliary circuits are identified as in the electrical drawing

**Contactors:**

Each bank of capacitors is controlled by a three-pole contactor. To limit the overcurrent peaks, each contactor is provided with insertion resistors. Rated voltage of auxiliary circuits: 110 Vac, 50 Hz.

**Fuses:**

Each bank of capacitors is protected by a set of three fuses (NH00 type) with high breaking capacity. Also the auxiliary circuits are protected by fuses.

**Capacitors B35 500 Vac Series**

Single phase of type self-healing, made up of metalized polypropylene, equipped with overpressure safety device and discharge resistor. Filling: biodegradable non toxic dry type, PCB free. Manufactured using new technologies of metallization.

Delta connection.

Capacitance tolerance: -5% +10%

Dielectric losses: <0.3W/kvar

Temperature class: -25°C (55°C)

**Regulators:**

Varmetric measurement by means of a C.T. (Current Transformer) (secondary 5A) not supplied

**Reference Standards:**

Comply with L.V. 73/23 (93/68) EEC Directive

Capacitors: CEI EN 60831-1/2

Equipment: CEI EN 60439-1, CEI EN 61921-1

**Options (on request):**

Automatic switch

Isolator with fuses

Protection degree : IP55

Type M: entry of the cable from bottom

Type L: entry of the cable from the top



**Network:** 400Vac 50Hz THDi ≤15%. Resonance non allowed

**Capacitors:** 500Vac 50Hz, THDi ≤35%

Type WxDxH mm	Power kVAR at 400V	Power of banks kVAR	Steps No	Isolating switch A	Regulator	Current A	Weight kg	Power kVAR at 415V
<b>B35PFSS-10.5</b> 460x215x480	10,5	1,5-3-6	7	63	RAUNI96	15	12	11
<b>B35PFSS-15</b> 460x215x480	15	3-6-6	5	63	RAUNI96	21	13	16
<b>B35PFSS-21</b> 460x215x480	21	3-6-12	7	63	RAUNI96	30	14	22
<b>B35PFSS-24</b> 460x215x480	24	6-6-12	4	63	RAUNI96	34	15	25
<b>B35PFSS-28.5</b> 610x215x480	28,5	1,5-3-6-6-12	19	80	RAUNI96	41	22	30
<b>B35PFSS-30</b> 460x215x480	30	6-12-12	5	100	RAUNI96	43	16	32
<b>B35PFSS-36</b> 610x215x480	36	6-6-12-12	6	100	RAUNI96	52	23	38
<b>B35PFSS-42</b> 610x215x480	42	6-12-12-12	7	100	RAUNI96	60	24	45
<b>B35PFSS-48</b> 610x215x480	48	6-6-12-24	8	100	RAUNI96	69	27	51
<b>B35PFSS-54</b> 610x215x480	54	6-12-12-24	9	125	RAUNI96	78	29	58
<b>B35PFSS-60</b> 610x215x480	60	12-12-12-24	5	160	RAUNI96	86	31	65
<b>B35PFMS-84</b> 420x380x920	84	6-12-18-24-24	14	250	RAUNI96	121	47	91
<b>B35PFMS-102</b> 420x380x920	102	6-12-18-24-42	17	400	RAUNI96	147	51	110
<b>B35PFMS-120</b> 420x380x920	120	12-24-36-48	10	400	RAUNI96	173	54	130
<b>B35PFMS-144</b> 420x380x1140	144	12-24-48-60	12	400	RAUNI96	207	60	155
<b>B35PFMS-156</b> 420x380x1140	156	12-24-48-72	13	400	RAUNI96	225	65	168
<b>B35PFMS-180</b> 420x380x1140	180	12-24-42-96	15	400	RAUNI96	259	69	194
<b>B35PFMS-204</b> 420x380x1360	204	24-48-48-84	8	500	RAUNI96	294	74	220
<b>B35PFLS-240</b> 610x610x1760	240	24-24-48-48-48-84	10	630	RAUNI144	345	260	258
<b>B35PFLS-300</b> 610x610x1760	300	30-30-60-60-60-60	10	800	RAUNI144	432	280	322
<b>B35PFLS-360</b> 610x610x1760	360	36-36-72-72-72-72	10	800	RAUNI144	518	300	388
<b>B35PFLS-420</b> 610x610x1960	420	42-42-84-84-84-84	10	1250	RAUNI144	605	320	452
<b>B35PFLS-480</b> 610x610x1960	480	48-48-96-96-96-96	10	1250	RAUNI144	691	340	517
<b>B35PFLS-540</b> 610x610x2160	540	54-54-108-108-108-108	10	1250	RAUNI144	777	380	582
<b>B35PFLS-600</b> 1220x610x1760	600	60-60-120-120-120-120	10	2x800	RAUNI144	864	552	646
<b>B35PFLS-660</b> 1220x610x1760	660	66-66-132-132-132-132	10	2x800	RAUNI144	950	574	711
<b>B35PFLS-720</b> 1220x610x1760	720	72-72-144-144-144-144	10	2x800	RAUNI144	1036	600	775
<b>B35PFLS-780</b> 1220x610x1960	780	78-78-156-156-156-156	10	2x1250	RAUNI144	1123	620	840
<b>B35PFLS-840</b> 1220x610x1960	840	84-84-168-168-168-168	10	2x1250	RAUNI144	1209	640	904
<b>B35PFLS-900</b> 1220x610x1960	900	90-90-180-180-180-180	10	2x1250	RAUNI144	1296	660	969
<b>B35PFLS-960</b> 1220x610x1960	960	96-96-192-192-192-192	10	2x1250	RAUNI144	1382	680	1033
<b>B35PFLS-1020</b> 1220x610x2160	1020	102-102-204-204-204-204	10	2x1250	RAUNI144	1468	700	1098
<b>B35PFLS-1080</b> 1220x610x2160	1080	108-108-216-216-216-216	10	2x1250	RAUNI144	1555	720	1163

Automatic capacitor banks  
Serie B35 THDi ≤ 35%

# Automatic capacitor banks

**B50 series**

Automatic capacitor banks  
Serie B50 THDI ≤ 50%



## Technical characteristics

### Rated voltage:

400Vac

### Rated frequency:

50Hz (60Hz on request)

### Voltage of auxiliary circuits:

110Vac

### Working temperature range:

-10°C/+50°C

### Cubicle:

20/10mm sheet steel, protected against corrosion by a phosphating treatment.

Epoxy powder painted, RAL 7035 color (other colors on request)

External Protection Degree:

IP30 (type S-M), IP40 (Type L)

Locking system:

by screw for cubicle type S and type M

by key for cubicle type L

### Ventilation:

Forced

### Isolating switch:

Three-pole with door interlocking device

### Supply:

Type S: entry of the cable from the top/bottom

Type M: entry of the cable from the top

Type L: entry of the cable from the bottom

### Wiring:

By N07VK CEI 20-22 flame retardant cables.

Auxiliary circuits are identified as in the electrical drawing

### Contactors:

Each bank of capacitors is controlled by a three-pole contactor. To limit the overcurrent peaks, each contactor is provided with insertion resistors. Rated voltage of auxiliary circuits: 110 Vac, 50 Hz.

### Fuses:

Each bank of capacitors is protected by a set of three fuses (NH00 type) with high breaking capacity. Also the auxiliary circuits are protected by fuses.

### Capacitors B50 550 Vac Series

Single phase of type self-healing, made up of metalized polypropylene, equipped with overpressure safety device and discharge resistor. Filling: biodegradable non toxic dry type, PCB free. Manufactured using new technologies of metallization.

Delta connection.

