

R.5/6

Automatic capacitor banks with detuned filters



Automatic capacitor banks with detuned filters

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R.5 - Automatic capacitor banks with detuned filters

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Automatic capacitor banks with detuned filters

The **FR / FRE** capacitor banks with detuned filters have been designed for power compensation purposes in networks with a high content of harmonics and where there is a risk of resonance.

Nowadays, installations with a high content of harmonics are quite common, so that when we perform a study for the compensation of the power factor, we must not only take into account the standard parameters, such as the active power, $\cos \varphi$ initial, $\cos \varphi$ objective and simultaneity of loads, but we must also take into account the harmonic distortion present in the installation.

Capacitor banks do not generate harmonics but they are elements that are highly sensitive to the presence of harmonics. Capacitors are receivers that can cause harmonic resonance, amplifying the levels of harmonics in our installations. They are capable of causing the following effects:

- Premature deterioration of capacitors, with the risk of their destruction.
- Unwanted protection tripping.
- Conductor overheating
- Overheating of transformers, causing excessive temperature trips, as well as additional losses in copper and iron and saturation
- Increase of thermal losses
- Errors in control processes.

Said filters are equipped with filter reactances, with factor $p = 7\%$, avoiding the amplification of harmonics above 189 Hz, while dampening existing harmonics.

In order to avoid resonances in frequencies under 189 Hz (third-order harmonics), filters with $p=14\%$

Functions of a rejection filter

- Protection of the network by shifting the resonance out of the frequencies injected in harmonics. This is done to avoid the amplification effects
- **Protection of capacitors** against the overloads generated by amplified voltages

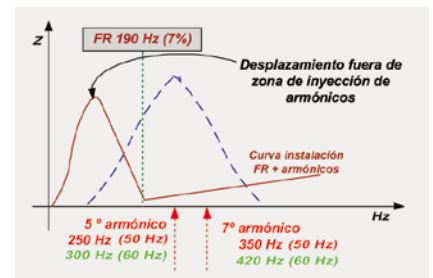
The threshold values recommended by **CIRCUTOR** for the installation of capacitor banks of the **FR/FRE** type, equipped with detuned filters, are as follows:

$$\begin{aligned} \text{THD}(I) &\geq 15\% \\ \text{THD}(U) &\geq 2.5\% \end{aligned}$$

The set of values mentioned above must be analysed to determine the need to install a capacitor bank with filters. A high value of $\text{THD}(U)$ with a low value of $\text{THD}(I)$ might be an indicator of a weak short-circuit power in our system, so that the harmonic resonance can increase and important changes in the levels of harmonics can lead to the deformation of the wave shape under voltage.



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In the case of project installations where the analysis of the values of $\text{THD}(I)$ and $\text{THD}(U)$ is not possible or is complicated, we will apply the following formula to determine whether it is necessary to install a capacitor bank with detuned filters or not.

Harmonic contamination index = $(\text{kW (harmonic loads)} / \text{kW (total load)}) \times 100$

A value above 15% indicates that our installation has a high content of harmonics, so that a capacitor bank with filters must be installed.

Selecting a FR / FRE capacitor bank

The following information is required before selecting a **FR / FRE** capacitor bank:

- ▶ Power factor (evolution in time)
- ▶ Measurement of the installation, in order to check the following:
 - Content of harmonics or potential resonance
 - Load variation speed. This will allow us to determine the type of regulation technology (contactors or electronic, with thyristors)

Connecting a FR / FRE capacitor bank

FR / FRE capacitor banks are usually connected to the general switchboard or secondary switchboards in the case of large-scale installations.

The FRF / FRM fixed capacitors act as single step filters. They are usually installed on the secondary power transformer of the installation.

Classification of detuned filters, in accordance with their compensation method

Detuned filters are as follows, as in the case of capacitor banks:

- **Fixed detuned filters.** For the compensation of transformers and motors (FRF / FRM).
- **Automatic detuned filters.** For the monitoring of variable loads.

The equipment will be (depending on the fluctuation speed of the load):

- **FR Series.** Equipped with electromechanical contactors and conventional power factor regulator
- **FRE Series.** Equipped with static contactors based on thyristors and quick power factor regulator. This solution offers a very fast switching operation and low maintenance as a result of the absence of mobile mechanical parts.

Comments about the data table

► (1) Switch

The switch gauge required by the capacitor bank is provided, but it is not included in the standard references. It is an optional element

► (2) Cable section (power connection cables)

The following tables show the cable sections recommended for the capacitor banks. The following have been taken into account to select the unit:

- Dimensioning criteria, 1.4 times the nominal current of the capacitor bank
- The section is provided by the phase
- The sections correspond to unipolar copper cables, with XLPE insulation, exposed (type F, perforated tray, ICT-BT-19), with a room temperature of 40 °C and no reducing coefficients by the grouping of various different lines
- Distance between the mains and capacitor bank of 15 m
- We recommend calculating the cable section in accordance with real data, as regards the length, type of channeling and cable used

FR 12 / FRE 12 type cabinets

The FR 12 / FRE 12 type cabinets are composed of two FR 6 / FRE6 cabinets. Therefore, they need two independent power cable connections.

When the capacitor banks are equipped with switches, one will be installed in each FR 6 / FRE 6 cabinet (total: two switches)

B - Alteration filtering solutions

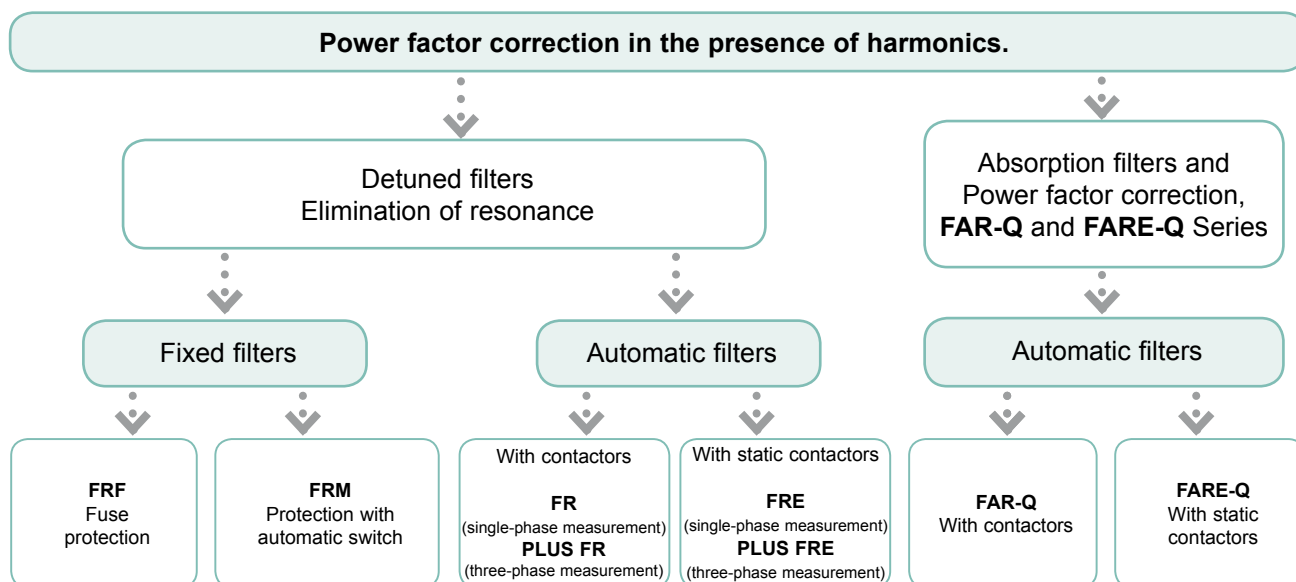
Different types of units are required to neutralise the different types of anomalies detected.

