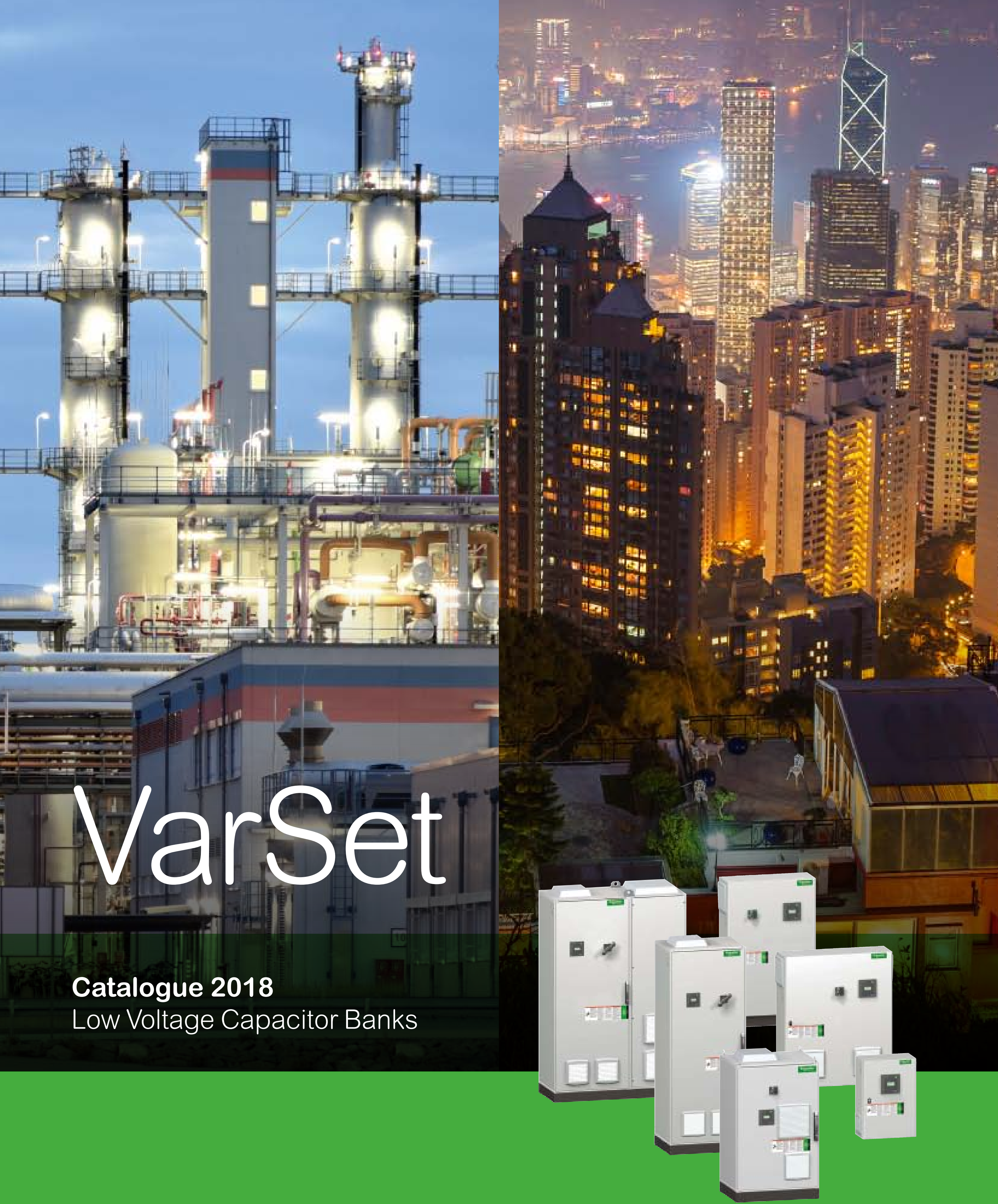


VarSet

Catalogue 2018

Low Voltage Capacitor Banks

schneider-electric.com

Life Is On | Schneider Electric

Your requirements…

Optimize energy consumption

- By reducing electricity bills,
- By reducing power losses,
- By reducing CO_2 emissions.

Increase power availability

- Compensate for voltage sags detrimental to process operation,
- Avoid nuisance tripping and supply interruptions..

Improve your business performance

- Optimize installation size,
- Reduce harmonic distortion to avoid the premature ageing of equipment and destruction of sensitive components.

Our solutions…

Reactive energy management

In electrical networks, reactive energy results in increased line currents for a given active energy transmitted to loads.

The main consequences are:

- Need for oversizing of transmission and distribution networks by utilities,
- Increased voltage drops and sags along the distribution lines,
- Additional power losses.

This results in increased electricity bills for industrial customers because of:

- Penalties applied by most utilities on reactive energy,
- Increased overall kVA demand,
- Increased energy consumption within the installations.

Reactive energy management aims to optimize your electrical installation by reducing energy consumption, and to improve power availability. Total CO_2 emissions are also reduced.

Utility power bills are typically reduced by 5% to 10%*.

"Our energy con-sumption was reduced by **9%** after we installed 10 capacitor banks with detuned reactors. Electricity bill optimised by 8% and payback in 2 years."

Testifies Michelin Automotive in France.

"Energy consumption reduced by **5%** with LV capacitor bank and active filter installed."

POMA OTIS Railways, Switzerland.