Capacitance tolerance: -5% +10%

Dielectric losses: <0.3W/kvar

Temperature class: -25°C (55°C)

### Regulators:

Varmetric measurement by means of a C.T. (Current Transformer)(secondary 5A) not supplied

### Reference Standards:

Comply with L.V. 73/23 (93/68) EEC Directive

Capacitors: CEI EN 60831-1/2

Equipment: CEI EN 60439-1, CEI EN 61921-1

### Options (on request):

Automatic switch

Isolator with fuses

Protection degree : IP55

Type M: entry of the cable from bottom

Type L: entry of the cable from the top

**Network:** 400Vac 50Hz THDi ≤20%.

Resonance not allowed

**Capacitors:** 550Vac 50Hz, THDi ≤50%



Type WxDxH mm	Power kVAR at 400V	Power of banks kVAR	Steps No	Isolating switch A	Regulator	Current A	Weight kg	Power kVAR at 415V
<b>B50PFSXS-15.5</b> 460x215x480	15,5	2,25-4,5-9	7	63	RAUNI96	22	14	16,5
<b>B50PFSXS-18</b> 460x215x480	18	4,5-4,5-9	4	63	RAUNI96	26	15	19
<b>B50PFSXS-22.5</b> 460x215x480	22,5	4,5-9-9	5	63	RAUNI96	32	16	24
<b>B50PFSXS-27</b> 610x215x480	27	4,5-4,5-9-9	6	80	RAUNI96	39	23	29
<b>B50PFSXS-36</b> 610x215x480	36	4,5-4,5-9-18	8	100	RAUNI96	52	27	38,5
<b>B50PFSXS-45</b> 610x215x480	45	9-9-9-18	5	100	RAUNI96	65	31	48
<b>B50PFMXS-63</b> 420x380x920	63	4,5-9-13,5-18-18	14	125	RAUNI96	91	47	68
<b>B50PFMXS-76</b> 420x380x920	76	4,5-9-13,5-18-31,5	17	250	RAUNI96	109	51	82
<b>B50PFMXS-90</b> 420x380x920	90	9-18-27-36	10	250	RAUNI96	139	54	97
<b>B50PFMXS-108</b> 420x380x1140	108	9-18-36-45	12	250	RAUNI96	155	60	117
<b>B50PFMXS-135</b> 420x380x1140	135	9-18-36-72	15	400	RAUNI96	194	69	146
<b>B50PFMXS-153</b> 420x380x1360	153	18-36-36-63	8	400	RAUNI96	220	78	165
<b>B50PFMXS-180</b> 420x380x1360	180	18-36-54-72	10	400	RAUNI96	259	88	194
<b>B50PFLXS-225</b> 610x610x1760	225	22,5-22,5-45-45-45-45	10	630	RAUNI144	324	260	242
<b>B50PFLXS-270</b> 610x610x1760	270	27-27-54-54-54-54	10	630	RAUNI144	388	280	291
<b>B50PFLXS-315</b> 610x610x1960	315	31,5-31,5-63-63-63-63	10	800	RAUNI144	454	320	339
<b>B50PFLXS-360</b> 610x610x1960	360	36-36-72-72-72-72	10	800	RAUNI144	518	340	388
<b>B50PFLXS-405</b> 610x610x2160	405	40,5-40,5-81-81-81-81	10	1250	RAUNI144	583	380	436
<b>B50PFLXS-450</b> 610x610x2160	450	45-45-90-90-90-90	10	1250	RAUNI144	648	400	485
<b>B50PFLXS-495</b> 610x610x2360	495	49,5-49,5-99-99-99-99	10	1250	RAUNI144	713	440	533
<b>B50PFLXS-540</b> 610x610x2360	540	54-54-108-108-108-108	10	1250	RAUNI144	778	460	582
<b>B50PFLXS-630</b> 1220x610x1960	630	63-63-126-126-126-126	10	2x800	RAUNI144	907	640	678
<b>B50PFLXS-720</b> 1220x610x1960	720	72-72-144-144-144-144	10	2x800	RAUNI144	1037	680	775
<b>B50PFLXS-810</b> 1220x610x2160	810	81-81-162-162-162-162	10	2x1250	RAUNI144	1167	730	872
<b>B50PFLXS-900</b> 1220x610x2160	900	90-90-180-180-180-180	10	2x1250	RAUNI144	1296	780	969
<b>B50PFLXS-990</b> 1220x610x2360	990	99-99-198-198-198-198	10	2x1250	RAUNI144	1426	830	1066
<b>B50PFLXS-1080</b> 1220x610x2360	1080	108-108-216-216-216-216	10	2x1250	RAUNI144	1556	880	1163

Automatic capacitor banks  
Serie B50 THDi ≤ 50%

# Automatic capacitor banks

**AR180 series**

With self anti-harmonics



Type L

Type L

Type M

## Technical characteristics

### Rated voltage:

400Vac

### Rated frequency:

50Hz (60Hz on request)

### Voltage of auxiliary circuits:

110Vac

### Working temperature range:

-10°C/+50°C

### Cubicle:

20/10mm sheet steel, protected against corrosion by a phosphating treatment.

Epoxy powder painted, RAL 7035 color (other colors on request)

External Protection Degree:

IP30 (type S-M), IP40 (Type L)

Locking system:

by screw for cubicle type S and type M

by key for cubicle type L

### Ventilation:

Forced

### Isolating switch:

Three-pole with door interlocking device

### Supply:

Type M: entry of the cable from the top

Type L: entry of the cable from the bottom

### Wiring:

By N07VK CEI 20-22 flame retardant cables.

Auxiliary circuits are identified as in the electrical drawing

### Contactors:

Each bank of capacitors is controlled by a three-pole contactor. To limit the overcurrent peaks, each contactor is provided with insertion resistors. Rated voltage of auxiliary circuits: 110 Vac, 50 Hz .

### Fuses:

Each bank of capacitors is protected by a set of three fuses (NH00 type) with high breaking capacity. Also the auxiliary circuits are protected by fuses.

### Capacitors AR180 550 Vac Series

Single phase of type self-healing, made up of metalized polypropylene, equipped with overpressure safety device and discharge resistor. Filling: biodegradable non toxic dry type, PCB free. Manufactured using new technologies of metallization.

Delta connection.

Capacitance tolerance: -5% +10%

Dielectric losses: <0.3W/kvar

Temperature class: -25°C (55°C)

### Blocking Reactors:

Tuning frequency 180Hz (3,6=7,7%)

### Regulators:

Varmetric measurement by means of a C.T. (Current Transformer)(secondary 5A) not supplied

### Reference Standards:

Comply with L.V. 73/23 (93/68) EEC Directive

Capacitors: CEI EN 60831-1/2

Equipment: CEI EN 60439-1, CEI EN 61921-1

### Options (on request):

Automatic switch

Isolator with fuses

Protection degree : IP55

Type M: entry of the cable from bottom

Type L: entry of the cable from the top



**Network:** 400Vac 50Hz THDi ≤50%. THDV<sub>MAX</sub> 6%  
**Blocking Reactors:** 180Hz (3,6=7,7%)  
**Capacitors:** 550Vac 50Hz, THDi ≤85%



Type WxDxH mm	Power kVAR at 400V	Power of banks kVAR	Steps No	Isolating switch A	Regulator	Current A	Weight kg	Power kVAR at 415V
AR180PFMA-20 420x380x920	20	2,5-2,5-5-10	8	125	RAUNI96	28,5	47	22
AR180PFMA-30 420x380x920	30	5-5-10-10	6	125	RAUNI96	43,2	57	33
AR180PFMA-40 420x380x1140	40	5-5-10-20	8	125	RAUNI96	57,6	74	43
AR180PFMA-50 420x380x1140	50	5-5-10-10-20	10	250	RAUNI96	72	78	54
AR180PFMA-60 420x380x1140	60	10-10-20-20	6	250	RAUNI96	86,4	100	65
AR180PFMA-70 420x380x1360	70	10-20-20-20	7	250	RAUNI96	100,8	112	75
AR180PFMA-80 420x380x1360	80	10-10-20-20-20	8	250	RAUNI96	115,2	126	86
AR180PFLA-100 610x610x1760	100	20-40-40	5	250	RAUNI144	144	220	108
AR180PFLA-110 610x610x1760	110	10-20-40-40	11	250	RAUNI144	158	240	118
AR180PFLA-150 610x610x1760	150	10-20-40-40-40	15	400	RAUNI144	216	280	161
AR180PFLA-180 610x610x1760	180	20-40-40-80	9	400	RAUNI144	260	300	194
AR180PFLA-220 610x610x1760	220	20-40-80-80	11	630	RAUNI144	317	325	237
AR180PFLA-260 610x610x1960	260	20-40-40-80-80	13	630	RAUNI144	375	365	280
AR180PFLA-300 610x610x1960	300	20-40-80-80-80	15	800	RAUNI144	432	385	323
AR180PFLA-340 610x610x2160	340	20-40-40-80-80-80	17	800	RAUNI144	491	415	365
AR180PFLA-380 610x610x2160	380	20-40-80-80-80-80	19	1250	RAUNI144	547	445	409
AR180PFLA-420 610x610x2160	420	20-40-40-80-80-160	21	1250	RAUNI144	606	475	452
AR180PFLA-460 610x610x2160	460	20-40-80-80-80-160	23	1250	RAUNI144	663	505	495
AR180PFLA-500 1220x610x1960	500	20-40-40-80-160-160	25	2x630	RAUNI144	722	775	538
AR180PFLA-560 1220x610x1960	560	80-160-160-160	7	2x800	RAUNI144	806	800	603
AR180PFLA-640 1220x610x1960	640	80-80-160-160-160	8	2x800	RAUNI144	922	860	689
AR180PFLA-720 1220x610x2160	720	80-160-160-160-160	9	2x800	RAUNI144	1037	920	775
AR180PFLA-800 1220x610x2160	800	80-80-160-160-160-160	10	2x800	RAUNI144	1152	980	861
AR180PFLA-880 1220x610x2360	880	80-160-160-160-160-160	11	2x1250	RAUNI144	1267	1040	947
AR180PFLA-960 1220x610x2360	960	80-160-160-160-160-240	12	2x1250	RAUNI144	1382	1100	1033

# Automatic capacitor banks

**AR140 series**

With self anti-harmonics



Type L

Type L

Type M

## Technical characteristics

**Rated voltage:**

400Vac

**Rated frequency:**

50Hz (60Hz on request)

**Voltage of auxiliary circuits:**

110Vac

**Working temperature range:**

-10°C/+50°C

**Cubicle:**

20/10mm sheet steel, protected against corrosion by a phosphating treatment.