There are five categories that classify the unit in accordance with the objective desired:








- **B.1:** Power factor correction in networks with harmonic currents
- **B.2:** Harmonic filtering
- **B.3:** Neutral discharges
- **B.4:** HF filtering
- Unbalance between phases (see NETACTIVE MULTIFUNCTION)

Power factor correction in networks with harmonic currents B.1

The Power factor correction in networks with a high content of harmonics can be carried out under two different objectives, as shown on the following diagram:

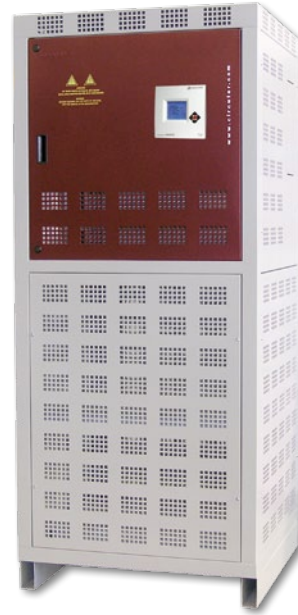


Product selection table

| | Equipment | Detuned filters | Protection | Connection | Scope | Page |
|--------------|---|-------------------|---------------------|------------|---|------|
| FRF |  | Fixed filters | By fuses | Contactors | 25 to 100 kvar | 11 |
| FRM |  | Fixed filters | By automatic switch | Contactors | 25 to 100 kvar | 11 |
| FR |  | Automatic | - | Contactors | Up to 75 kvar: FRS Up to 400 kvar: FR4 Up to 600 kvar: FR6 Up to 800 kvar: FR8 Up to 1200 kvar: FR12 | 7 |
| PLUS FR |  | Automatic | - | Contactors | Up to 75 kvar: PLUS FRS Up to 400 kvar: PLUS FR4 Up to 600 kvar: PLUS FR6 Up to 800 kvar: PLUS FR8 Up to 1200 kvar: PLUS FR12 | 9 |
| FRE |  | Automatic filters | - | Thyristors | Up to 75 kvar: FRES Up to 400 kvar: FRE4 Up to 600 kvar: FRE6 Up to 800 kvar: FRE8 Up to 1200 kvar: FRE12 | 13 |
| PLUS FRE |  | Automatic filters | - | Thyristors | Up to 75 kvar: PLUS FRES Up to 400 kvar: PLUS FRE4 Up to 600 kvar: PLUS FRE6 Up to 800 kvar: PLUS FRE8 Up to 1200 kvar: PLUS FRE12 | 15 |
| PLUS FRE f-f |  | Automatic filters | - | Thyristors | Up to 300 kvar: PLUS FREF4 Up to 400 kvar: PLUS FREF6 Up to 600 kvar: PLUS FREF8 Up to 800 kvar: PLUS FREF12 | 17 |

FR

Capacitor banks with detuned filters



Description

The **FR** Series capacitor banks with detuned filters have been designed for power compensation purposes in networks with fluctuating load levels, a high content of harmonics and where there is a risk of resonance. Power variations are relatively slow (in seconds) so that the switching operations are carried out with contactors.

Application

Its application is mainly focused on the compensation of installations with different loads, which require a regulated compensation, as a result of the power factor variations and where there is a high content of harmonics in the network.

• **Fixed detuned filters.** For the compensation of transformers and motors (**FRF/FRM**)

• **Automatic detuned filters.** For the monitoring of variable loads (**FR**).

Features

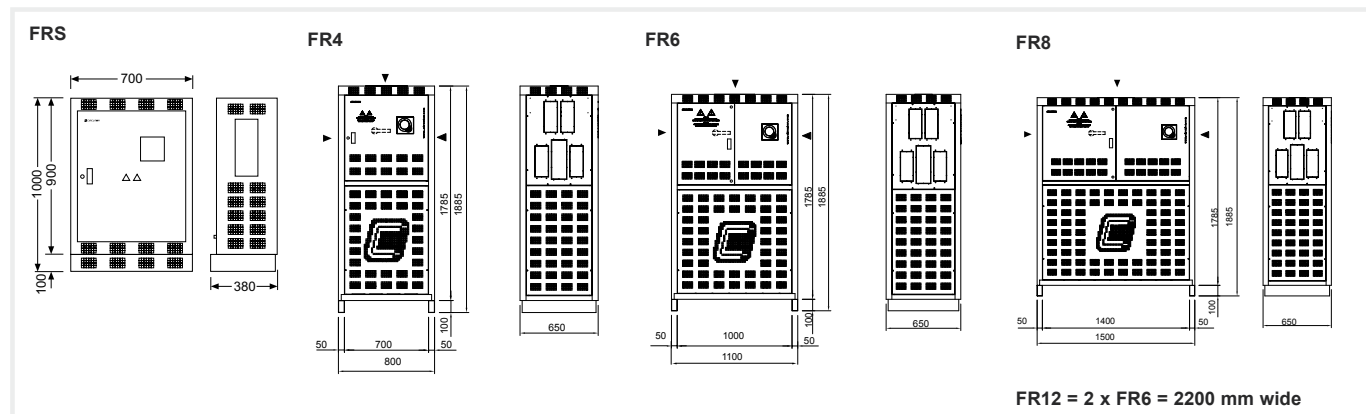
| Features | | |
|---|-------------|--|
| Operating voltage | | 230, 400 V (for other voltages, please ask) |
| Support voltage (400 V) | | 440 V |
| Capacity tolerance | | ± 10% |
| Unit composed of | | <ul style="list-style-type: none">• CFB capacitor• Contactors with pre-insertion block and quick discharge resistor• Individual protection of each step with fuses with high rupture power (HRP). NH-00 Series.• Two-pole protection circuit-breaker for capacitor bank and regulator operations.• Power factor regulator of the computer Max series.• Detuned filters tuned at 189 Hz for the protection against harmonics present in the network and to avoid the problems of resonance with fifth or higher order harmonics. Built-in thermostat for the disconnection of the step in case of excessive temperatures (90 °C). |
| Add-ons | | <ul style="list-style-type: none">• Manual capacitor bank header switch• Automatic capacitor bank header switch• Automatic switch + Earth leakage protection at the capacitor bank's header• Forced ventilation unit + thermostat• Polycarbonate plate to protect against direct contacts• Auto-transformer 400/230 V |
| Insulation level | | 3 / 15 kV |
| Discharge resistance | | 75 V / 3 minutes |
| Overload | | 1.3 times the rated current permanently |
| Overvoltage | | <ul style="list-style-type: none">• 10 % 8 over 24 hours• 15 % up to 15 minutes over 24 hours• 20 % up to 5 minutes over 24 hours• 30 % up to 1 minutes over 24 hours |
| Contactor operating voltage | | 230 V |
| Ambient conditions | | |
| Class D temperature | Daily mean | 45 °C |
| | Annual mean | 35 °C |
| | Maximum | 50 °C |
| | Minimum | -25 °C |
| Humidity | | 80% RH |
| Altitude | | 2,000 m |
| Construction features | | |
| Degree of protection | | IP 21 |
| Colour | | RAL 7035 Grey RAL 3005 Maroon |
| Assembly conditions | | |
| Type of assembly | | Vertical |
| Ventilation | | Natural or forced, depending on the option |
| Distance between capacitors | | Minimum, 2 cm |
| Standards | | |
| CEI 60831-1. CEI 70/7. UNE 20827. UNE 20010. BS 1650. VDE 560 | | |