"70 capacitor banks with detuned reactors installed, energy consumption reduced by 10%, electrcity bill optimised by 18%, payback in just **1 year.**"

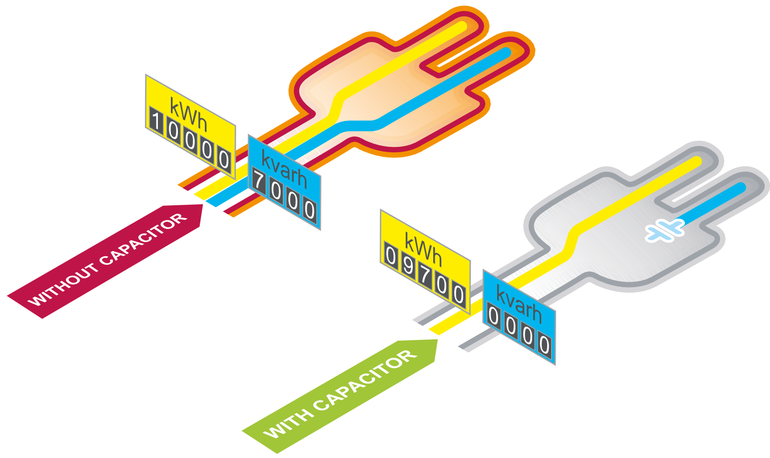
Madrid Barrajas airport Spain.

"Our network performance improved significantly after we installed 225 LV Detuned capacitor banks. The capacitor banks incorporates advanced metering system and remote communication ensures continued operation and minimal down time."

Ministry of Electricity and Water, Kuwait.

* Performance reflects actual customer experience, your results may vary depending on your environment.

Improve electrical networks and **reduce energy costs**



Power Factor Correction

Every electric machine needs active power (kW) and reactive power (kVAr) to operate.

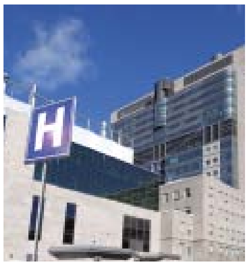
- The power rating of the installation in kVA is the combination of both:
  $(kVA)^2 = (kW)^2 + (kVAr)^2$
- The Power Factor has been defined as the ratio of active power (kW) to apparent power (kVA).
  Power Factor = (kW) / (kVA)

The objective of Reactive Energy management is improvement of Power Factor, or "Power Factor Correction".

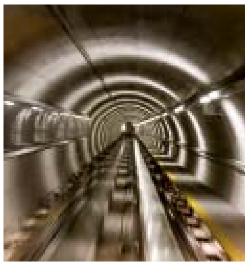
This is typically achieved by producing reactive energy close to the consuming loads, through connection of capacitor banks to the network.

Ensure **reliability** and **safety** on installations

Quality and reliability



- Continuity of service thanks to the high performance and long life expectancy of capacitors.
- 100% testing in manufacturing plant.
- Design and engineering with the highest international standards.



Safety

- Over-pressure system for safe disconnection at the end of life.
- All materials and components are free of PCB pollutants.

Efficiency and productivity

- Product development including innovation in ergonomics and ease of installation and connection.
- Specially designed components to save time on installation and maintenance.
- All components and solutions available through a network of distributors and partners in more than 100 countries.

Thanks to the know-how developed over 50 years, Schneider Electric ranks as the global specialist in Energy management providing a unique and comprehensive portfolio.

Schneider Electric helps you to make the most of your energy with innovative, reliable and safe solutions.

Quality & Environment

Quality certified
ISO9001, ISO14001 and ISO50001

A major strength

In each of its units, Schneider Electric has an operating organization whose main role is to verify quality and ensure compliance with standards. This procedure is:

- uniform for all departments;
- recognized by numerous customers and official organizations.

But, above all, its strict application has made it possible to obtain the recognition of independent organizations.

The quality system for design and manufacturing is certified in compliance with the requirements of the ISO 9001 and ISO 14001 Quality Assurance model.

Stringent, systematic controls

During its manufacture, each equipment item undergoes systematic routine tests to verify its quality and compliance:

- dielectric testing;
- earth connection continuity test;
- functional test of probes & ventilation;
- functional test of the PFC system;
- verification of protection settings;
- verification of compliance with drawings and diagrams.

The results obtained are recorded and initialled by the Quality Control Department on the specific test certificate for each device.

RoHS, REACh Compliance

Low voltage power factor correction equipments and components of Schneider Electric are RoHS, REACh Compliant.

Schneider Electric undertakes to reduce the energy bill and CO_2 emissions of its customers by proposing products, solutions and services which fit in with all levels of the energy value chain.

The Power Factor Correction and harmonic filtering offer form part of the energy efficiency approach.

Energy Efficiency

Immediate Savings*

* Assuming the Power Factor correction equipment is properly chosen, installed, connected and commissioned.

General contents
VarSet

Power Factor correction Guidelines

Power Factor correction Guidelines

Other chapters

Why reactive energy management?

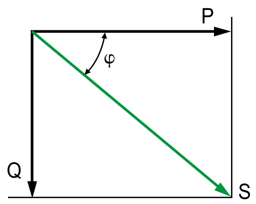


Fig. 1 In this representation, the Power Factor (P/S) is equal to cos φ.

Due to this higher supplied current, the circulation of reactive energy in distribution networks results in:

- Overload of transformers
- Higher temperature rise in power cables
- Additional losses
- Large voltage drops
- Higher energy consumption and cost
- Less distributed active power

Principle of reactive energy management

All AC electrical networks consume two types of power: active power (kW) and reactive power (kVAr):

- **The active power P** (in kW) is the real power transmitted to loads such as motors, lamps, heaters, computers, etc. The electrical active power is transformed into mechanical power, heat or light.
- **The reactive power Q** (in kVAr) is used only to power the magnetic circuits of machines, motors and transformers.