Epoxy powder painted, RAL 7035 color (other colors on request)

External Protection Degree:

IP30 (type S-M), IP40 (Type L)

Locking system:

by screw for cubicle type S and type M

by key for cubicle type L

**Ventilation:**

Forced

**Isolating switch:**

Three-pole with door interlocking device

**Supply:**

Type M: entry of the cable from the top

Type L: entry of the cable from the bottom

**Wiring:**

By N07VK CEI 20-22 flame retardant cables.

Auxiliary circuits are identified as in the electrical drawing

**Contactors:**

Each bank of capacitors is controlled by a three-pole contactor. Rated voltage of auxiliary circuits: 110 Vac, 50 Hz

**Fuses:**

Each bank of capacitors is protected by a set of three fuses (NH00 type) with high breaking capacity. Also the auxiliary circuits are protected by fuses.

**Capacitors AR140 550 Vac Series**

Single phase of type self-healing, made up of metalized polypropylene, equipped with overpressure safety device and discharge resistor. Filling: biodegradable non toxic dry type, PCB free. Manufactured using new technologies of metallization.

Delta connection.

Capacitance tolerance: -5% +10%

Dielectric losses: <0.3W/kvar

Temperature class: -25°C (55°C)

**Blocking Reactors:**

Tuning frequency 140Hz (2,8=12,7%)

**Regulators:**

Varmetric measurement by means of a C.T. (Current Transformer)(secondary 5A) not supplied

**Reference Standards:**

Comply with L.V. 73/23 (93/68) EEC Directive

Capacitors: CEI EN 60831-1/2

Equipment: CEI EN 60439-1, CEI EN 61921-1

**Options (on request):**

Automatic switch

Isolator with fuses

Protection degree : IP55

Type M: entry of the cable from bottom

Type L: entry of the cable from the top

**Network:** 400Vac 50Hz THDi ≤100%. THDV<sub>MAX</sub> 6%  
**Blocking Reactors:** 140Hz (2,8=12,7%)  
**Capacitors:** 550Vac 50Hz, THDi ≤100%



Type WxDxH mm	Power kVAR at 400V	Power of banks kVAR	Steps No	Isolated switch A	Regulator	Current A	Weight kg	Power kVAR at 415V
AR140PFMHA-20 420x380x1360	50	5-5-10-10-20	10	250	RAUNI96	72	78	54
AR140PFMHA-60 420x380x1360	60	10-10-20-20	6	250	RAUNI96	86,4	100	65
AR140PFMHA-70 420x380x1360	70	10-20-20-20	7	250	RAUNI96	100,8	112	76
AR140PFMHA-80 420x380x1360	80	20-20-20-20	4	250	RAUNI96	115,2	126	86
AR140PFLHA-100 610x610x1760	100	20-40-40	5	250	RAUNI144	144	220	108
AR140PFLHA-140 610x610x1760	140	20-40-80	7	400	RAUNI144	202	260	151
AR140PFLHA-180 610x610x1760	180	20-40-40-80	9	400	RAUNI144	260	300	194
AR140PFLHA-220 610x610x1760	220	20-40-80-80	11	630	RAUNI144	317	325	237
AR140PFLHA-260 610x610x1960	260	20-40-40-80-80	13	630	RAUNI144	374	365	280
AR140PFLHA-300 610x610x1960	300	20-40-80-80-80	15	800	RAUNI144	432	385	323
AR140PFLHA-340 610x610x2160	340	20-40-40-80-80-80	17	800	RAUNI144	491	415	365
AR140PFLHA-380 610x610x2160	380	20-40-80-80-80-80	19	1250	RAUNI144	547	445	409
AR140PFLHA-420 610x610x2360	420	20-40-40-80-80-160	21	1250	RAUNI144	607	475	452
AR140PFLHA-460 610x610x2360	460	20-40-80-80-80-160	23	1250	RAUNI144	662	505	495
AR140PFLHA-500 1220x610x1960	500	20-40-40-80-160-160	25	2x630	RAUNI144	722	775	538
AR140PFLHA-560 1220x610x1960	560	80-160-160-160	7	2x800	RAUNI144	806	800	603
AR140PFLHA-640 1220x610x1960	640	80-80-160-160-160	8	2x800	RAUNI144	922	860	689
AR140PFLHA-720 1220x610x2160	720	80-160-160-160-160	9	2x800	RAUNI144	1037	920	775
AR140PFLHA-800 1220x610x2160	800	80-80-160-160-160-160	10	2x800	RAUNI144	1152	980	861
AR140PFLHA-880 1220x610x2360	880	80-160-160-160-160-160	11	2x1250	RAUNI144	1267	1040	947
AR140PFLHA-960 1220x610x2360	960	80-160-160-160-160-240	12	2x1250	RAUNI144	1382	1100	1033

# Static capacitor banks

**AST series**

With self anti-harmonics

## Generalities

Static power factor correction equipment differs from the standard equipment for the following reasons:

- The reactive power regulator has a switching time of the banks extremely quicker than the standard regulator.
- The device for switching the capacitors banks is electronic, controlled by thyristors, with the capability of switching the capacitors at zero crossing.

Static switching by thyristors has the following advantages:

- Maximum speed in switching the capacitors banks (the total power is switched in less than one second)
- No current peak on the capacitors at the time of switching of the banks
- No voltage peak on the capacitors at the time of switching off the banks
- Elimination of deterioration of the contacts of the standard contactors
- Noise reduced to a minimum
- Reduced handling
- Prolonged capacitor life

## Technical characteristics

### Rated voltage:

400Vac

### Rated frequency:

50Hz (60Hz on request)

### Voltage of auxiliary circuits:

110Vac

### Working temperature range:

-5°C/+50°C

### Cubicle:

20/10mm sheet steel, protected against corrosion by a phosphating treatment.

Epoxy powder painted, RAL 7035 color (other colors on request)

External Protection Degree: IP30

Locking system: by key

### Ventilation:

Forced

### Isolating switch:

Three-pole with door interlocking device

### Supplying:

Entry of the cable from the bottom

### Wiring:

By N07VK CEI 20-22 flame retardant cables.

Auxiliary circuits are identified as in the electrical drawing

### Fuses:

Each capacitor banks is protected by a set of three fuses (NH00 type) with high breaking capacity. Also the auxiliary circuits are protected by fuses.

### Activation:

Thyristors zero-crossing static devices

### Capacitors 550 Vac Series

Single phase of type self-heating, made up of metalized polypropylene, equipped with overpressure safety device and discharge resistor. Filling: biodegradable non toxic dry type, PCB free. Manufactured using new technologies of metallization.

Delta connection.

Capacitance tolerance: -5% +10%

Dielectric losses: <0.3W/kvar

Temperature class: -25°C (55°C)

### Self blocking resonant frequency:

Tuning frequency 180Hz (3,6=7,7%)

### Regulators:

Varmetric measurement by means of a C.T. (Current Transformer) (secondary 5A) not supplied