FR

Capacitor banks with detuned filters



Dimensions

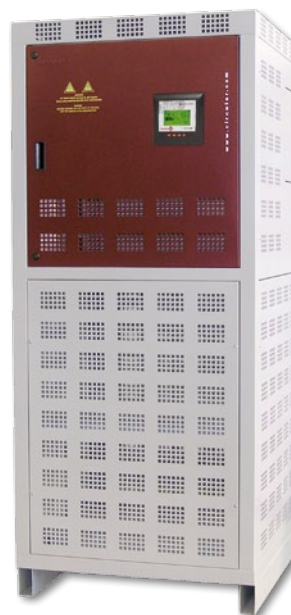


References

| kvar | Composition | Switch (A) | Cable section (mm ²) | Weight (kg) | Dimensions (mm) width x height x depth | Type | Code |
|------|-------------------------------|----------------|----------------------------------|-------------|--|---------------|--------|
| 440 | 400 | | | | | | |
| 17,5 | 14 (2,5 + 5 + 10) | 63 - Included | 6 | 105 | 700 x 1000 x 380 | FRS-17,5-440 | R5H450 |
| 25 | 21 (5 + (2 X 10)) | 63 - Included | 10 | 120 | 700 x 1000 x 380 | FRS-25-440 | R5H455 |
| 27,5 | 23 (2,5 + 5 + (2 X 10)) | 125 - Included | 16 | 130 | 700 x 1000 x 380 | FRS-27,5-440 | R5H460 |
| 35 | 29 (5 + (3 X 10)) | 125 - Included | 16 | 140 | 700 x 1000 x 380 | FRS-35-440 | R5H465 |
| 37,5 | 31 (7,5 + (2 X 15)) | 125 - Included | 25 | 150 | 700 x 1000 x 380 | FRS-37,5-440 | R5H470 |
| 45 | 37 (3 x 15) | 125 - Included | 25 | 175 | 700 x 1000 x 380 | FRS-45-440 | R5H475 |
| 60 | 50 (4 x 15) | 200 - Included | 35 | 200 | 700 x 1000 x 380 | FRS-60-440 | R5H480 |
| 75 | 62 (4 x 18,75) | 200 - Included | 50 | 215 | 700 x 1000 x 380 | FRS-75-440 | R5H485 |
| 87,5 | 72 (12,5 + 25 + 50) | 200 | 50 | 300 | 800 x 1900 x 650 | FR4-87,5-440 | R5E416 |
| 100 | 83 (25 + 25 + 50) | 250 | 95 | 325 | 800 x 1900 x 650 | FR4-100-440 | R5E420 |
| 125 | 103 (25 + 50 + 50) | 400 | 95 | 345 | 800 x 1900 x 650 | FR4-125-440 | R5E422 |
| 150 | 125 (25 + 25 + 50 + 50) | 400 | 95 | 355 | 800 x 1900 x 650 | FR4-150-440 | R5E423 |
| 175 | 145 (25 + 50 + 100) | 400 | 120 | 365 | 800 x 1900 x 650 | FR4-175-440 | R5E425 |
| 200 | 165 (50 + 50 + 100) | 400 | 150 | 380 | 800 x 1900 x 650 | FR4-200-440 | R5E428 |
| 250 | 207 (50 + (2 x 100)) | 630 | 185 | 390 | 800 x 1900 x 650 | FR4-250-440 | R5E429 |
| 300 | 248 (50 + 50 + (2 x 100)) | 630 | 240 | 410 | 800 x 1900 x 650 | FR4-300-440 | R5E430 |
| 350 | 289 (50 + (3 x 100)) | 800 | 2x150 | 430 | 800 x 1900 x 650 | FR4-350-440 | R5E432 |
| 400 | 331 (4 x 100) | 800 | 2x185 | 460 | 800 x 1900 x 650 | FR4-400-440 | R5E434 |
| 400 | 331 (50 + 50 + (3 x 100)) | 800 | 2x185 | 550 | 1100 x 1900 x 650 | FR6-400-440 | R5J425 |
| 450 | 372 (50 + (4 x 100)) | 1000 | 2x185 | 587 | 1100 x 1900 x 650 | FR6-450-440 | R5J430 |
| 500 | 413 (5 x 100) | 1000 | 2x240 | 621 | 1100 x 1900 x 650 | FR6-500-440 | R5J435 |
| 550 | 455 (50 + (5 x 100)) | 1250 | 2x240 | 658 | 1100 x 1900 x 650 | FR6-550-440 | R5J440 |
| 600 | 496 (6 x 100) | 1250 | 2x240 | 685 | 1100 x 1900 x 650 | FR6-600-440 | R5J445 |
| 600 | 496 (50 + 50 + (5 x 100)) | 1250 | 2x240 | 820 | 1500 x 1900 x 650 | FR8-600-440 | R5K436 |
| 650 | 537 (50 + (6 x 100)) | 1250 | 3x150 | 865 | 1500 x 1900 x 650 | FR8-650-440 | R5K438 |
| 700 | 579 (7 x 100) | 1250 | 3x150 | 910 | 1500 x 1900 x 650 | FR8-700-440 | R5K440 |
| 750 | 620 (50 + (7 x 100)) | 1600 | 3x185 | 955 | 1500 x 1900 x 650 | FR8-750-440 | R5K442 |
| 800 | 661 (8 x 100) | 1600 | 3x185 | 1000 | 1500 x 1900 x 650 | FR8-800-440 | R5K442 |
| 800 | 661 (50 + 50 + (7 x 100)) | 1250 / 400 | 2x240/ 240 | 1100 | 2200 x 1900 x 650 | FR12-800-440 | R5L425 |
| 850 | 702 (50 + (8 x 100)) | 1000 / 630 | 2x240/ 240 | 1137 | 2200 x 1900 x 650 | FR12-850-440 | R5L430 |
| 900 | 744 (9 x 100) | 1250 / 630 | 2x240/ 240 | 1174 | 2200 x 1900 x 650 | FR12-900-440 | R5L435 |
| 950 | 785 (50 + (9 x 100)) | 1000 / 800 | 2x240/ 2x185 | 1211 | 2200 x 1900 x 650 | FR12-950-440 | R5L440 |
| 1000 | 826 (10 x 100) | 1250 / 800 | 2x240/ 2x185 | 1248 | 2200 x 1900 x 650 | FR12-1000-440 | R5L445 |
| 1050 | 868 (50 + (10 x 100)) | 1250 / 800 | 2x240/ 2x240 | 1285 | 2200 x 1900 x 650 | FR12-1050-440 | R5L450 |
| 1100 | 909 (11 x 100) | 1250 / 1000 | 2x240/ 2x240 | 1322 | 2200 x 1900 x 650 | FR12-1100-440 | R5L455 |
| 1150 | 950 (50 + (11 x 100)) | 2 X 1250 | 2x240/ 2x240 | 1359 | 2200 x 1900 x 650 | FR12-1150-440 | R5L460 |
| 1200 | 992 (12 x 100) | 2 X 1250 | 2x240/ 2x240 | 1389 | 2200 x 1900 x 650 | FR12-1200-440 | R5L465 |

PLUS FR

Intelligent capacitor banks with detuned filters



Description

Intelligent state-of-the-art capacitor banks, capable of measuring the three installation phases and compensating the total power factor consumption accurately.

The **PLUS FR** series includes detuned filters tuned at 189 Hz to avoid the resonance phenomena in 5th or higher order harmonics. Units for other harmonics orders are manufactured on demand.

Including **CIRCUTOR's** measurement technology, effectively creating a compensation + measurement unit. As a power quality analyzer, it displays any electrical parameter of the network in real time and records it in its memory, with maximum and minimum values, date and hour.

Application

Its application is mainly focused on the compensation of installations with different loads, which require a regulated compensation, as a result of the power factor variations and where there is a high content of harmonics in the network.

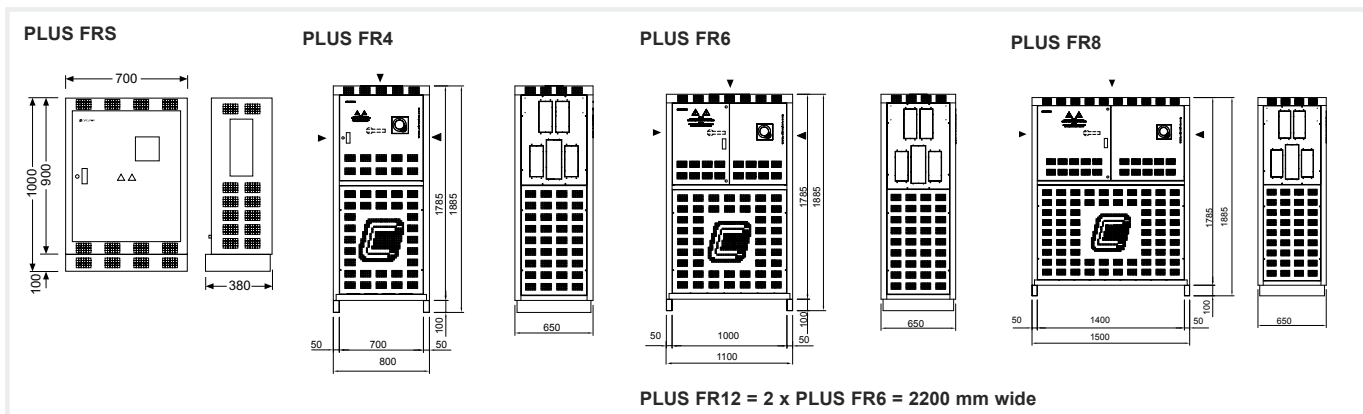
- **Fixed detuned filters.** For the compensation of transformers and motors (**FRF /FRM**).
- **Automatic detuned filters.** For the monitoring of variable loads (**PLUS FR**).

Features

| Features | | |
|---|--|---|
| Operating voltage | | 230, 400 V (for other voltages, please ask) |
| Support voltage (400 V) | | 440 V |
| Capacity tolerance | | ± 10% |
| Unit composed of | <ul style="list-style-type: none"> • CFB capacitor • Contactors with pre-insertion block and quick discharge resistor • Individual protection of each step with fuses with high rupture power (HRP). NH-00 Series. • Two-pole protection circuit-breaker for capacitor bank and regulator operations. • Power factor regulator of the computer Plus series, three-phase measurement and power analyzer functions • Detuned filters tuned at 189 Hz for the protection against harmonics present in the network and to avoid the problems of resonance with fifth or higher order harmonics. Built-in thermostat for the disconnection of the step in case of excessive temperatures (90 °C) | |
| Add-ons | <ul style="list-style-type: none"> • Manual capacitor bank header switch • Automatic capacitor bank header switch • Automatic switch + Earth leakage protection at the capacitor bank's header • Forced ventilation unit + thermostat • Polycarbonate plate to protect against direct contacts • Auto-transformer 400/230 V | |
| Insulation level | | 3 / 15 kV |
| Discharge resistance | | 75 V / 3 minutes |
| Overload | | 1.3 times the rated current permanently |
| Overvoltage | | <ul style="list-style-type: none"> • 10 % 8 over 24 hours • 15 % up to 15 minutes over 24 hours • 20 % up to 5 minutes over 24 hours • 30 % up to 1 minutes over 24 hours |
| Contactor operating voltage | | 230 V |
| Ambient conditions | | |
| Class D temperature | Daily mean | 45 °C |
| | Annual mean | 35 °C |
| | Maximum | 50 °C |
| | Minimum | -25 °C |
| Humidity | | 80% RH |
| Altitude | | 2,000 m |
| Construction features | | |
| Degree of protection | | IP 21 |
| Colour | | RAL 7035 Grey RAL 3005 Maroon |
| Assembly conditions | | |
| Type of assembly | | Vertical |
| Ventilation | | Natural or forced, depending on the option |
| Distance between capacitors | | Minimum, 2 cm |
| Standards | | |
| CEI 60831-1, CEI 70/7, UNE 20827, UNE 20010, BS 1650, VDE 560 | | |