The apparent power S (in kVA) is the vector combination of active and reactive power.

The circulation of reactive power in the electrical network has major technical and economic consequences. For the same active power P, a higher reactive power means a higher apparent power, and thus a higher current must be supplied.

The circulation of active power over time results in active energy (in kWh).
The circulation of reactive power over time results in reactive energy (kvarh).

In an electrical circuit, the reactive energy is supplied in addition to the active energy.

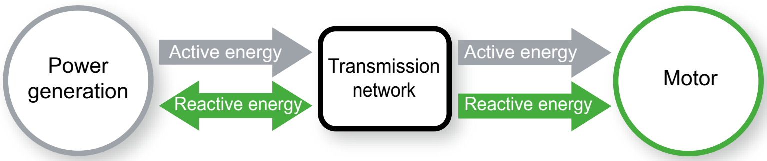


Fig. 2 Reactive energy supplied and billed by the energy provider.

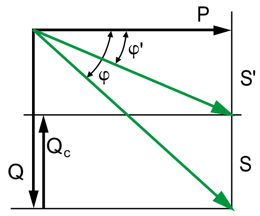


Fig. 4

For these reasons, there is a great advantage in generating reactive energy at the load level in order to prevent the unnecessary circulation of current in the network. This is what is known as "power factor correction". This is obtained by the connection of capacitors, which produce reactive energy in opposition to the energy absorbed by loads such as motors.

The result is a reduced apparent power, and an improved power factor P/S' as illustrated in the diagram opposite.

The power generation and transmission networks are partially relieved, reducing power losses and making additional transmission capacity available.

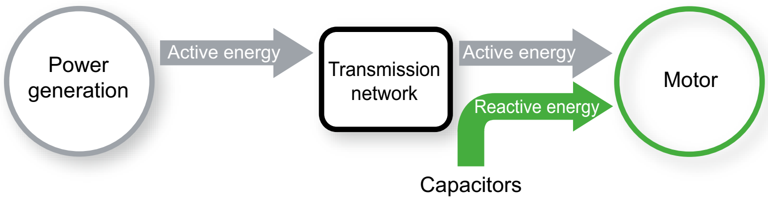


Fig. 3 The reactive power is supplied by capacitors.
No billing of reactive power by the energy supplier

A

Benefits of reactive energy management

Optimized reactive energy management brings economic and technical advantages as follows:

Savings on the electricity bill

- Eliminating penalties on reactive energy and decreasing kVA demand.
- Reducing power losses generated in the transformers and conductors of the installation.

Example:
Loss reduction in a 630 kVA transformer PW = 6,500 W with an initial Power Factor = 0.7.
With power factor correction, we obtain a final Power Factor = 0.98.
The losses become: 3,316 W, i.e. a reduction of 49%.

Increasing available power

A high power factor optimizes an electrical installation by allowing better use of the components. The power available at the secondary of a MV/LV transformer can therefore be increased by fitting power factor correction equipment on the low voltage side.

The table opposite shows the increased available power at the transformer output through improvement of the Power Factor from 0.7 to 1.

Power factor	Increased available power
0.7	0%
0.8	+ 14%
0.85	+ 21%
0.90	+ 28%
0.95	+ 36%
1	+ 43%

Reducing installation size

Installing power factor correction equipment allows conductor cross-section to be reduced, since less current is absorbed by the compensated installation for the same active power.

The opposite table shows the multiplying factor for the conductor cross-section with different power factor values.

Power factor	Cable cross-section multiplying factor
1	1
0.80	1.25
0.60	1.67
0.40	2.50

Reducing voltage drops in the installation

Installing capacitors allows voltage drops to be reduced upstream of the point where the power factor correction device is connected.

This prevents overloading of the network and reduces harmonics, so that you will not have to overrate your installation.

Method for determining compensation

The selection of Power Factor Correction equipment should follow the following 4-step process and must be done by any people having the relevant skills:

- Step 1: Calculation of the required reactive power.
- Step 2: Selection of the compensation mode:
  - Central, for the complete installation
  - By sector
  - For individual loads, such as large motors.
- Step 3: Selection of the compensation type:
  - Fixed, by connection of a fixed-value capacitor bank;
  - Automatic, by connection of a different number of steps, allowing adjustment of the reactive energy to the required value;
  - Dynamic, for compensation of highly fluctuating loads.
- Step 4: Allowance for operating conditions and harmonics.

Step 1: Calculation of the required reactive power

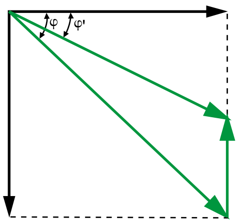


Fig. 5

The objective is to determine the required reactive power Q_c (kvar) to be installed, in order to improve the power factor cos φ and reduce the apparent power S.

For φ' < φ, we obtain: cos φ' > cos φ and tan φ' < tan φ.

This is illustrated in the diagram opposite.

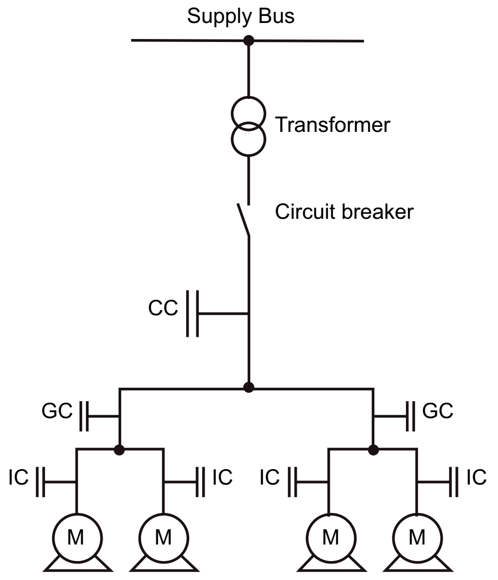
Q_c can be determined from the formula Q_c = P. (tan φ - tan φ'), which is deduced from the diagram.
Q_c = power of the capacitor bank in kVAr.
P = active power of the load in kW.
tan φ = tangent of phase shift angle before compensation.
tan φ' = tangent of phase shift angle after compensation.