### Reference Standards:

Complying with: L.V. 73/23 (93/68) EEC Directive

Capacitors: CEI EN 60831-1/2

Equipment: CEI EN 60439-1

### Options (on request):

Protection and Control Instrument SPC2

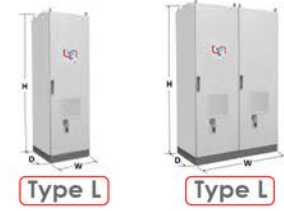
Protection Degree: IP40 - IP55

Entry of the cable from the top

**Network:** 400Vac 50Hz THDi<sub>i</sub> ≤50%. THDV<sub>MAX</sub> 6%

**Self resonant frequency:** 180Hz (3,6=7,7%) 5 of resonant frequency

**Capacitors:** 550Vac 50Hz, THDi ≤85%



Type WxDxH mm	Power kVAR-400V	Power of banks kVAR	Steps No.	Isolating switch A	Regulator Ref.	Current A	Weight kg	Power kVAR - 415V
<b>ASTPFL-100</b> 610x610x1760	100	20-40-40	5	250	RAUNI2ST	144	300	107
<b>ASTPFL-140</b> 610x610x1760	140	20-40-80	7	400	RAUNI2ST	201	320	150
<b>ASTPFL-160</b> 610x610x1760	160	40-40-80	4	400	RAUNI2ST	230	340	171
<b>ASTPFL-200</b> 610x610x1760	200	40-80-80	5	630	RAUNI2ST	288	360	214
<b>ASTPFL-240</b> 610x610x1960	240	40-40-80-80	6	630	RAUNI2ST	354	400	257
<b>ASTPFL-280</b> 610x610x1960	280	40-80-80-80	7	630	RAUNI2ST	403	450	300
<b>ASTPFL-320</b> 610x610x2160	320	40-40-80-160	8	800	RAUNI2ST	460	510	342
<b>ASTPFL-360</b> 610x610x2160	360	40-80-80-160	9	800	RAUNI2ST	518	570	385
<b>ASTPFL-400</b> 610x610x2360	400	40-40-80-80-80-80	10	1250	RAUNI2ST	576	630	428
<b>ASTPFL-440</b> 610x610x2360	440	40-80-160-160	11	1250	RAUNI2ST	633	660	471
<b>ASTPFL-480</b> 610x610x2360	480	80-80-160-160	6	1250	RAUNI2ST	691	690	514
<b>ASTPFL-560</b> 1220x610x1960	560	80-160-160-160	7	2x800	RAUNI2ST	806	820	599
<b>ASTPFL-640</b> 1220x610x1960	640	80-80-160-160-160	8	2x800	RAUNI2ST	921	950	685
<b>ASTPFL-720</b> 1220x610x2160	720	80-160-160-160-160	9	2x1250	RAUNI2ST	1036	1060	770
<b>ASTPFL-800</b> 1220x610x2160	800	80-80-160-160-160-160	10	2x1250	RAUNI2ST	1152	1180	856
<b>ASTPFL-880</b> 1220x610x2360	880	80-160-160-160-160-160	11	2x1250	RAUNI2ST	1267	1290	942
<b>ASTPFL-960</b> 1220x610x2360	960	80-80-160-160-160-320	12	2x1250	RAUNI2ST	1382	1400	1027

Static capacitor banks  
Serie AST THDi ≤ 85%



# Fixed capacitor banks

## QSRB25 series

Fixed capacitor banks  
Serie QSRB25 THDi ≤ 50%



### Technical characteristics

**Rated voltage**

400Vac

**Rated frequency**

50Hz (60Hz on request)

**Rated power**

Referred to rated frequency and voltage

**Working Temperature Range**

-25°C/+50°C

**Cubicle**

20/10mm sheet steel, protected against corrosion by a phosphating treatment. Epoxy powder painted, RAL 7035 color (other colors on request).

External Protection degree: IP30

Locking system: by screw

**Ventilation**

Natural

**Isolating switch**

Three-pole with door interlocking device

**Supplying**

Entry of the cable from the top

**Wiring**

By N07VK CEI 20-22 flame retardant cables

**Fuses**

Each capacitor banks is protected by a set of three fuses (NH00 type) with high breaking capacity

**Capacitors**

Single phase of type self-healing, made up of metalized polypropylene, equipped with overpressure safety device and discharge resistor.

Filling: biodegradable non toxic dry type, PCB free. Delta connection

**Serie 440Vac**

Capacitance tolerance: -5% +10%

Dielectric losses: <0.3W/kvar

Temperature class: -25°C (55°C)

**Reference standards**

Complying with: L.V. 73/23 (93/68)

EEC directive.

Capacitors: CEI EN 60831-1/2

Equipment: CEI EN 60439-1/2



**Network:** 400Vac 50Hz THDi ≤10%, Resonance not allowed, **Capacitors:** 440Vac 50Hz, THDi ≤50%

Type WxDxH mm	Power kVAR-400V	Isolating switch A	Current A	Weight kg	Power kVAR-415V
<b>QSRB25-5</b> 325x225x380	5	40	7,2	8	5,5
<b>QSRB25-10</b> 325x225x380	10	40	14,4	9	11
<b>QSRB25-15</b> 325x225x380	15	40	21,6	10	16
<b>QSRB25-20</b> 325x225x380	20	63	28,8	12	22
<b>QSRB25-25</b> 325x225x380	25	63	36	13	27
<b>QSRB25-30</b> 325x225x380	30	80	43	15	32,5
<b>QSRB25-40</b> 355x225x550	40	125	58	18	43
<b>QSRB25-50</b> 355x225x550	50	125	72	20	54
<b>QSRB25-60</b> 355x225x550	60	200	86	22	65

# Fixed capacitor banks

## QSRB35 Series

### Technical characteristics

**Rated voltage**

400Vac

**Rated frequency**

50Hz (60Hz on request)

**Rated power**

Referred to rated frequency and voltage

**Working Temperature Range**

-25°C/+50°C

**Cubicle**

20/10mm sheet steel, protected against corrosion by a phosphating treatment.

Epoxy powder painted, RAL 7035 color (other colors on request).

External Protection degree: IP30

Locking system: by screw

**Ventillation**

Natural

**Isolating switch**

Three-pole with door interlocking device

**Supplying**

Entry of the cable from the top

**Wiring**

By N07VK CEI 20-22 flame retardant cables

**Fuses**

Each bank of capacitors is protected by a set of three fuses (NH00 type) with high breaking capacity

**Capacitors**

Single phase of type self-healing, made up of metalized polypropylene, equipped with overpressure safety device and discharge resistor.

Filling: biodegradable non toxic dry type, PCB free. Delta connection

**Serie 500Vac**

Capacitance tolerance: -5% +10%

Dielectric losses: <0.3W/kvar

Temperature class: -25°C (55°C)



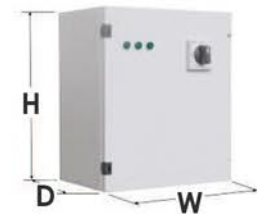
Fixed capacitor banks  
Serie QSRB35 THDi ≤ 70%

**Reference standards**

Comply with L.V. 73/23 (93/68) EEC

Directive. Capacitors: CEI EN 60831-1/2

Equipment: CEI EN 60439-1/2



**Network:** 400Vac 50Hz THDi ≤15%, Resonance not allowed, **Capacitors:** 500Vac 50Hz, THDi ≤70%

Type WxDxH mm	Power kVAR-400V	Isolating switch A	Current A	Weight kg	Power kVAR-415V
<b>QSRB35-4,2</b> 325x225x380	4,2	40	6	8	4,5
<b>QSRB35-8,4</b> 325x225x380	8,4	40	12,1	9	9
<b>QSRB35-12,6</b> 325x225x380	12,6	40	18,1	10	13,5
<b>QSRB35-16,8</b> 325x225x380	16,8	63	24,2	12	18
<b>QSRB35-21</b> 325x225x380	21	63	30,2	13	22,6
<b>QSRB35-25,2</b> 325x225x380	25,2	63	36,3	15	27,1
<b>QSRB35-33,6</b> 355x225x550	33,6	125	48,4	18	36,1
<b>QSRB35-42</b> 355x225x550	42	125	60,5	20	45,2
<b>QSRB35-50,4</b> 355x225x550	50,4	125	72,6	22	54,2

# Power factor controller RAUNI96

Power factor controller  
RAUNI96



## Description

- Automatic power factor controller
- Panel mounting, standard 96x96mm housing
- Backlit LCD screen
- 5 relays, expandable to 7 max
- 4 navigation keys for function and settings
- Alarm messages in 6 languages
- Expansion bus modules: RS485, USB communications interface
- Additional relay outputs
- High accuracy TRMS measurements
- Wide selection of electrical measures, including voltage and current THD with harmonic analysis up to 15th order
- Voltage input separated from power supply, suitable for connection in medium voltage applications
- Wide-range power supply (100-440VAC)
- Front optical programming interface: galvanically isolated, high speed, waterproof, USB compatible
- 2-level password protection for settings
- Backup copy of original settings
- Embedded temperature sensor

## Supplying

Rated voltage: 100-440 Vac / 45-66 Hz / 110-250 Vdc  
Power consumption/dissipation: 3,5W - 9,5VA  
Immunity time for microbreakings: <25ms

## Voltage inputs

Maximum rated voltage: 600 Vac / 45-66 Hz  
Measuring method: True RMS  
Wiring mode: Single-phase, two-phase, three-phase with or without neutral or balanced three-phase system

## Current inputs

Rated current: 1A ou 5A  
Measuring method: True RMS  
Permanent thermic limits: +20%  
Power consumption: <0,6VA