PLUS FR

Intelligent capacitor banks with detuned filters

**Dimensions****References**

| kvar | | Composition | Switch (A) | Cable section (mm ²) | Weight (kg) | Dimensions (mm) width x height x depth | Type | Code |
|------|-----|---------------------------|----------------|----------------------------------|-------------|--|--------------------|--------|
| 440 | 400 | | | | | | | |
| 17,5 | 14 | (2,5 + 5 + 10) | 63 - Included | 6 | 105 | 700 x 1000 x 380 | PLUS FRS-17,5-440 | R5G450 |
| 25 | 21 | (5 + (2 X 10)) | 63 - Included | 10 | 120 | 700 x 1000 x 380 | PLUS FRS-25-440 | R5G455 |
| 27,5 | 23 | (2,5 + 5 + (2 X 10)) | 125 - Included | 16 | 130 | 700 x 1000 x 380 | PLUS FRS-27,5-440 | R5G460 |
| 35 | 29 | (5 + (3 X 10)) | 125 - Included | 16 | 140 | 700 x 1000 x 380 | PLUS FRS-35-440 | R5G465 |
| 37,5 | 31 | (7,5 + (2 X 15)) | 125 - Included | 25 | 150 | 700 x 1000 x 380 | PLUS FRS-37,5-440 | R5G470 |
| 45 | 37 | (3 x 15) | 125 - Included | 25 | 175 | 700 x 1000 x 380 | PLUS FRS-45-440 | R5G475 |
| 60 | 50 | (4 x 15) | 200 - Included | 35 | 200 | 700 x 1000 x 380 | PLUS FRS-60-440 | R5G480 |
| 75 | 62 | (4 x 18,75) | 200 - Included | 50 | 215 | 700 x 1000 x 380 | PLUS FRS-75-440 | R5G485 |
| 87,5 | 72 | (12,5 + 25 + 50) | 200 | 50 | 300 | 800 x 1900 x 650 | PLUS FR4-87,5-440 | R5D416 |
| 100 | 83 | (25 + 25 + 50) | 250 | 95 | 325 | 800 x 1900 x 650 | PLUS FR4-100-440 | R5D420 |
| 125 | 103 | (25 + 50 + 50) | 400 | 95 | 345 | 800 x 1900 x 650 | PLUS FR4-125-440 | R5D422 |
| 150 | 125 | (25 + 25 + 50 + 50) | 400 | 95 | 355 | 800 x 1900 x 650 | PLUS FR4-150-440 | R5D423 |
| 175 | 145 | (25 + 50 + 100) | 400 | 120 | 365 | 800 x 1900 x 650 | PLUS FR4-175-440 | R5D425 |
| 200 | 165 | (50 + 50 + 100) | 400 | 150 | 380 | 800 x 1900 x 650 | PLUS FR4-200-440 | R5D428 |
| 250 | 207 | (50 + (2 X 100)) | 630 | 185 | 390 | 800 x 1900 x 650 | PLUS FR4-250-440 | R5D429 |
| 300 | 248 | (50 + 50 + (2 X 100)) | 630 | 240 | 410 | 800 x 1900 x 650 | PLUS FR4-300-440 | R5D430 |
| 350 | 289 | (50 + (3 X 100)) | 800 | 2x150 | 430 | 800 x 1900 x 650 | PLUS FR4-350-440 | R5D432 |
| 400 | 331 | (4 x 100) | 800 | 2x185 | 460 | 800 x 1900 x 650 | PLUS FR4-400-440 | R5D434 |
| 400 | 331 | (50 + 50 + (3 X 100)) | 800 | 2x185 | 550 | 1100 x 1900 x 650 | PLUS FR6-400-440 | R5M425 |
| 450 | 372 | (50 + (4 X 100)) | 1000 | 2x185 | 587 | 1100 x 1900 x 650 | PLUS FR6-450-440 | R5M430 |
| 500 | 413 | (5 x 100) | 1000 | 2x240 | 621 | 1100 x 1900 x 650 | PLUS FR6-500-440 | R5M435 |
| 550 | 455 | (50 + (5 X 100)) | 1250 | 2x240 | 658 | 1100 x 1900 x 650 | PLUS FR6-550-440 | R5M440 |
| 600 | 496 | (6 x 100) | 1250 | 2x240 | 685 | 1100 x 1900 x 650 | PLUS FR6-600-440 | R5M445 |
| 600 | 496 | (50 + 50 + (5 X 100)) | 1250 | 2x240 | 820 | 1500 x 1900 x 650 | PLUS FR8-600-440 | R57436 |
| 650 | 537 | (50 + (6 X 100)) | 1250 | 3x150 | 865 | 1500 x 1900 x 650 | PLUS FR8-650-440 | R57438 |
| 700 | 579 | (7 x 100) | 1250 | 3x150 | 910 | 1500 x 1900 x 650 | PLUS FR8-700-440 | R57440 |
| 750 | 620 | (50 + (7 X 100)) | 1600 | 3x185 | 955 | 1500 x 1900 x 650 | PLUS FR8-750-440 | R57442 |
| 800 | 661 | (8 x 100) | 1600 | 3x185 | 1000 | 1500 x 1900 x 650 | PLUS FR8-800-440 | R57442 |
| 800 | 661 | (50 + 50 + (7 X 100)) | 1250 / 400 | 2x240/ 240 | 1100 | 2200 x 1900 x 650 | PLUS FR12-800-440 | R55425 |
| 850 | 702 | (50 + (8 X 100)) | 1000 / 630 | 2x240/ 240 | 1137 | 2200 x 1900 x 650 | PLUS FR12-850-440 | R55430 |
| 900 | 744 | (9 x 100) | 1250 / 630 | 2x240/ 240 | 1174 | 2200 x 1900 x 650 | PLUS FR12-900-440 | R55435 |
| 950 | 785 | (50 + (9 X 100)) | 1000 / 800 | 2x240/ 2x185 | 1211 | 2200 x 1900 x 650 | PLUS FR12-950-440 | R55440 |
| 1000 | 826 | (10 x 100) | 1250 / 800 | 2x240/ 2x185 | 1248 | 2200 x 1900 x 650 | PLUS FR12-1000-440 | R55445 |
| 1050 | 868 | (50 + (10 X 100)) | 1250 / 800 | 2x240/ 2x240 | 1285 | 2200 x 1900 x 650 | PLUS FR12-1050-440 | R55450 |
| 1100 | 909 | (11 x 100) | 1250 / 1000 | 2x240/ 2x240 | 1322 | 2200 x 1900 x 650 | PLUS FR12-1100-440 | R55455 |
| 1150 | 950 | (50 + (11 X 100)) | 2 X 1250 | 2x240/ 2x240 | 1359 | 2200 x 1900 x 650 | PLUS FR12-1150-440 | R55460 |
| 1200 | 992 | (12 x 100) | 2 X 1250 | 2x240/ 2x240 | 1389 | 2200 x 1900 x 650 | PLUS FR12-1200-440 | R55465 |

FRF / FRM

Fixed capacitor with rejection reactance $p = 7\%$



Description

The **FRF / FRM** Series capacitor banks with detuned filters have been designed for power compensation purposes in motors and transformers with a constant load level, a high content of harmonics and where there is a risk of resonance. Including:

- **FRF**: general protection with NH-00 fuses with a high rupture power (HRP) for the capacitor.
- **FRM**: general circuit breaker protection for the capacitor.

Application

Its application is mainly based on the compensation of transformers and motors. In general, it is used for the compensation of installations under constant loads and where there is a high content of harmonics in the network.