The parameters φ and tan φ can be obtained from billing data, or from direct measurement in the installation.

The following table can be used for direct determination.

Before compensation			**Reactive power (kvar) to be installed per kW of load, in order to get the required cos φ' or tan φ'**						
		tan φ'	**0.75**	**0.62**	**0.48**	**0.41**	**0.33**	**0.23**	**0.00**
		cos φ'	**0.80**	**0.85**	**0.90**	**0.925**	**0.95**	**0.975**	**1.000**
tan φ	**cos φ**								
1.73	0.5		0.98	1.11	1.25	1.32	1.40	1.50	1.73
1.02	0.70		0.27	0.40	0.54	0.61	0.69	0.79	1.02
0.96	0.72		0.21	0.34	0.48	0.55	0.64	0.74	0.96
0.91	0.74		0.16	0.29	0.42	0.50	0.58	0.68	0.91
0.86	0.76		0.11	0.24	0.37	0.44	0.53	0.63	0.86
0.80	0.78		0.05	0.18	0.32	0.39	0.47	0.57	0.80
0.75	0.80			0.13	0.27	0.34	0.42	0.52	0.75
0.70	0.82			0.08	0.21	0.29	0.37	0.47	0.70
0.65	0.84			0.03	0.16	0.24	0.32	0.42	0.65
0.59	0.86				0.11	0.18	0.26	0.37	0.59
0.54	0.88				0.06	0.13	0.21	0.31	0.54
0.48	0.90					0.07	0.16	0.26	0.48

Example:
consider a 1000 kW motor with cos φ = 0.8 (tan φ = 0.75).
In order to obtain cos φ = 0.95, it is necessary to install a capacitor bank with a reactive power equal to k x P, i.e.: Qc = 0.42 x 1000 = 420 kvar.



CC: Central Compensation
GC: Group Compensation
IC: Individual Compensation
M: Motor Load

Fig. 6

Step 2: Selection of the compensation mode

The location of low-voltage capacitors in an installation constitutes the mode of compensation, which may be central (one location for the entire installation), by sector (section-by-section), at load level, or some combination of the latter two. In principle, the ideal compensation is applied at a point of consumption and at the level required at any moment in time.

In practice, technical and economic factors govern the choice.

The location for connection of capacitor banks in the electrical network is determined by:

- the overall objective (avoid penalties on reactive energy relieve transformer or cables, avoid voltage drops and sags)
- the operating mode (stable or fluctuating loads)
- the foreseeable influence of capacitors on the network characteristics
- the installation cost.

Central compensation

The capacitor bank is connected at the head of the installation to be compensated in order to provide reactive energy for the whole installation.
This configuration is convenient for a stable and continuous load factor.

Group compensation (by sector)

The capacitor bank is connected at the head of the feeders supplying one particular sector to be compensated. This configuration is convenient for a large installation, with workshops having different load factors.

Compensation of individual loads

The capacitor bank is connected right at the inductive load terminals (especially large motors). This configuration is very appropriate when the load power is significant compared to the subscribed power.
This is the ideal technical configuration, as the reactive energy is produced exactly where it is needed, and adjusted to the demand.

A

Step 3: Selection of the compensation type

Different types of compensation should be adopted depending on the performance requirements and complexity of control:

- Fixed, by connection of a fixed-value capacitor bank
- Automatic, by connection of a different number of steps, allowing adjustment of the reactive energy to the required value
- Dynamic, for compensation of highly fluctuating loads.

Fixed compensation

This arrangement uses one or more capacitor(s) to provide a constant level of compensation. Control may be:

- Manual: by circuit-breaker or load-break switch
- Semi-automatic: by contactor
- Direct connection to an appliance and switched with it.

These capacitors are installed:

- At the terminals of inductive loads (mainly motors)
- At busbars supplying numerous small motors and inductive appliances for which individual compensation would be too costly
- In cases where the load factor is reasonably constant.

Automatic compensation

This kind of compensation provides automatic control and adapts the quantity of reactive power to the variations of the installation in order to maintain the targeted cos φ. The equipment is installed at points in an installation where the active-power and/or reactive-power variations are relatively large, for example:

- on the busbars of a main distribution switchboard
- on the terminals of a heavily-loaded feeder cable.

Where the kvar rating of the capacitors is less than or equal to 15% of the power supply transformer rating, a fixed value of compensation is appropriate. Above the 15% level, it is advisable to install an automatically-controlled capacitor bank.

Control is usually provided by an electronic device (Power Factor Controller) which monitors the actual power factor and orders the connection or disconnection of capacitors in order to obtain the targeted power factor. The reactive energy is thus controlled by steps. In addition, the Power Factor Controller provides information on the network characteristics (voltage amplitude and distortion, power factor, actual active and reactive power…) and equipment status. Alarm signals are transmitted in case of malfunction.

Connection is usually provided by contactors. For compensation of highly fluctuating loads use of active filters or Electronic Var Compensators (EVC) are recommened. Contact Schneider Electric for electronic compensation solutions.