## Output with relay: OUT 1-4

Contact type: 4x1 NO + common contact  
Rated current: AC1-5A 250 Vac, AC15-1,5A 440 Vac  
Maximum current on the common terminal contact: 10A

## Output with relay: OUT 5

Contact type: 1 reverse contact  
Rated current: AC1-5A 250Vac, AC15-1,5A 440Vac (N.O. only)

## Insulation voltage

Rated insulation voltage: 600Vac  
Rated impulse withstand voltage Uimp: 9,5Kv

## Ambient operating conditions

Operating temperature: -20°C +60°C  
Storage temperature: -30°C +80°C

## Connections

Terminal type: Plug-in/removable  
Cable cross section (min...max): 0,2...2,5 mm<sup>2</sup> (24-12 AWG)

## Housing

Version: flush mount  
Material: polycarbonate  
Degree of protection : IP54 on front - IP20 on terminals  
Weight: 350g

## Certification and compliance

Reference standards: IEC/EN 61010-1, IEC/EN 61000-6-2, IEC/EN 61000-6-4 UL508 et CSA C22.2-N°14



# Power factor controller RAUNI144



Power factor controller  
RAUNI144

## Description

- Automatic power factor controller
- Panel mounting, standard 144x144mm housing
- Backlit LCD screen
- 8 relays, expandable to 12 max
- 5 navigation keys for function and settings
- Alarm messages in 6 languages
- Expansion bus modules: RS485, USB communications interface
- Additional relay outputs
- High accuracy TRMS measurements
- Wide selection of electrical measures, including voltage and current THD with harmonic analysis up to 15th order
- Voltage input separated from power supply, suitable for connection in medium voltage applications
- Wide-range power supply (100-440VAC)
- Front optical programming interface: galvanically isolated, high speed, waterproof, USB compatible
- 2-level password protection for settings
- Backup copy of original settings
- Embedded temperature sensor



## Supplying

Rated voltage: 100-440 Vac / 45-66 Hz / 110-250 Vdc  
Power consumption: 2,5W - 7,0VA  
Immunity time for microbreakings: <25ms

## Voltage inputs

Maximum rated voltage: 600 Vac / 45-66 Hz  
Measuring method: True RMS  
Wiring mode: Single-phase, two-phase, three-phase with or without neutral or balanced three-phase system

## Current inputs

Rated current: 1A ou 5A  
Measuring method: True RMS  
Permanent thermic limits: +20%  
Power consumption: <0,6VA

## Outputs with relay: OUT 1-4

Contact type: 7x1 NO + common contact  
Rated current: AC1-5A 250 Vac, AC15-1,5A 440 Vac  
Maximum current at common contact: 10A

## Outputs with relay: OUT 5

Contact type: 1 reverse contact  
Rated current: AC1-5A 250Vac, AC15-1,5A 440Vac (N.O. only)

## Insulation voltage

Rated insulation voltage: 600Vac  
Rated impulse withstand voltage Uimp: 9,5Kv

## Ambient operating conditions

Operating temperature: -20°C +60°C  
Storage temperature: -30°C +80°C

## Connections

Terminal type: Plug-in/removable  
Cable cross section (min...max): 0,2...2,5 mm<sup>2</sup> (24-12 AWG)

## Housing

Version: flush mount  
Material: polycarbonate  
Degree of protection : IP54 on front - IP20 on terminals  
Weight: 640g

## Certification and compliance

Reference standards: IEC/EN 61010-1, IEC/EN 61000-6-2, IEC/EN 61000-6-4 UL508 et CSA C22.2-N°14

# Unitary active filter FAFW series



## Active filtering and power quality

The loads operated by electronic devices are increasingly adopted in more and more industrial and commercial applications such as: Variable Speed Drives, rectifiers, UPS systems, DC power supplies, welding machines, computers, TV, energy efficient lamps, photocopiers. These loads generate waveform distortions that become threats for network and components.

In particular voltage and current harmonics, where the latter is the most dangerous, generate a series of problems, like:

- Heating cables
- Undue tripping of circuit breakers
- Blowing of fuses
- Overloading of the capacitors and network resonance
- Overload on the neutral cable
- Premature aging transformers
- Malfunction of electronic equipment

## Features and benefits

FAFW is the new generation of active harmonic filters. It reliably mitigates harmonics and compensates voltage dips as well as reactive power. The FAFW analyzes network disturbances and provides an opposing compensation current. In doing so, FAFW actively adapts to fluctuations and responds in less than half a millisecond.

Its compact dimensions, simple installation, and digital intelligence allow for a quick and straight forward integration in the most diverse applications.

- Nominal operating voltage: 380V to 480V
- Operating frequency: 47 to 63Hz
- Rated compensation current: 30 to 100A at 40°C
- Total harmonic current distortion: THID < 5%
- Compensation capability odd harmonics: up to the 50th order
- Response time: < 300  $\mu$ s
- Protection category: IP20
- Cooling forced air
- Overload capability: 2.5xIn (rated current) for 10ms
- Ambient temperature: 40°C
- Altitude: 1000m
- Parallel operation: up to 5 filters
- Interface: ethernet, RS485, ModBus
- Controller: digital with FFT analysis
- Current limitation: at nominal current
- Current transformers (not included) 100:5 to 50000:5
- Design corresponding to UL508 CE (LVD 2006/95/EC)



Type	Dimensions WxHxD, mm	Rated phase current A rms	Rated neutral line A rms	Power loss W	Weight kg
FAF3W-30	360x590x290	30	---	< 900	47
FAF3W-50	360x590x290	50	---	< 1300	47
FAF3W-100	468x970x412	100	---	< 2200	105
FAF3W-120	468x970x412	120	---	< 2500	105
FAF4W-30	415x840x300	30	90	< 950	70
FAF4W-60	415x840x300	60	180	< 1800	70
FAF4W-100	468x1460x412	100	300	< 3000	145
FAF4W-120	468x1460x412	120	300	< 3000	145

## Reducing harmonics

These products allows to reinject a current corresponding to the total harmonic component (the first order). By this way, the network is traversed by a current equal to the single fundamental component.

## Applications

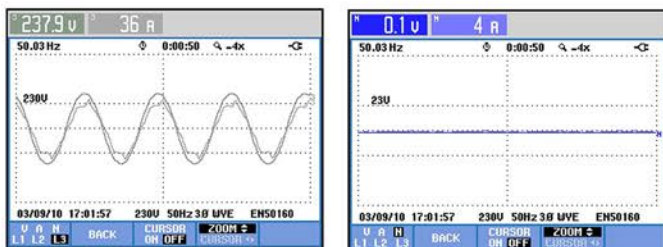
The applications of the FAFW active filters are very flexible and cover many industrial applications. The FAFW series is an intelligent system to compensate existing electrical installations or the upgrade of a new project with upstream study of the installation.

Here is a list of lists of possible applications with the use of the active filter:

- Automotive Factories
- Stationery
- Photovoltaics
- Automation for construction
- Boat Engine
- machines and automation
- Cement
- Frequency inverters
- Petrochemicals
- Data centers
- Water treatment
- Foundries
- Elevators
- machines for welding
- Breakdown of tunnels
- Installation of wind turbines
- Inverters

## Examples

### With FAFW filtering



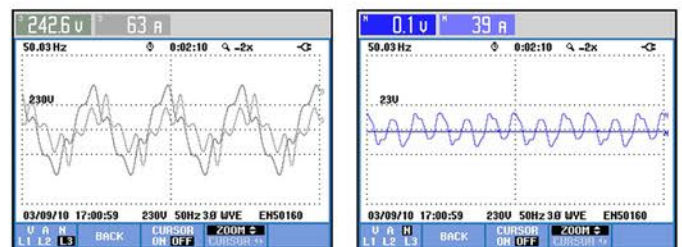
Current and voltage in L3 with filtering

Current and voltage in the neutral with filtering



Voltage distortion THD-V of 24.1% with filtering

### Without FAFW filtering



Current and voltage in L3 without filtering

Current and voltage in the neutral without filtering



Voltage distortion THD-V of 24.1% without filtering

# Modular Active Power Filter (APF) FAFW34030 series

Modular active power filter  
FAFW34030 series



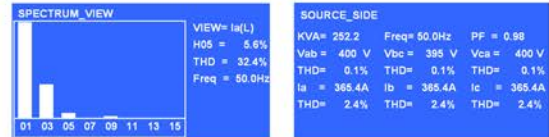
## Power factor correction

The Aunilec APF not only compensate harmonic current but also the reactive power. It is able to correct for either a leading or lagging power factor.