Features

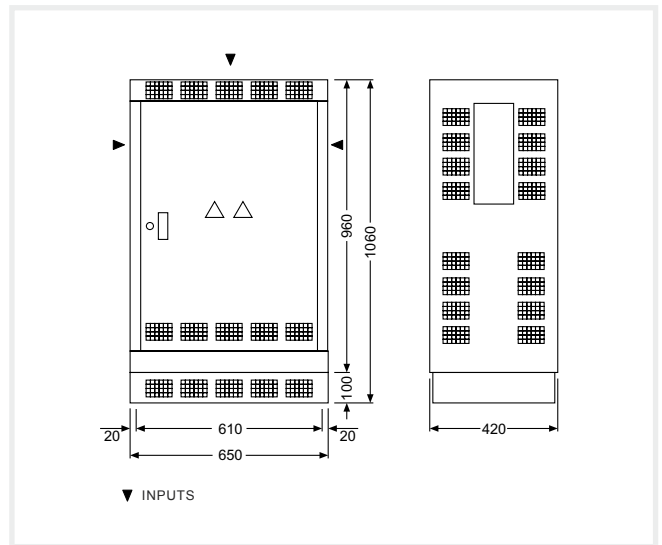
| Features | | |
|---|---|---|
| Operating voltage | | 230, 400 (for other voltages, please ask) |
| Support voltage (400 V) | | 440 V |
| Capacity tolerance | | ±10% |
| Unit composed of | | <ul style="list-style-type: none"> • CFB capacitor • FRF: General protection fuse, type NH-00 with a high rupture power (HRP) • FRM: General three-pole protection circuit breaker • Detuned filters tuned at 189 Hz for the protection against harmonics present in the network and to avoid the problems of resonance with fifth or higher order harmonics. Built-in thermostat for the disconnection of the step in case of excessive temperatures (90 °C) |
| Insulation level | | 3 / 15 kV |
| Discharge resistance | | 75 V / 3 minutes |
| Overload | | 1.3 times the rated current permanently |
| Overvoltage | | <ul style="list-style-type: none"> • 10 % 8 over 24 hours • 15 % up to 15 minutes over 24 hours • 20 % up to 5 minutes over 24 hours • 30 % up to 1 minute over 24 hours |
| Frequency | | 50 or 60 Hz |
| Losses: | <ul style="list-style-type: none"> • Dielectric • Total | <ul style="list-style-type: none"> • < 0.2 W / kvar • < 0.5 W / kvar |
| Protections | | <ul style="list-style-type: none"> • Dielectric regeneration • Internal fuse • Overpressure system • Vermiculite |
| Construction features | | |
| Terminals: | <ul style="list-style-type: none"> • Power rating • Earth | <ul style="list-style-type: none"> • M6 for CV, M10 para CQ, CSB, CSB-6B, CFB, CFB-6B • M6 |
| Torque value | | <ul style="list-style-type: none"> • CV 5 Nm • CQ, CSB, CSB-6B, CFB, CFB-6B: 15 Nm |
| Ambient conditions | | |
| Class D temperature: | Daily mean Annual mean Maximum Minimum | 45 °C 35 °C 50 °C -25 °C |
| Humidity | | 80% RH |
| Altitude | | 2,000 m |
| Assembly conditions | | |
| Degree of protection | | IP 21 |
| Type of assembly | | Vertical |
| Ventilation | | Natural or forced, depending on the option |
| Colour | | RAL 7035 Grey RAL 3005 Maroon |
| Standards | | |
| CEI 60831-1, CEI 70/7, UNE 20827, UNE 20010, BS 1650, VDE 560 | | |

FRF / FRM

Fixed capacitor with rejection
reactance $p = 7 \%$



Dimensions



References

440 V / 50 Hz

FRF: APR Fuse protection

| kvar | | (A) | Weight (kg) | Cable section (mm ²) | Dimensions (mm) width x height x depth | Type | Code |
|-------|-------|-----|-------------|----------------------------------|---|--------------|--------|
| 440 V | 400 V | | | | | | |
| 25 | 21 | 33 | 78 | 10 | 650 x 1060 x 420 | FRF-25-440 | R55350 |
| 37,5 | 31 | 47 | 82 | 16 | 650 x 1060 x 420 | FRF-37.5-440 | R55370 |
| 50 | 42 | 66 | 85 | 25 | 650 x 1060 x 420 | FRF-50-440 | R55380 |
| 60 | 50 | 79 | 90 | 35 | 650 x 1060 x 420 | FRF-60-440 | R55390 |
| 75 | 62 | 99 | 96 | 50 | 650 x 1060 x 420 | FRF-75-440 | R553A0 |
| 100 | 83 | 131 | 110 | 70 | 650 x 1060 x 420 | FRF-100-440 | R553B0 |

440 V / 50 Hz

FRM: Three-pole automatic protection

| kvar | | (A) | Weight (kg) | Cable section (mm ²) | Dimensions (mm) width x height x depth | Type | Code |
|-------|-------|-----|-------------|----------------------------------|---|--------------|--------|
| 440 V | 400 V | | | | | | |
| 25 | 21 | 33 | 78 | 10 | 650 x 1060 x 420 | FRM-25-440 | R57350 |
| 37,5 | 31 | 47 | 82 | 16 | 650 x 1060 x 420 | FRM-37.5-440 | R57370 |
| 50 | 42 | 66 | 85 | 25 | 650 x 1060 x 420 | FRM-50-440 | R57380 |
| 60 | 50 | 79 | 90 | 35 | 650 x 1060 x 420 | FRM-60-440 | R57390 |
| 75 | 62 | 99 | 96 | 50 | 650 x 1060 x 420 | FRM-75-440 | R573A0 |
| 100 | 83 | 131 | 110 | 70 | 650 x 1060 x 420 | FRM-100-440 | R573B0 |

FRE

Capacitor banks with detuned filters with thyristors



Description

The **FRE** Series capacitor banks with detuned filters have been designed for power compensation purposes in networks with fluctuating load levels, a high content of harmonics and where there is a risk of resonance.

Power variations are relatively quick (in milliseconds) so that the switching operations can be carried out by thyristors, which are connected to a voltage control plate; the capacitor is connected and disconnected with a zero voltage difference. This system avoids transients in the connection and disconnection of steps, with an immediate response to load fluctuations.

Application

The most common application is with individual loads or in installations where a quick compensation response is needed (for ex., welding units, motors for lifting units, lifts, etc.) and where there is a high content of harmonics in the network.

Features

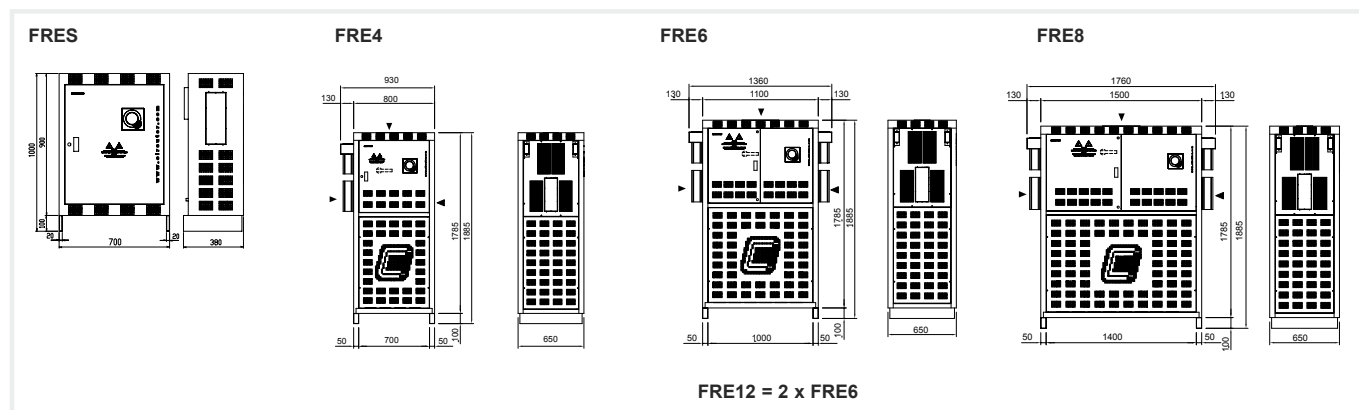
| Features | | |
|---|--|---|
| Operating voltage | | 230, 400 V (for other voltages, please ask) |
| Support voltage (400 V) | | 440 V |
| Capacity tolerance | | ± 10% |
| Unit composed of | <ul style="list-style-type: none"> • CFB capacitor • Static switching unit on each step, composed of static contactors (thyristors) • Individual protection of each step with fuses with high rupture power (HRP). NH-00 Series. • Two-pole protection circuit-breaker for capacitor bank and regulator operations. • Power factor regulator computer 8df / computer Smart-F series. • Heat removal radiators • Built-in thermostat on the radiator for the disconnection of each step in case of high temperatures (90 °C) • Detuned filters tuned at 189 Hz for the protection against harmonics present in the network and to avoid the problems of resonance with fifth or higher order harmonics. | |
| Add-ons | <ul style="list-style-type: none"> • Manual capacitor bank header switch • Automatic capacitor bank header switch • Automatic switch + Earth leakage protection at the capacitor bank's header • Forced ventilation unit + thermostat • Polycarbonate plate to protect against direct contacts • Auto-transformer 400/230 V | |
| Insulation level | | 3 / 15 kV |
| Discharge resistance | | 75 V / 3 minutes |
| Overload | | 1.3 times the rated current permanently |
| Overvoltage | | <ul style="list-style-type: none"> • 10 % 8 over 24 hours • 15 % up to 15 minutes over 24 hours • 20 % up to 5 minutes over 24 hours • 30 % up to 1 minutes over 24 hours |
| Contactor operating voltage | | 230 V |
| Ambient conditions | | |
| Class D temperature | Daily mean | 45 °C |
| | Annual mean | 35 °C |
| | Maximum | 50 °C |
| | Minimum | -25 °C |
| Humidity | | 80% RH |
| Altitude | | 2,000 m |
| Construction features | | |
| Degree of protection | | IP 21 |
| Colour | | RAL 7035: Grey / RAL 3005: Maroon |
| Assembly conditions | | |
| Type of assembly | | Vertical |
| Ventilation | | Natural or forced, depending on the option |
| Distance between capacitors | | Minimum, 2 cm |
| Standards | | |
| CEI 60831-1, CEI 70/7, UNE 20827, UNE 20010, BS 1650, VDE 560 | | |