Dynamic compensation

This kind of compensation is required when fluctuating loads are present, and voltage fluctuations have to be prevented. The principle of dynamic compensation is to associate a fixed capacitor bank and an electronic var compensator, providing either leading or lagging reactive currents.

The result is continuously varying fast compensation, perfectly suitable for loads such as lifts, crushers, spot welding, etc.

Step 4: Allowance for operating conditions and harmonics

Capacitor banks should be selected depending on the working conditions expected during their lifetime.

Allowing for operating conditions

The operating conditions have a great influence on the life expectancy of capacitors. The following parameters should be taken into account:

- Ambient Temperature (°C)
- Expected over-current, related to voltage disturbances, including maximum sustained overvoltage
- Maximum number of switching operations/year
- Required life expectancy.

Our Power Factor Correction equipment are not suitable for a use in an environment with an explosive atmosphere (ATEX).

Allowing for harmonics

Impact of harmonics on capacitors

Some loads (variable speed motors, static converters, welding machines, arc furnaces, fluorescent lamps, etc.) pollute the electrical network by reinjecting harmonics.

To take account of the effects of the harmonics on the capacitors, the type of compensation equipment must be correctly determined:

Gh / Sn	≤ 15%	≤ 25%	≤ 50%
Range	VarSet Easy "no polluted network"	VarSet "low polluted network"	VarSet "polluted network"

Choosing equipment according to the harmonic pollution level

Equipment can be chosen:

- Either theoretically from the Gh/Sn ratio if the data is available.

Gh: apparent power of harmonic-generating loads (variable speed motors, static converters, power electronics, etc).

Sn: apparent power of the transformer.

The Gh/Sn rule is valid for a THD(I) of all the harmonic generators < 30% and for a pre-existing THD(U) < 2%.

If these values are exceeded, a harmonic analysis of the network or measurements are required.

Example 1:
U = 400 V, P = 300 kW, Sn = 800 kVA, Gh = 150 kVA
Gh/Sn = 18.75% φ VarSet "low polluted network" equipment

Example 2:
U = 400 V, P = 100 kW, Sn = 800 kVA, Gh = 300 kVA
Gh/Sn = 37.5% φ VarSet "polluted network" equipment

- Or from the total harmonic current distortion THD(I) measured at the transformer secondary, **at full load and without without connected capacitors**:

THD(I) %	VarSet Easy "no polluted network"	VarSet "low polluted network"	VarSet "polluted network"	Accusine Active filters
≤ 5%				
5% < … ≤ 10%				
10% < … ≤ 20%				
> 20%				

- Or from the total harmonic voltage distortion THD(U) measured at the transformer secondary, **at full load and without without connected capacitors**:

THD(U) %	VarSet Easy "no polluted network"	VarSet "low polluted network"	VarSet "polluted network"	Accusine Active filters
≤ 3%				
3% < … ≤ 4%				
4% < … ≤ 7%				
> 7%				

When Qc > 30% of Sn, "polluted network type" must be choosen to avoid any resonnance

Method for determining compensation

- If both THD(I) and THD(U) are measured and do not result in the same type of power factor correction, the most rigorous solution must be chosen.

Example:
A measurement gives:
- THD(I) = 15% VarSet "polluted network" solution
- THD(U) = 3.5% VarSet "low polluted network" solution

The VarSet "polluted network" solution must be chosen.

General

The purpose of the detuned reactors (DR) is to prevent the harmonics present on the network from being amplified and to protect the capacitors (this corresponds to our VarSet "polluted network" range). They must be connected in series with the capacitors.

Caution: as the detuned reactors generate an overvoltage at the capacitor terminals, capacitors at least 480 V must be used for a 400 V network.

Technical data

- Choice of tuning
  The tuning frequency fr corresponds to the resonance frequency of the L-C assembly.

  $$fr = \frac{1}{(2\pi\sqrt{LC})}$$

  We also speak of tuning order n.

  For a 50 Hz network, we have:

  $$n = \frac{fr}{50\text{ Hz}}$$

- The tuning order chosen must ensure that the harmonic current spectrum range is outside the resonance frequency.
- It is also important to ensure that no remote-control frequencies are disturbed.

The most common tuning orders are 3, 8 or 4.2 (2.7 is used for 3rd order harmonics).

Tuning order selection table for Network 50 Hz

Harmonic generators	Remote control frequency (Ft)		
	165 Hz < Ft ≤ 250 Hz	250 Hz < Ft ≤ 350 Hz	None or Ft > 350 Hz
Three-phase harmonic generators (2)	2.7 (1)	3.8	4.2
Single-phase harmonic generators (3)	2.7		

Tuning order selection table for Network 60 Hz

Harmonic generators	Remote control frequency (Ft)		
	200 Hz < Ft ≤ 300 Hz	300 Hz < Ft ≤ 450 Hz	None or Ft > 450Hz
Three-phase harmonic generators (2)	2.7	3.8	4.2
Single-phase harmonic generators (3)	2.7		

(1) a tuning order of 4.2 can be used in France with a remote control frequency of 175 Hz.
(2) Example of three-phase harmonic generators : Variable speed drives, rectifiers,UPS,starters.
(3) Single phase harmonic generators case must be considered if the power of single phase harmonic generators in KVA is more than half of the total power of your harmonic generators.

Concordance between tuning order, tuning frequency and relative impedance

Tuning order	Relative impedance [p = 1 / n²] (%)	Tuning frequency for @ 50 Hz (Hz)	Tuning frequency for @ 60 Hz (Hz)
2,7	14	135	162
3,8	7	190	228
4,2	5,7	215	252

Typical solutions depending on applications

Customer requirements

The table below shows the solutions most frequently used in different types of applications.