## Specifications

- Modular design, easy to extend
- Up to 51st harmonic
- Individual selection up to 12 harmonic simultaneously filtered
- Close/open loop control
- Improves power factor
- Unbalanced loads compensation
- Reduces apparent power consumption at the supply and saves costs
- Resolves the nuisance tripping of capacitors
- Programmable power factor correction
- Full-time DSP control system
- Easy selection and maintenance
- Shunt connection
- Flexible upgrading and redundancy
- Parallel operation with different capacity
- User friendly LCD control panel
- EPO (Emergency Power Off)
- Rack/wall installation
- USB, RS232, RS485/422, SNMP
- 2 years warranty

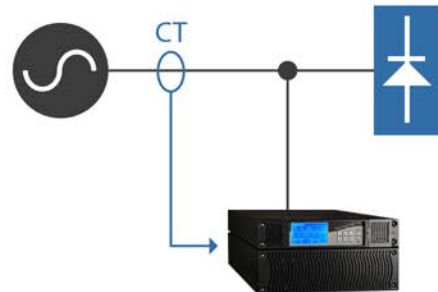
## LCD display



The user friendly LCD display offers access to all parameters, waveforms, harmonic spectrum system power quality, settings, status and alarms, events log and multi-language.

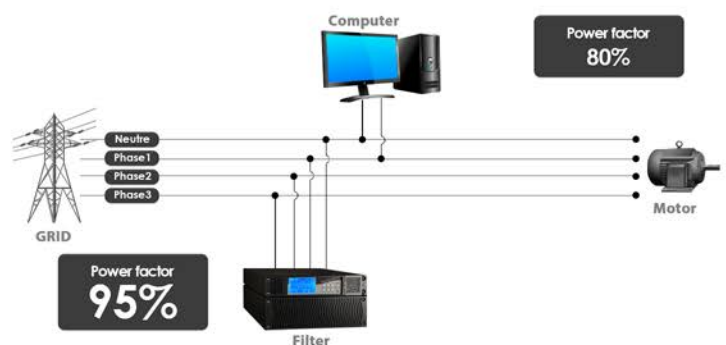
## Close/open Loop Control

The CT is allowed to install at source or load side for measure the harmonic current from the load. When CT is installed at source side, the close loop control method is used for best accuracy of harmonic current compensation. (When CT is installed at the load side, the open loop control will be used).



## Harmonic current generator

The Aunilec APF behaves like an harmonics current generator. It will measure the harmonic generated from the non-linear loads and cancel these harmonics with an opposite phase at the same amplitude.





<b>FAFW34030</b>	
	<b>— APF - Control Module —</b>
Input voltage	400V +15%, -20%
Phase/wires	3 phases 4 wires/3wires
Frequency	50/60Hz +/-3% (auto sensing)
Compensated harmonic orders	From 2 <sup>nd</sup> to 51 <sup>st</sup> order
Power Factor correction	Compensate both lagging and leading reactive power (programmable)
CT ratio	Can be set, primary current : 100A-10000A, secondary current : 1A (standard)/5A (optional)
CT location	Source or lead side
Response time	< 20ms
Controllable power module	400V
Number of power module	Up to 4 power modules
Parallel	Up to 8 control modules
Max. heat losses	50 watt
Color	RAL9011
Protection	IP20
Dimensions (WxDxH)	440x710x86mm
Weight	5kg
	<b>— APF - Power Module —</b>
Input voltage	400V +15%, -20%
Phase/wires	3 phases 4 wires/3wires
Frequency	50/60Hz +/-3%
Max. compensation current/phase	35 Rms
De-rating compensation current/phase	30 Rms
Max. compensation current for neutral	105 Rms
Inrush current	Less than rated current
Current limitation	Yes, at full correcting
Max. heat losses	650 Watts
Color	RAL9011
Protection	IP20
Dimensions (WxDxH)	440x710x131mm
Weight	31kg
<b>— Environment</b>	
Storage temperature	-20°C to +70°C
Operating temperature	0-40°C
Relative humidity	< 95%
Altitude	< 1000m
Standards	EN61000-3-4, IEEE519-1992, EN60146
<b>— Interface</b>	
Communication	RS232/USB (standard) - RS485/RS422, ethernet card (optional)
Software (optional)	ESD-Link34
Protocol	J-Bus/MODBUS
<b>— Control panel</b>	
LED	Power on off, filtering, full correcting, error, reset, status, alarm
LCD (optional)	Parameter, waveform, spectrum, even log (up to 300), compensation setting, logic control, multi language

# Operating and maintenance manual

## Use and maintenance

### 1. General remarks

The automatic power factor correction equipments are used to keep the power factor of a plant to an average value higher than the minimum fixed at 0.9. The regulation is obtained by means of a suitable electronic regulator of reactive power with high sensitiveness and precision.

The equipment consist of modular capacitor banks which are connected and disconnected automatically, in function of the capacitive reactive power required by the load, by mean of contactors provided with a device able to limit the current peak.

The capacitors used in the bank are VRC or MFHC type, provided with discharge resistors and overpressure safety disconnecter.

The equipment is contained in a metal cubicle painted with epoxy resins with protection degree IP30.

A complete wiring diagram of the equipment is enclosed, showing the way to install the equipment. (see figure 1 page 29)

### 2. Connection to the network

The three phases of the network must be connected respectively to R (L1), S (L2) and T (L3) terminals onto the main switch input. For earthing the bar on the right side of the equipment must be used.

Terminals K (S1) and L (S2) must be connected to the secondary of a Current Transformer (CT) with secondary current 5A connected on the phase R (L1) (see Fig.1).

In order to work properly the equipment must be connected as indicated in Fig.1; on the same page some typical connection mistakes are shown.

### 3. Reactive power regulator

The model of the regulator installed may change according to the performance required. For this reason, with regards to its characteristics and calibration modalities, it is necessary to refer to the specific instructions enclosed.

### 4. Start and use

#### **WARNING!**

**Before switching on the equipment, check the correct tightening of all the connections. Repeat this operation periodically.**

If the regulator is correctly installed the equipment connects and disconnects automatically the capacitor banks according to the load variation; in this case the number of banks connected is evidence by the leds STEP on the regulator. If during the first installation, the regulator of reactive power would show a capacitive load and no banks have been connected, it means that the CT has been installed on the wrong phase (see fig. 2,3 and 4).

In order to avoid that the limits of overtemperature are passed inside the cubicle, the reactive power regulator starts the fan when temperature passes 35°C.

When the temperature goes down below 35°C (exactly at 28°C), the fan is disconnected.

If the temperature inside the cubicle, in spite of the cooling due to the fan operation, reaches 55°C, all the banks are disconnected and a remote signal alarm is activated.

In the equipments which are equipped with SPC2 device, the ventilation and the alarm signal are generated by SPC2.

In the B35PFS series the ventilation is natural.

#### **WARNING!**

**Using the manual control please wait at least 1 minute before connecting the same bank again.**

# Operating and maintenance manual

## Use and maintenance

### 5. Control of the automatic operation

The check of the correct operation of the automatic regulator can be done by modifying the load conditions in a suitable way.

If the operation is not correct the reason should be founded among one of the following errors:

- CT connected on the wrong phase (see Fig.3).
- CT installed between the equipment and the load (see Fig.4).
- CT inserted on the supply cables of the power factor correction equipment (see Fig.2).
- Defective or unsuitable CT.

### 6. Maintenance

Our equipments do not need special maintenance; periodical check must be however carried out on:

- All electronic parts (reactive power regulator and module SPC2) in order to check their efficiency.
- Protection fuses on the auxiliary circuits.
- Protection fuses on the capacitor banks (equipped with signaling).
- The efficiency of the cooling system, checking that the fans are not defective or mechanically blocked and cleaning with an air jet on the relevant grills.
- The efficiency of the contactors, by replacing those which are defective and periodically checking the tightening of the terminals.
- The presence of capacitors with overpressure device tripped (these single phase capacitor must be replaced to avoid to compromise the performance of the complete equipment).

This last check is particularly important for AR180... and AR140.. where checking that the tuning frequency of the filter does not change in the time. Even if, the components used are high quality, it can occur that some capacitor fails causing the trip of the overpressure safety device.

The consequent loss of capacitance may cause a change of the tuning frequency of the filter with consequent dangerous overloads.

In view of the above, a periodical test has to be carried out to check the presence of capacitors with tripped overpressure device (these have an expansion of the upper part in the case) replacing them with new capacitors.

In order to prevent possible reduction of the original capacitance values (this phenomena can involve more than a capacitor) it is useful to check during the installation, after the first month of operation and then two or three time per year, the current absorbed by the banks, connecting them manually with no load and taking note of the results on a table.

Big differences in measures or eventual unbalances of the three phases show the need of a special maintenance.