FRE

Capacitor banks with detuned filters with thyristors



Dimensions



References

| kvar | | Composition | Switch (A) | Cable section (mm ²) | Weight (kg) | Dimensions (mm) width x height x depth | Type | Code |
|------|-----|---------------------------|----------------|----------------------------------|-------------|--|----------------|--------|
| 440 | 400 | | | | | | | |
| 17,5 | 14 | (2,5 + 5 + 10) | 63 - Included | 6 | 105 | 700 x 1000 x 380 | FRES-17,5-440 | R6H450 |
| 25 | 21 | (5 + (2 X 10)) | 63 - Included | 10 | 120 | 700 x 1000 x 380 | FRES-25-440 | R6H455 |
| 27,5 | 23 | (2,5 + 5 + (2 x 10)) | 125 - Included | 16 | 130 | 700 x 1000 x 380 | FRES-27,5-440 | R6H460 |
| 35 | 29 | (5 + (3 X 10)) | 125 - Included | 16 | 140 | 700 x 1000 x 380 | FRES-35-440 | R6H465 |
| 37,5 | 31 | (7,5 + (2 X 15)) | 125 - Included | 25 | 150 | 700 x 1000 x 380 | FRES-37,5-440 | R6H470 |
| 45 | 37 | (3 x 15) | 125 - Included | 25 | 175 | 700 x 1000 x 380 | FRES-45-440 | R6H475 |
| 60 | 50 | (4 x 15) | 200 - Included | 35 | 200 | 700 x 1000 x 380 | FRES-60-440 | R6H480 |
| 75 | 62 | (4 x 18,75) | 200 - Included | 50 | 215 | 700 x 1000 x 380 | FRES-75-440 | R6H485 |
| 87,5 | 72 | (12,5 + 25 + 50) | 200 | 50 | 300 | 930 x 1900 x 650 | FRE4-87,5-440 | R6E416 |
| 100 | 83 | (25 + 25 + 50) | 250 | 95 | 325 | 930 x 1900 x 650 | FRE4-100-440 | R6E420 |
| 125 | 103 | (25 + 50 + 50) | 400 | 95 | 345 | 930 x 1900 x 650 | FRE4-125-440 | R6E422 |
| 150 | 125 | (25 + 25 + 50 + 50) | 400 | 95 | 355 | 930 x 1900 x 650 | FRE4-150-440 | R6E423 |
| 175 | 145 | (25 + 50 + 100) | 400 | 120 | 365 | 930 x 1900 x 650 | FRE4-175-440 | R6E425 |
| 200 | 165 | (50 + 50 + 100) | 400 | 150 | 380 | 930 x 1900 x 650 | FRE4-200-440 | R6E428 |
| 250 | 207 | (50 + (2 x 100)) | 630 | 185 | 390 | 930 x 1900 x 650 | FRE4-250-440 | R6E429 |
| 300 | 248 | (50 + 50 + (2 x 100)) | 630 | 240 | 410 | 930 x 1900 x 650 | FRE4-300-440 | R6E430 |
| 350 | 289 | (50 + (3 x 100)) | 800 | 2x150 | 430 | 930 x 1900 x 650 | FRE4-350-440 | R6E432 |
| 400 | 331 | (4 x 100) | 800 | 2x185 | 460 | 930 x 1900 x 650 | FRE4-400-440 | R6E434 |
| 400 | 331 | (50 + 50 + (3 x 100)) | 800 | 2x185 | 550 | 1360 x 1900 x 650 | FRE6-400-440 | R6J425 |
| 450 | 372 | (50 + (4 x 100)) | 1000 | 2x185 | 587 | 1360 x 1900 x 650 | FRE6-450-440 | R6J430 |
| 500 | 413 | (5 x 100) | 1000 | 2x240 | 621 | 1360 x 1900 x 650 | FRE6-500-440 | R6J435 |
| 550 | 455 | (50 + (5 x 100)) | 1250 | 2x240 | 658 | 1360 x 1900 x 650 | FRE6-550-440 | R6J440 |
| 600 | 496 | (6 x 100) | 1250 | 2x240 | 685 | 1360 x 1900 x 650 | FRE6-600-440 | R6J445 |
| 600 | 496 | (50 + 50 + (5 x 100)) | 1250 | 2x240 | 820 | 1760 x 1900 x 650 | FRE8-600-440 | R6K436 |
| 650 | 537 | (50 + (6 x 100)) | 1250 | 3x150 | 865 | 1760 x 1900 x 650 | FRE8-650-440 | R6K438 |
| 700 | 579 | (7 x 100) | 1250 | 3x150 | 910 | 1760 x 1900 x 650 | FRE8-700-440 | R6K440 |
| 750 | 620 | (50 + (7 x 100)) | 1600 | 3x185 | 955 | 1760 x 1900 x 650 | FRE8-750-440 | R6K442 |
| 800 | 661 | (8 x 100) | 1600 | 3x185 | 1000 | 1760 x 1900 x 650 | FRE8-800-440 | R6K444 |
| 800 | 661 | (50 + 50 + (7 x 100)) | 1250 / 400 | 2x240/ 240 | 1100 | 2720 x 1900 x 650 | FRE12-800-440 | R6L425 |
| 850 | 702 | (50 + (8 x 100)) | 1000 / 630 | 2x240/ 240 | 1137 | 2720 x 1900 x 650 | FRE12-850-440 | R6L430 |
| 900 | 744 | (9 x 100) | 1250 / 630 | 2x240/ 240 | 1174 | 2720 x 1900 x 650 | FRE12-900-440 | R6L435 |
| 950 | 785 | (50 + (9 x 100)) | 1000 / 800 | 2x240/ 2x185 | 1211 | 2720 x 1900 x 650 | FRE12-950-440 | R6L440 |
| 1000 | 826 | (10 x 100) | 1250 / 800 | 2x240/ 2x185 | 1248 | 2720 x 1900 x 650 | FRE12-1000-440 | R6L445 |
| 1050 | 868 | (50 + (10 x 100)) | 1250 / 800 | 2x240/ 2x240 | 1285 | 2720 x 1900 x 650 | FRE12-1050-440 | R6L450 |
| 1100 | 909 | (11 x 100) | 1250 / 1000 | 2x240/ 2x240 | 1322 | 2720 x 1900 x 650 | FRE12-1100-440 | R6L455 |
| 1150 | 950 | (50 + (11 x 100)) | 2 X 1250 | 2x240/ 2x240 | 1359 | 2720 x 1900 x 650 | FRE12-1150-440 | R6L460 |
| 1200 | 992 | (12 x 100) | 2 X 1250 | 2x240/ 2x240 | 1389 | 2720 x 1900 x 650 | FRE12-1200-440 | R6L465 |

PLUS FRE

Capacitor banks with detuned filters with thyristors



Description

Intelligent state-of-the-art capacitor banks, capable of measuring the three installation phases and compensating the total power factor consumption accurately and in real time.

The **PLUS FRE** series includes detuned filters tuned at 189 Hz to avoid the resonance phenomena in 5th or higher order harmonics. Units for other harmonics orders are manufactured on demand.

Including **CIRCUTOR**'s measurement technology, effectively creating a compensation + measurement unit. As a power quality analyzer, it displays any electrical parameter of the network in real time and records it in its memory, with maximum and minimum values, date and hour.

Application

The most common application is with individual loads or in installations where a quick compensation response is needed (for ex., welding units, motors for lifting units, lifts, etc.) and where there is a high content of harmonics in the network.