- Very frequently
- Usually
- Occasionally

In all cases, it is strongly recommended that measurements be carried out on site in order to validate the solution.

Types of applications	VarSet Easy "no polluted network" Gh/Sn ≤ 15%	VarSet "low polluted network" Gh/Sn ≤ 25%	VarSet "polluted network" Gh/Sn ≤ 50%
Industry			
Food and drink	Occasionally	Occasionally	Very frequently
Textiles			Usually
Wood	Very frequently	Very frequently	Occasionally
Paper			Usually
Printing			Very frequently
Chemicals - pharmaceuticals			Very frequently
Plastics			Usually
Glass - ceramics			Usually
Steel production			Usually
Metallurgy			Usually
Automotive		Very frequently	Usually
Cement works			Usually
Mining		Very frequently	Occasionally
Refineries			Usually
Microelectronics			Very frequently
Tertiary			
Banks - insurance	Very frequently	Very frequently	Very frequently
Supermarkets	Very frequently	Very frequently	Usually
Hospitals	Very frequently	Very frequently	Usually
Stadiums			Very frequently
Amusement parks			Very frequently
Hotels - offices	Very frequently	Very frequently	Occasionally
Energy and infrastructure			
Substations	Usually	Usually	
Water distribution			Very frequently
Internet			Very frequently
Railway transport			Very frequently
Airports			Very frequently
Underground train systems			Very frequently
Bridges			Very frequently
Tunnels			Usually
Wind turbines		Very frequently	

VarSet offer

VarSet offer

Other chapters

B

VarSet

ISO 9001
Quality certified manufacturing
ISO 14001
Environmental management system

Non contractual picture

The entire VarSet range offers a unique combination of abilities to give you more convenience, reliability and performance across a broad range of applications.

Forward-thinking design and meticulous manufacturing quality means you can count on VarSet capacitor banks to deliver dependable, long-term service.

Embedded communication features will allow you to optimize surveillance, maintenance and performance of your capacitor bank asset.

EcoStruxure™
Innovation At Every Level

EcoStruxure™ Power ready

- Seemless integration thanks to embedded Modbus communication
- Remote equipment follow up & control
- Remote troubleshooting
- Enable analytics & mobile benefits of EcoStruxure™ Power

Safety

> Protection

- overload protection for each stage
- short-circuit protection for each stage
- thermal monitoring device
- 3 phase overPressure Disconnection System on each capacitor
- direct contact protection open door

> Robust Enclosure System

- IP31 protection for indoor application
- IP54 kit available for dusty and harsh environment
- high quality welding and painting
- IK10 protection against mechanical shocks

> Tested and certified

- fully type-tested according to IEC 61921 & IEC 61439- 1 & 2

Reliability

> Long-life performance

- Schneider capacitor engineered for harsh environment and long life*
- multi level and redondancy of protections
- reduced switching inrush current thanks to special design contactor or detuned reactors
- integration of high quality Schneider components

> Easy maintenance

- automatic step size detection
- self diagnosis of capacitor output & derating
- alarm functions available (temperature, Harmonics, Voltage, Overload , hunting…)

Performance

> Easy installation & commissioning

- automatic step size detection
- current transformer polarity auto-detection
- top or bottom cable connection

> Advanced measurement and monitoring functions

- real time step monitoring (remaining power, number of switches)
- harmonic control till the 19th harmonic
- 4 quadrant operations
- overload assessment thru harmonics

> Configurable overload and short-circuit protection options

> Future-ready : "Connectable product"

* Cf. Low voltage components catalog PFCED310003EN

VarSet Easy

VarSet easy range is optimized to give the performance you need for standard operating conditions.

Manufactured with meticulous quality means and designed to deliver reliable performance, it's the easy choice for savings and fast return on investment.

Simplicity

> Easy to install

- compact enclosure
- easy accessible gland plates for power cables

> Ease of use and maintenance

- easy programming and commissioning with Varplus Logic controller
- simple replacement or retrofit of EasyCan capacitors
- straightforward integration with any building or any energy management system thanks to modbus communication