#### **WARNING!**

**Further to the check of the correct thighteing of all the connection, periodically clean the equipment inside by removing possible dust not compatible with the good operation of the equipment.**

# Operating and maintenance manual

## Use and maintenance

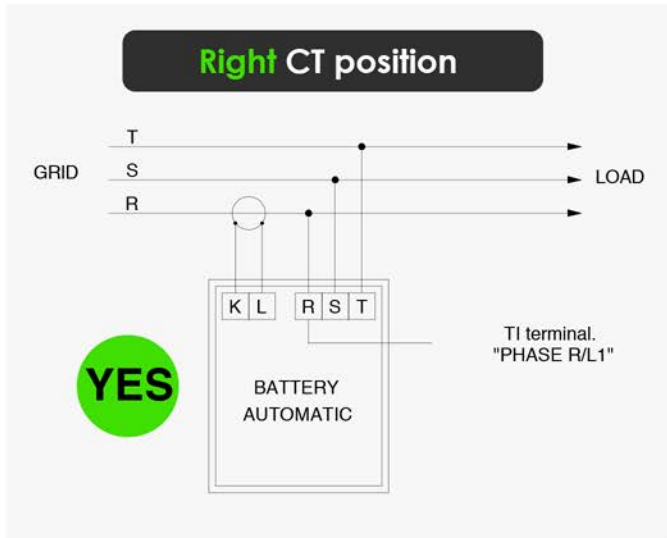


Figure 1

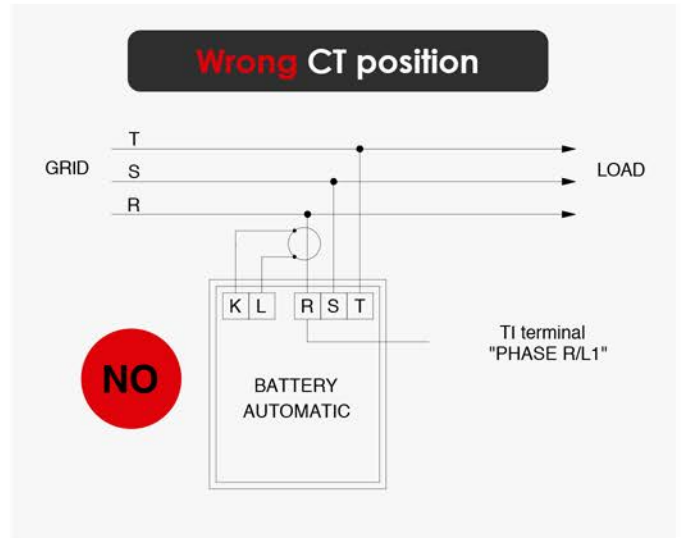


Figure 2

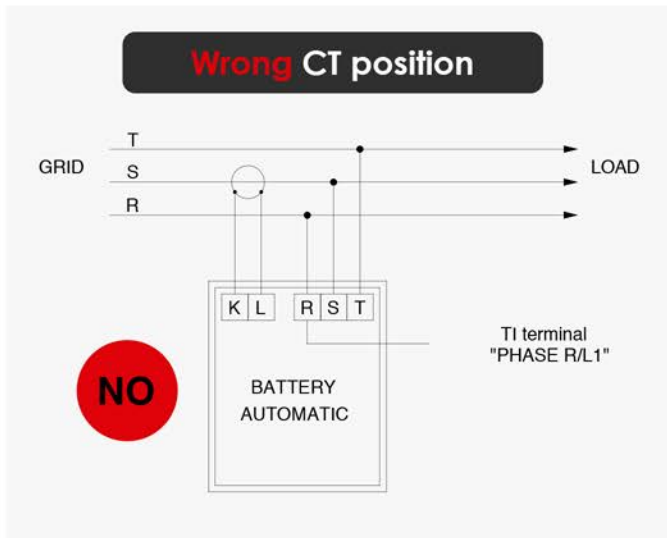


Figure 3

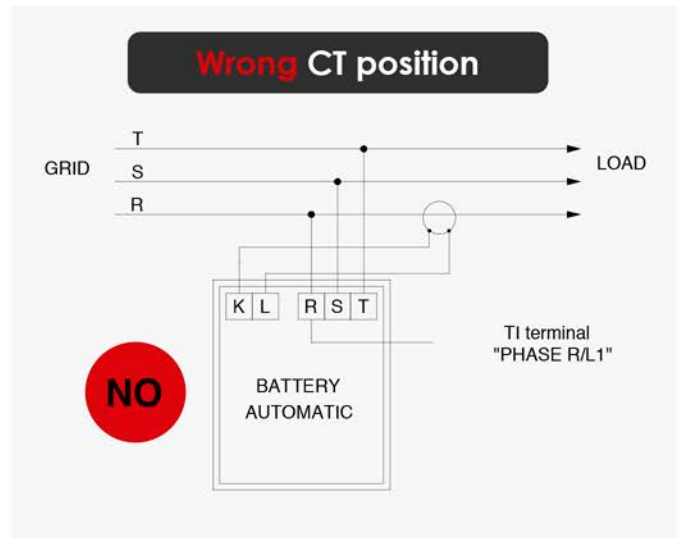


Figure 4

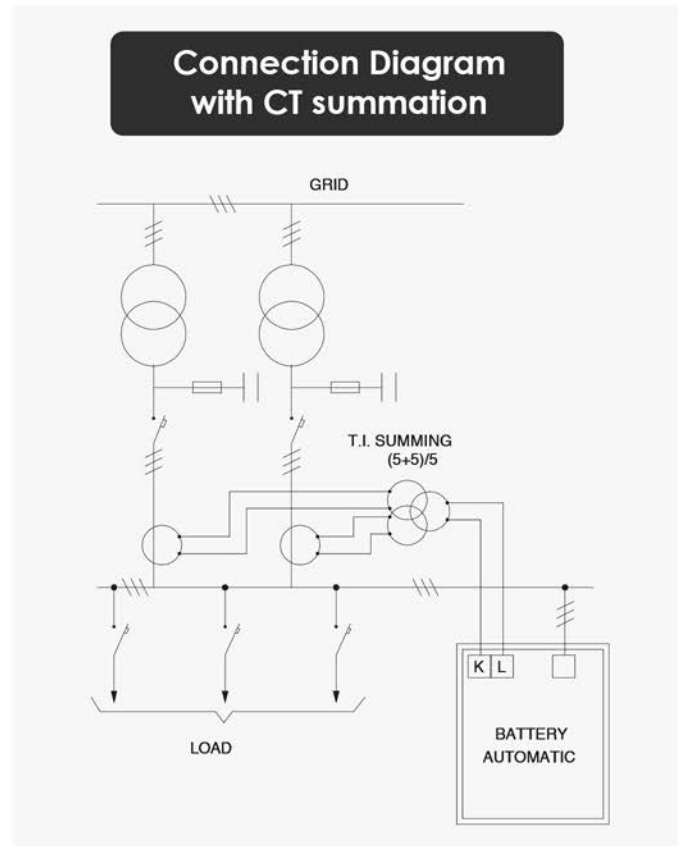
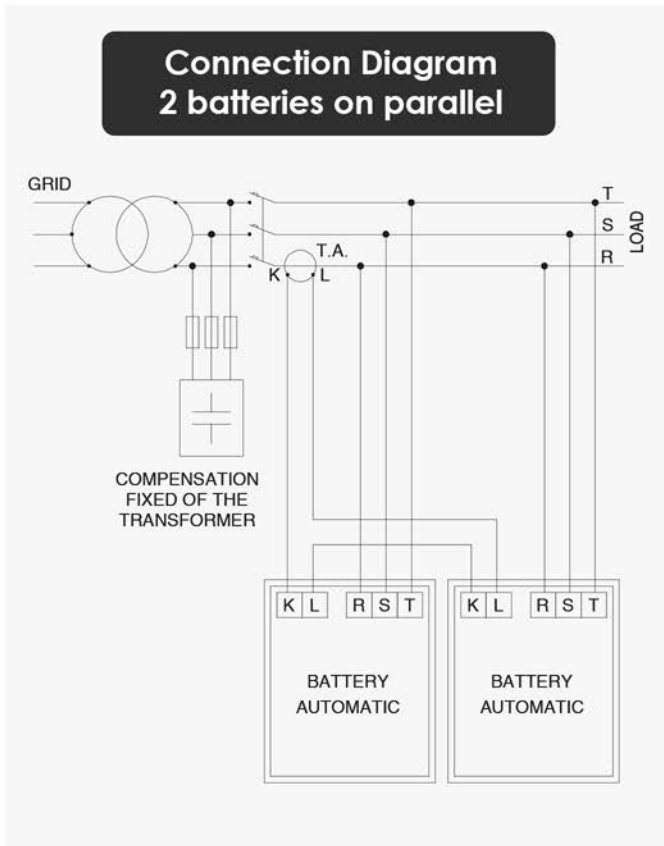
Conformity **CE**



# Operating and maintenance manual

## Use and maintenance

### Connection Diagram



## Factory

The factory was founded in 1950's and is specializes in the manufacture of electrical capacitors for general alternative current applications, such as lighting, motors and permanent service for the compensation of reactive power (see specific catalogs).