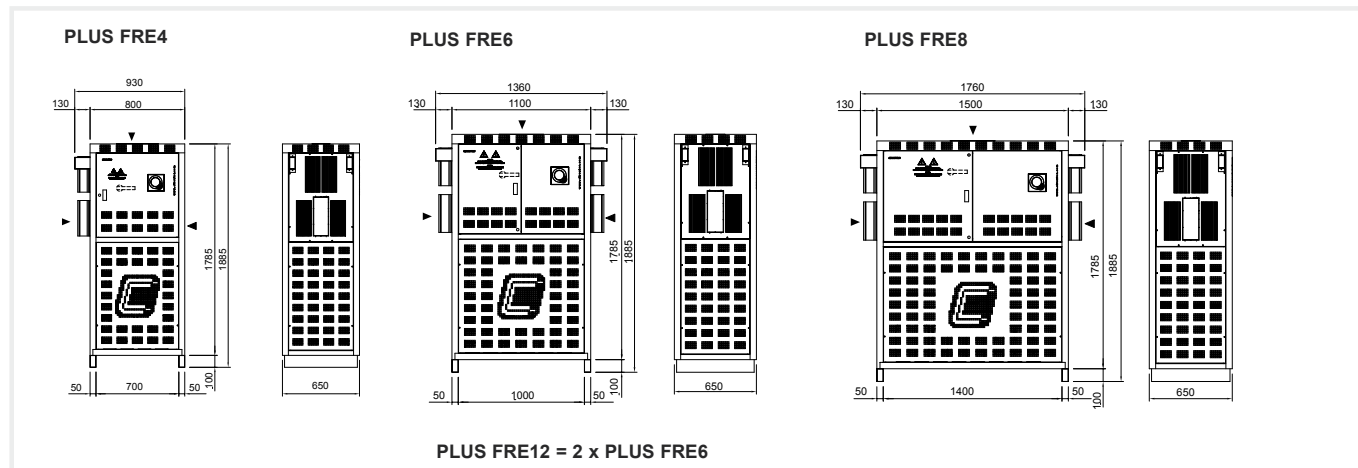
Features

| Features | | |
|---|--|---|
| Operating voltage | | 230, 400 V (for other voltages, please ask) |
| Support voltage (400 V) | | 440 V |
| Capacity tolerance | | ± 10% |
| Unit composed of | <ul style="list-style-type: none"> • CFB capacitor • Static switching unit on each step, composed of static contactors (thyristors) • Individual protection of each step with fuses with high rupture power (HRP). NH-00 Series. • Two-pole protection circuit-breaker for capacitor bank and regulator operations. • Power factor regulator of the computer Plus-TF series, three-phase measurement and power analyzer functions • Heat removal radiators • Built-in thermostat on the radiator for the disconnection of each step in case of high temperatures (90 °C) • Detuned filters tuned at 189 Hz for the protection against harmonics present in the network and to avoid the problems of resonance with fifth or higher order harmonics. | |
| Add-ons | <ul style="list-style-type: none"> • Manual capacitor bank header switch • Automatic capacitor bank header switch • Automatic switch + Earth leakage protection at the capacitor bank's header • Forced ventilation unit + thermostat • Polycarbonate plate to protect against direct contacts • Auto-transformer 400/230 V | |
| Insulation level | | 3 / 15 kV |
| Discharge resistance | | 75 V / 3 minutes |
| Overload | | 1.3 times the rated current permanently |
| Overvoltage | | <ul style="list-style-type: none"> • 10 % 8 over 24 hours • 15 % up to 15 minutes over 24 hours • 20 % up to 5 minutes over 24 hours • 30 % up to 1 minutes over 24 hours |
| Contactor operating voltage | | 230 V |
| Ambient conditions | | |
| Class D temperature | Daily mean | 45 °C |
| | Annual mean | 35 °C |
| | Maximum | 50 °C |
| | Minimum | -25 °C |
| Humidity | | 80% RH |
| Altitude | | 2,000 m |
| Construction features | | |
| Degree of protection | | IP 21 |
| Colour | | RAL 7035 Grey |
| | | RAL 3005 Maroon |
| Assembly conditions | | |
| Type of assembly | | Vertical |
| Ventilation | | Natural or forced, depending on the option |
| Distance between capacitors | | Minimum, 2 cm |
| Standards | | |
| CEI 60831-1, CEI 70/7, UNE 20827, UNE 20010, BS 1650, VDE 560 | | |

PLUS FRE

Capacitor banks with detuned filters with thyristors

Dimensions



References

| kvar | Composition | Switch (A) | Cable section (mm ²) | Weight (kg) | Dimensions (mm) width x height x depth | Type | Code |
|------|-------------------------------|-------------|----------------------------------|-------------|--|---------------------|--------|
| 440 | 400 | | | | | | |
| 87,5 | 72 (12,5 + 25 + 50) | 200 | 50 | 300 | 1060 x 1900 x 650 | PLUS FRE4-87,5-440 | R6B416 |
| 100 | 83 (25 + 25 + 50) | 250 | 95 | 325 | 1060 x 1900 x 650 | PLUS FRE4-100-440 | R6B420 |
| 125 | 103 (25 + 50 + 50) | 400 | 95 | 345 | 1060 x 1900 x 650 | PLUS FRE4-125-440 | R6B422 |
| 150 | 125 (25 + 25 + 50 + 50) | 400 | 95 | 355 | 1060 x 1900 x 650 | PLUS FRE4-150-440 | R6B423 |
| 175 | 145 (25 + 50 + 100) | 400 | 120 | 365 | 1060 x 1900 x 650 | PLUS FRE4-175-440 | R6B425 |
| 200 | 165 (50 + 50 + 100) | 400 | 150 | 380 | 1060 x 1900 x 650 | PLUS FRE4-200-440 | R6B428 |
| 250 | 207 (50 + (2 x 100)) | 630 | 185 | 390 | 1060 x 1900 x 650 | PLUS FRE4-250-440 | R6B429 |
| 300 | 248 (50 + 50 + (2 x 100)) | 630 | 240 | 410 | 1060 x 1900 x 650 | PLUS FRE4-300-440 | R6B430 |
| 350 | 289 (50 + (3 x 100)) | 800 | 2x150 | 430 | 1060 x 1900 x 650 | PLUS FRE4-350-440 | R6B432 |
| 400 | 331 (4 x 100) | 800 | 2x185 | 460 | 1060 x 1900 x 650 | PLUS FRE4-400-440 | R6B434 |
| 400 | 331 (50 + 50 + (3 x 100)) | 800 | 2x185 | 550 | 1360 x 1900 x 650 | PLUS FRE6-400-440 | R6B425 |
| 450 | 372 (50 + (4 x 100)) | 1000 | 2x185 | 587 | 1360 x 1900 x 650 | PLUS FRE6-450-440 | R6B430 |
| 500 | 413 (5 x 100) | 1000 | 2x240 | 621 | 1360 x 1900 x 650 | PLUS FRE6-500-440 | R6B435 |
| 550 | 455 (50 + (5 x 100)) | 1250 | 2x240 | 658 | 1360 x 1900 x 650 | PLUS FRE6-550-440 | R6B440 |
| 600 | 496 (6 x 100) | 1250 | 2x240 | 685 | 1360 x 1900 x 650 | PLUS FRE6-600-440 | R6B445 |
| 600 | 496 (50 + 50 + (5 x 100)) | 1250 | 2x240 | 820 | 1760 x 1900 x 650 | PLUS FRE8-600-440 | R6B436 |
| 650 | 537 (50 + (6 x 100)) | 1250 | 3x150 | 865 | 1760 x 1900 x 650 | PLUS FRE8-650-440 | R6B438 |
| 700 | 579 (7 x 100) | 1250 | 3x150 | 910 | 1760 x 1900 x 650 | PLUS FRE8-700-440 | R6B440 |
| 750 | 620 (50 + (7 x 100)) | 1600 | 3x185 | 955 | 1760 x 1900 x 650 | PLUS FRE8-750-440 | R6B442 |
| 800 | 661 (8 x 100) | 1600 | 3x185 | 1000 | 1760 x 1900 x 650 | PLUS FRE8-800-440 | R6B444 |
| 800 | 661 (50 + 50 + (7 x 100)) | 1250 / 400 | 2x240/ 240 | 1100 | 2720 x 1900 x 650 | PLUS FRE12-800-440 | R6B425 |
| 850 | 702 (50 + (8 x 100)) | 1000 / 630 | 2x240/ 240 | 1137 | 2720 x 1900 x 650 | PLUS FRE12-850-440 | R6B430 |
| 900 | 744 (9 x 100) | 1250 / 630 | 2x240/ 240 | 1174 | 2720 x 1900 x 650 | PLUS FRE12-900-440 | R6B435 |
| 950 | 785 (50 + (9 x 100)) | 1000 / 800 | 2x240/ 2x185 | 1211 | 2720 x 1900 x 650 | PLUS FRE12-950-440 | R6B440 |
| 1000 | 826 (10 x 100) | 1250 / 800 | 2x240/ 2x185 | 1248 | 2720 x 1900 x 650 | PLUS FRE12-1000-440 | R6B445 |
| 1050 | 868 (50 + (10 x 100)) | 1250 / 800 | 2x240/ 2x240 | 1285 | 2720 x 1900 x 650 | PLUS FRE12-1050-440 | R6B450 |
| 1100 | 909 (11 x 100) | 1250 / 1000 | 2x240/ 2x240 | 1322 | 2720 x 1900 x 650 | PLUS FRE12-1100-440 | R6B455 |
| 1150 | 950 (50 + (11 x 100)) | 2 X 1250 | 2x240/ 2x240 | 1359 | 2720 x 1900 x 650 | PLUS FRE12-1150-440 | R6B460 |
| 1200 | 992 (12 x 100) | 2 X 1250 | 2x240/ 2x240 | 1389 | 2720 x 1900 x 650 | PLUS FRE12-1200-440 | R6B465 |

PLUS FRE f-f

Capacitor banks with detuned filters with thyristors



Description

State-of-the-art intelligent capacitor banks that are capable of measuring the three installation phases and compensating the total power factor consumption of each phase in real time.