Reliability

> Protection

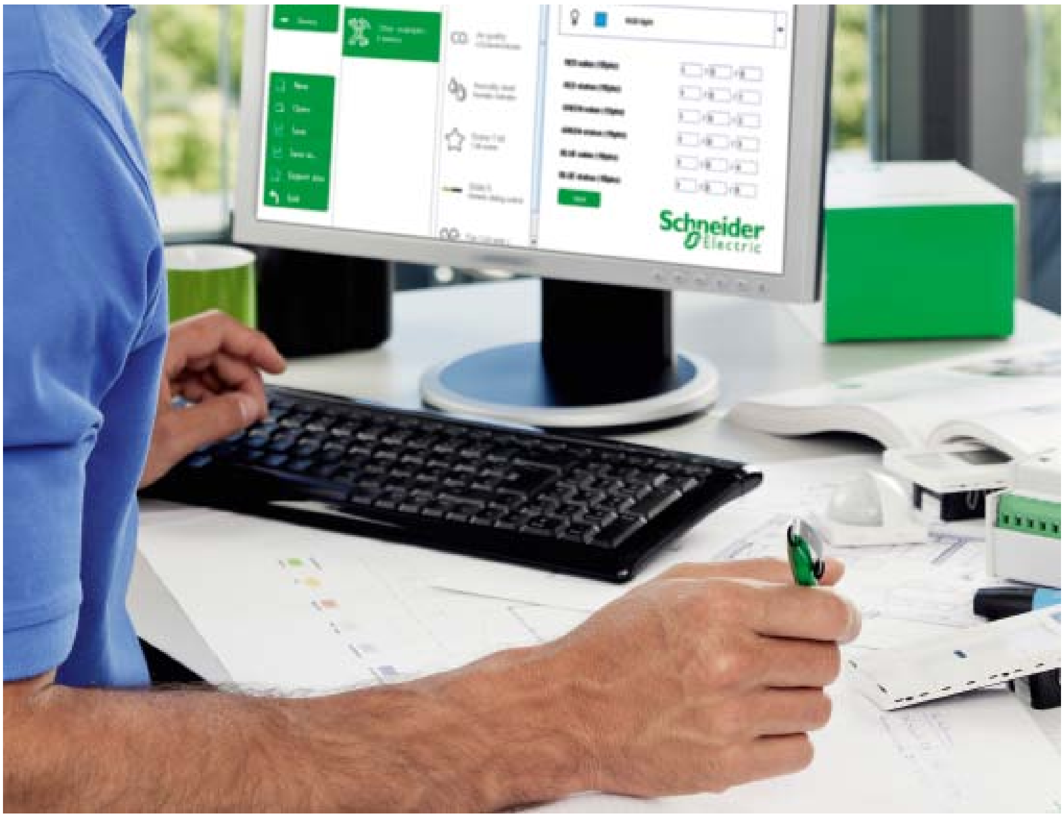
- thermal monitoring
- harmonic overload
- direct accidental contact
- 3 phase simultaneous safe diconnection at end of life

> Robust enclosure

- IP31 for indoor application
- IK10 protection against mechanical shocks
- high quality welding and painting

> Tested

- fully type tested according to IEC 61439-1 & 2, IEC 61921



Selector web page:

ECODIAL Software:

ID-Spec Software:

Compensation type

- **Automatic compensation:**
This compensation type is used for unstable loads.
The VarSet LV equipment will automatically adjust the reactive power according to variations in load and/or power factor. Schneider Electric recommends the use of automatic compensation when the capacitor bank's power is more than 15% of the power of the transformer, in order to avoid overcompensation.

- **Fixed compensation:**
This compensation type is used for stable loads, with synchronised voltage and current. The equipment will supply a constant reactive power irrespective of load variations.

Network pollution

Non-linear loads, such as devices using power electronics, generate harmonic pollution on the network.

The selection of the appropriate power factor correction solution has to be adapted depending on the level of network pollution.

The selection is based on the value of the Gh/Sn ratio, with:
- Gh = total power of the non–linear loads
- Sn = rated power of the supply transformer

The selection can also be made according to the percentage of total harmonic current distortion THDi or total harmonic voltage distortion THDu measured.

Selection guide

The compensation needs of your installation vary depending on factors such as load variation, Network harmonic pollution level and the characteristics of the installation. Find out the right level of compensation for your network with the help of the chart below.

Your load variation

Variable or unstable load

Choose
automatic compensation

Network harmonic pollution level

No polluted

Gh/Sn	≤ 15%
Thdu	≤ 3%
Thdi	≤ 5%

Choose
VarSet Easy for "no polluted network"

400 V - 50 Hz
from 7.5 to 600 kVAr

See page 28

Low polluted

Gh/Sn	≤ 25%
Thdu	≤ 4%
Thdi	≤ 10%

Choose
VarSet for "low polluted network"

400 V - 50 Hz
from 6 to 1150 kVAr

bottom - See page 30
Top - See page 38

400 V - 60 Hz
from 100 to 600 kVAr

See page 40

Polluted

Gh/Sn	≤ 50%
Thdu	≤ 7%
Thdi	≤ 20%

Choose
VarSet for "polluted network"

400 V - 50 Hz
from 50 to 1150 kVAr

DR 2.7 - See page 36
DR 3.8 - Bottom - See page 32
DR 3.8 - Top - See page 38
DR 4.2 - See page 34

400V - 60 Hz
from 200 to 600 kVAr

DR 2.7 - See page 34
DR 3.8 - See page 34

Stable load

Choose
fixed compensation

Network harmonic pollution level

Low polluted

Gh/Sn	≤ 25%
Thdu	≤ 4%
Thdi	≤ 10%

Choose
VarSet for "low polluted network"

400 V - 50 Hz
from 79 to 200 kVAr

See page 26

Polluted

Gh/Sn	≤ 50%
Thdu	≤ 7%
Thdi	≤ 20%

Choose
VarSet for "polluted network"

400 V - 50 Hz
from 50 to 200 kVAr

See page 26

VarSet offer
Fixed compensation
400 V / 50 Hz
Low polluted network
Polluted network - Tuning order 3.8 & 4.2

B

Environment
- Installation: Indoor
- Ambient temperature: -5°C to 45°C
- Average daily temperature: +35°C max
- Humidity: up to 95%
- Maximum altitude: 2000 m

Standards
- IEC 61921
- IEC 61439-1/2

Environment certifications
RoHS compliant, produced in 14001 certified plants, product environmental profile available