She is also specialized in the production of fixed and automatic capacitor banks for low voltage compensation with inserting capacitors or electromechanical (contactors) or static (triac).

Capacitor banks are constructed in series, using automatic and semi-automatic lines and high reliability components, ensuring a very high quality with particular competitive price.

Quality is a constant and inalienable imperative:

- capacitors used are certified IMQ - EN60831-1 / 2 (IEC 831-1 / 2)
- the capacitor banks have passed the tests required by the CEI EN 60439-1 (CEI 17-13 / 1) conducted by CESI

The production plant has been certified Quality System since 1993 according to UNI EN ISO 9001 Standards, updated with the ISO 9001: 2000 certification. Currently, we are putting in place the certification of environmental system according to UNI EN ISO 14001.

All this allowed us to impose on the international market our products, exporting to over 90 countries in five continents.

# Calculation of the multiplier to determine capacity required for power factor correction

## Example:

To bring a power factor from 0.82 to 0.94  
multiply the power subscribed by the coefficient  
resulting of 0.34 (crossing the line and column of the table below)

$$Kvar_{cap} = KW_{load} \cdot (\tan\phi_1 - \tan\phi_2) = KW_{load} \cdot M$$

(M is calculated according to the table below)

		tan phi2															
		0,62	0,59	0,57	0,54	0,51	0,48	0,46	0,43	0,4	0,36	0,33	0,29	0,25	0,2	0,14	0
		cos phi2															
		0,85	0,86	0,87	0,88	0,89	0,9	0,91	0,92	0,93	0,94	0,95	0,96	0,97	0,98	0,99	1
tan phi1	cos phi1																
4,9	0,2	4,28	4,31	4,33	4,36	4,39	4,41	4,44	4,47	4,5	4,54	4,57	4,61	4,65	4,7	4,76	4,9
3,87	0,25	3,25	3,28	3,31	3,33	3,36	3,39	3,42	3,45	3,48	3,51	3,54	3,58	3,62	3,67	3,73	3,87
3,18	0,3	2,56	2,59	2,61	2,64	2,67	2,7	2,72	2,75	2,78	2,82	2,85	2,89	2,93	2,98	3,04	3,18
2,68	0,35	2,06	2,08	2,11	2,14	2,16	2,19	2,22	2,25	2,28	2,31	2,35	2,38	2,43	2,47	2,53	2,68
2,29	0,4	1,67	1,7	1,72	1,75	1,78	1,81	1,84	1,87	1,9	1,93	1,96	2	2,04	2,09	2,15	2,29
1,98	0,45	1,36	1,39	1,42	1,44	1,47	1,5	1,53	1,56	1,59	1,62	1,66	1,69	1,73	1,78	1,84	1,98
1,73	0,5	1,11	1,14	1,17	1,19	1,22	1,25	1,28	1,31	1,34	1,37	1,4	1,44	1,48	1,53	1,59	1,73
1,52	0,55	0,9	0,93	0,95	0,98	1,01	1,03	1,06	1,09	1,12	1,16	1,19	1,23	1,27	1,32	1,38	1,52
1,33	0,6	0,71	0,74	0,77	0,79	0,82	0,85	0,88	0,91	0,94	0,97	1	1,04	1,08	1,13	1,19	1,33
1,23	0,63	0,61	0,64	0,67	0,69	0,72	0,75	0,78	0,81	0,84	0,87	0,9	0,94	0,98	1,03	1,09	1,23
1,17	0,65	0,55	0,58	0,6	0,63	0,66	0,68	0,71	0,74	0,77	0,81	0,84	0,88	0,92	0,97	1,03	1,17
1,14	0,66	0,52	0,55	0,57	0,6	0,63	0,65	0,68	0,71	0,74	0,78	0,81	0,85	0,89	0,94	1	1,14
1,11	0,67	0,49	0,52	0,54	0,57	0,6	0,62	0,65	0,68	0,71	0,75	0,78	0,82	0,86	0,91	0,97	1,11
1,08	0,68	0,46	0,49	0,51	0,54	0,57	0,59	0,62	0,65	0,68	0,72	0,75	0,79	0,83	0,88	0,94	1,08
1,05	0,69	0,43	0,46	0,48	0,51	0,54	0,57	0,59	0,62	0,65	0,69	0,72	0,76	0,8	0,85	0,91	1,05
1,02	0,7	0,4	0,43	0,45	0,48	0,51	0,54	0,56	0,59	0,62	0,66	0,69	0,73	0,77	0,82	0,88	1,02
0,99	0,71	0,37	0,4	0,43	0,45	0,48	0,51	0,54	0,57	0,6	0,63	0,66	0,7	0,74	0,79	0,85	0,99
0,96	0,72	0,34	0,37	0,4	0,42	0,45	0,48	0,51	0,54	0,57	0,6	0,64	0,67	0,71	0,76	0,82	0,96
0,94	0,73	0,32	0,34	0,37	0,4	0,42	0,45	0,48	0,51	0,54	0,57	0,61	0,64	0,69	0,73	0,79	0,94
0,91	0,74	0,29	0,32	0,34	0,37	0,4	0,42	0,45	0,48	0,51	0,55	0,58	0,62	0,66	0,71	0,77	0,91
0,88	0,75	0,26	0,29	0,32	0,34	0,37	0,4	0,43	0,46	0,49	0,52	0,55	0,59	0,63	0,68	0,74	0,88
0,86	0,76	0,24	0,26	0,29	0,32	0,34	0,37	0,4	0,43	0,46	0,49	0,53	0,56	0,6	0,65	0,71	0,86
0,83	0,77	0,21	0,24	0,26	0,29	0,32	0,34	0,37	0,4	0,43	0,47	0,5	0,54	0,58	0,63	0,69	0,83
0,8	0,78	0,18	0,21	0,24	0,26	0,29	0,32	0,35	0,38	0,41	0,44	0,47	0,51	0,55	0,6	0,66	0,8
0,78	0,79	0,16	0,18	0,21	0,24	0,26	0,29	0,32	0,35	0,38	0,41	0,45	0,48	0,53	0,57	0,63	0,78
0,75	0,8	0,13	0,16	0,18	0,21	0,24	0,27	0,29	0,32	0,35	0,39	0,42	0,46	0,5	0,55	0,61	0,75
0,72	0,81	0,1	0,13	0,16	0,18	0,21	0,24	0,27	0,3	0,33	0,36	0,4	0,43	0,47	0,52	0,58	0,72
0,7	0,82	0,08	0,1	0,13	0,16	0,19	0,21	0,24	0,27	0,3	0,34	0,37	0,41	0,45	0,49	0,56	0,7
0,67	0,83	0,05	0,08	0,11	0,13	0,16	0,19	0,22	0,25	0,28	0,31	0,34	0,38	0,42	0,47	0,53	0,67
0,65	0,84	0,03	0,05	0,08	0,11	0,13	0,16	0,19	0,22	0,25	0,28	0,32	0,35	0,4	0,44	0,5	0,65
0,62	0,85		0,03	0,05	0,08	0,11	0,14	0,16	0,19	0,22	0,26	0,29	0,33	0,37	0,42	0,48	0,62
0,59	0,86			0,03	0,05	0,08	0,11	0,14	0,17	0,2	0,23	0,26	0,3	0,34	0,39	0,45	0,59
0,57	0,87				0,03	0,05	0,08	0,11	0,14	0,17	0,2	0,24	0,28	0,32	0,36	0,42	0,57
0,54	0,88					0,03	0,06	0,08	0,11	0,14	0,18	0,21	0,25	0,29	0,34	0,4	0,54
0,51	0,89						0,03	0,06	0,09	0,12	0,15	0,18	0,22	0,26	0,31	0,37	0,51
0,48	0,9							0,03	0,06	0,09	0,12	0,16	0,19	0,23	0,28	0,34	0,48
0,46	0,91								0,03	0,06	0,09	0,13	0,16	0,2	0,25	0,31	0,46
0,43	0,92									0,03	0,06	0,1	0,13	0,18	0,22	0,28	0,43
0,4	0,93										0,03	0,07	0,1	0,4	0,19	0,25	0,4
0,36	0,94											0,03	0,07	0,11	0,16	0,22	0,36

cos phi1 = power factor before compensation • cos phi 2 - new power factor  
tan phi1 = tangent phi measured on the installation • tan phi2 = tangent phi to obtain

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