The **PLUS FRE f-f** series includes detuned filters tuned at 189 Hz to avoid the resonance phenomena in 5th or higher order harmonics. Units for other harmonics orders are manufactured on demand.

Including **CIRCUTOR's** measurement technology, effectively creating a compensation + measurement unit. As a power quality analyzer, it displays any electrical parameter of the network in real time and records it in its memory, with maximum and minimum values, date and hour.

Application

The most common application is with individual loads or in installations where a quick compensation response is needed (for ex., welding units, motors for lifting units, lifts, etc.) and where there is a high content of harmonics in the network.

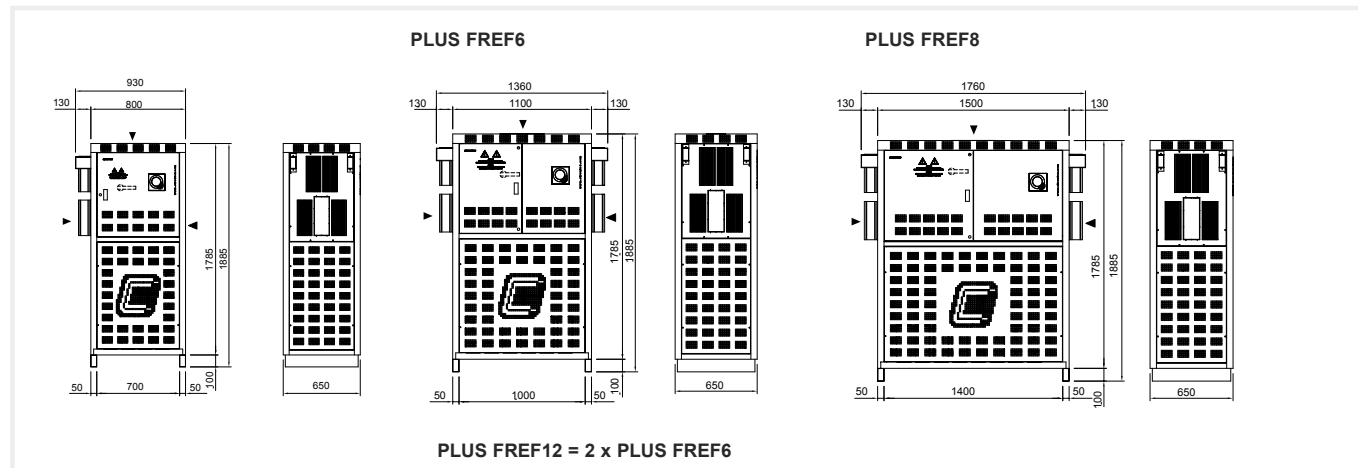
Features

| Features | | |
|---|--|---|
| Operating voltage | | 230, 400 V (for other voltages, please ask) |
| Support voltage | | 440 V |
| Capacity tolerance | | ± 10% |
| Unit composed of | <ul style="list-style-type: none"> • CFB capacitor • Static switching unit on each step, composed of static contactors (thyristors) • Individual protection of each step with fuses with high rupture power (HRP). NH-00 Series. • Two-pole protection circuit-breaker for capacitor bank and regulator operations. • Power factor regulator of the computer Plus-TF series, three-phase measurement and power analyzer functions • Heat removal radiators • Built-in thermostat on the radiator for the disconnection of each step in case of high temperatures (90 °C) • Detuned filters tuned at 189 Hz for the protection against harmonics present in the network and to avoid the problems of resonance with fifth or higher order harmonics. | |
| Add-ons | <ul style="list-style-type: none"> • Manual capacitor bank header switch • Automatic capacitor bank header switch • Automatic switch + Earth leakage protection at the capacitor bank's header • Forced ventilation unit + thermostat • Polycarbonate plate to protect against direct contacts • Auto-transformer 400/230 V | |
| Insulation level | | 3 / 15 kV |
| Discharge resistance | | 75 V / 3 minutes |
| Overload | | 1.3 times the rated current permanently |
| Overvoltage | | <ul style="list-style-type: none"> • 10 % 8 over 24 hours • 15 % up to 15 minutes over 24 hours • 20 % up to 5 minutes over 24 hours • 30 % up to 1 minutes over 24 hours |
| Contactor operating voltage | | 230 V |
| Ambient conditions | | |
| Class D temperature | Daily mean | 45 °C |
| | Annual mean | 35 °C |
| | Maximum | 50 °C |
| | Minimum | -25 °C |
| Humidity | | 80% RH |
| Altitude | | 2,000 m |
| Construction features | | |
| Degree of protection | | IP 21 |
| Colour | | RAL 7035 Grey |
| | | RAL 3005 Maroon |
| Assembly conditions | | |
| Type of assembly | | Vertical |
| Ventilation | | Natural or forced, depending on the option |
| Distance between capacitors | | Minimum, 2 cm |
| Standards | | |
| CEI 60831-1, CEI 70/7, UNE 20827, UNE 20010, BS 1650, VDE 560 | | |

PLUS FRE f-f

Capacitor banks with detuned filters with thyristors

Dimensions



References

| kvar | Composition | Switch (A) | Cable section (mm ²) | Weight (kg) | Dimensions (mm) width x height x depth | Type | Code |
|------|-------------------------------|------------|----------------------------------|-------------|--|---------------------|--------|
| 440 | 400 | | | | | | |
| 87,5 | 72 (12,5 + 25 + 50) | 200 | 50 | 300 | 1060 x 1900 x 650 | PLUS FREF4-87,5-440 | R69000 |
| 100 | 83 (25 + 25 + 50) | 250 | 95 | 325 | 1060 x 1900 x 650 | PLUS FREF4-100-440 | R69001 |
| 125 | 103 (25 + 50 + 50) | 400 | 95 | 345 | 1060 x 1900 x 650 | PLUS FREF4-125-440 | R69002 |
| 150 | 125 (3 x 50) | 400 | 95 | 355 | 1060 x 1900 x 650 | PLUS FREF4-150-440 | R69003 |
| 175 | 145 (25 + 50 + 100) | 400 | 120 | 365 | 1060 x 1900 x 650 | PLUS FREF4-175-440 | R69004 |
| 200 | 165 (50 + 50 + 100) | 400 | 150 | 380 | 1060 x 1900 x 650 | PLUS FREF4-200-440 | R69005 |
| 250 | 207 (50 + 100 + 100) | 630 | 185 | 390 | 1060 x 1900 x 650 | PLUS FREF4-250-440 | R69006 |
| 300 | 248 (3 x 100) | 630 | 240 | 410 | 1060 x 1900 x 650 | PLUS FREF4-300-440 | R69007 |
| 300 | 248 (50 + 50 + (2 x 100)) | 630 | 240 | 430 | 1360 x 1900 x 650 | PLUS FREF6-300-440 | R69008 |
| 350 | 289 (50 + (3 x 100)) | 630 | 2x150 | 445 | 1360 x 1900 x 650 | PLUS FREF6-350-440 | R69009 |
| 400 | 331 (4 x 100) | 800 | 2x185 | 460 | 1360 x 1900 x 650 | PLUS FREF6-400-440 | R69010 |
| 400 | 331 (50 + 50 + (3 x 100)) | 800 | 240 | 550 | 1760 x 1900 x 650 | PLUS FREF8-400-440 | R69011 |
| 450 | 372 (50 + (4 x 100)) | 1000 | 2x185 | 587 | 1760 x 1900 x 650 | PLUS FREF8-450-440 | R69012 |
| 500 | 413 (5 x 100) | 1000 | 2x240 | 621 | 1760 x 1900 x 650 | PLUS FREF8-500-440 | R69013 |
| 500 | 413 (50 + 50 + (4 x 100)) | 1000 | 2x240 | 638 | 1760 x 1900 x 650 | PLUS FREF8-500-440 | R69014 |
| 550 | 455 (50 + (5 x 100)) | 1250 | 2x240 | 658 | 1760 x 1900 x 650 | PLUS FREF8-550-440 | R69015 |
| 600 | 496 (6 x 100) | 1250 | 2x240 | 685 | 1760 x 1900 x 650 | PLUS FREF8-600-440 | R69016 |
| 600 | 496 (50 + 50 + (5 x 100)) | 800 / 400 | 240/95 | 870 | 2720 x 1900 x 650 | PLUS FREF12-600-440 | R69017 |
| 650 | 537 (50 + (6 x 100)) | 630 / 630 | 2x150/95 | 907 | 2720 x 1900 x 650 | PLUS FREF12-650-440 | R69018 |
| 700 | 579 (7 x 100) | 800 / 630 | 2x185/240 | 944 | 2720 x 1900 x 650 | PLUS FREF12-700-440 | R69019 |
| 750 | 620 (50 + (7 x 100)) | 800 / 630 | 2x185/2x150 | 981 | 2720 x 1900 x 650 | PLUS FREF12-750-440 | R69020 |
| 800 | 661 (8 x 100) | 2 x 650 | 2x185/2x185 | 1016 | 2720 x 1900 x 650 | PLUS FREF12-800-440 | R69021 |