General characteristics

Electrical Characteristics	
Rated Voltage	400 V - 50 Hz
Capacitance Tolerance	-5%, +10%
Connection type	Three-phase
Power losses	< 2.5 W/kVAr for low polluted network
	< 6 W/kVAr for polluted network
Maximum permissible over current (with thermal protection included)	1.43 In for low polluted network
	1.31 In for polluted network with 4.2 tuning factor
	1.19 In for polluted network with 3.8 tuning factor
Maximum permissible over voltage	1.1 x Un, 8 h every 24 h
Insulation voltage	500 V up to 32 kVAr, 690 V from 50 kVAr
Rated Impulse Withstand Voltage (Uimp)	8 kV
Enclosure	
Degree of protection	IP31
Colour	RAL 7035
Degree of mechanical resistance	IK10
Protection against direct contacts open door	IPxxB
Head circuit breaker protection	
Without circuit breaker	Busbar Connection
	LV bank must be protected by a circuit breaker on upstream switchboard
With circuit breaker	Compact NSX
	Rotary handle above 100 kVAr
Step	
Capacitors Type	VarplusCan 400 V - 50 Hz for low polluted network
	VarplusCan 480 V - 50 Hz for polluted network
	Maximum over current: 1.8 In
	Overpressure protection
	Discharge resistance 50 V - 1 min
Detuned Reactor	Varplus DR
	Overheating protection by thermostat
Temperature control	
	By thermostat
Installation	
Auxiliary supply	Transformer 400/230 V included from 50 kVAr

Options available through configurator (see page 43):
- Top or bottom connection
- Tuning factor 2,7

VarSet offer
Fixed compensation
400 V / 50 Hz
Low polluted network
Polluted network - Tuning order 3.8 & 4.2

Low polluted network

References	Power (kVAr)	Breaking Capacity	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker						
Wall-mounted - Top connection						
VLVFW0N03501AA	9	15 kA	IC60H 20A	VLVFW0N	650 x 450 x 250 mm	48
VLVFW0N03502AA	16		IC60H 40A			
VLVFW0N03503AA	22		IC60H 50A			
VLVFW0N03504AA	32		IC60H 63A			
VLVFW1N03506AA	50	35 kA	NSX160F	VLVFW1N	700 x 600 x 300 mm	64
VLVFW1N03507AA	75		NSX250F			
VLVFW1N03508AA	100		NSX250F			
Floor-standing - Bottom connection						
VLVFW2N03509AA	125	50 kA	NSX400N 400A	VLVFW2N	1300 x 800 x 300 mm	117
VLVFW2N03510AA	150		NSX400N 400A			
VLVFW2N03511AA	175		NSX400N 400A			
VLVFW2N03512AA	200		NSX400N 630A			

References	Power (kVAr)	Short-time withstand current	Preconised upstream protection	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
Without circuit breaker						
Floor-standing - Bottom connection						
VLVFW2N03509AB	125	30 kA/1s	NSX400N 400A	VLVFW2N	1300 x 800 x 300 mm	117
VLVFW2N03510AB	150		NSX400N 400A			
VLVFW2N03511AB	175		NSX400N 400A			
VLVFW2N03512AB	200		NSX400N 630A			

Polluted network

References	Power (kVAr)	Tuning order / Tuning Frequency	Breaking Capacity	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker							
Floor-standing - Bottom connection							
VLVFF2P03506AA	50	3.8 / 190 Hz	50 kA	NSX250N 250A	VLVFF2P	1400 x 800 x 600 mm	320
VLVFF2P03507AA	75			NSX250N 250A			
VLVFF2P03508AA	100			NSX250N 250A			
VLVFF2P03510AA	150			NSX400N 400A			
VLVFF2P03512AA	200			NSX400N 400A			
VLVFF2P03506AD	50	4.2 / 210 Hz		NSX250N 250A			
VLVFF2P03507AD	75			NSX250N 250A			
VLVFF2P03508AD	100			NSX250N 250A			
VLVFF2P03510AD	150			NSX400N 400A			
VLVFF2P03512AD	200			NSX400N 400A			

References	Power (kVAr)	Tuning order / Tuning Frequency	Short-time withstand current	Preconised upstream protection	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
Without circuit breaker							
Floor-standing - Bottom connection							
VLVFF2P03506AB	50	3.8 / 190 Hz	35kA/1s	NSX250N 250A	VLVFF2P	1400 x 800 x 600 mm	320
VLVFF2P03507AB	75			NSX250N 250A			
VLVFF2P03508AB	100			NSX250N 250A			
VLVFF2P03510AB	150			NSX400N 400A			
VLVFF2P03512AB	200			NSX400N 400A			
VLVFF2P03506AE	50	4.2 / 210 Hz		NSX250N 250A			
VLVFF2P03507AE	75			NSX250N 250A			
VLVFF2P03508AE	100			NSX250N 250A			
VLVFF2P03510AE	150			NSX400N 400A			
VLVFF2P03512AE	200			NSX400N 400A			

Dimensions and weight: see page 48.
Main protection recommendations: see page 64 to 66.

Automatic compensation

400 V / 50 Hz

VarSet Easy

No polluted network

B

Environment

- Installation: Indoor
- Ambient temperature: -5°C to 45°C
- Average daily temperature: +35°C max
- Humidity: up to 95%
- Maximum altitude: 2000 m

Standards

- IEC 61921
- IEC 61439-1/2

Environment certifications

RoHS compliant, produced in 14001 certified plants, product environmental profile available

General characteristics

Electrical Characteristics	
Rated Voltage	400 V - 50 Hz
Capacitance Tolerance	-5%, +10%
Connection type	Three-phase
Power losses	< 2 W/kVAr
Maximum permissible over current	1.36 In for no polluted network
Maximum permissible over voltage	1.1 x Un, 8 h every 24 h
Overload protection	By Thdu management from controller
Insulation voltage	500 V up to 30 kVAr, 690 V from 37 kVAr
Rated Impulse Withstand Voltage (Uimp)	8 kV
Enclosure	
Degree of protection	IP31
Colour	RAL 7035
Degree of mechanical resistance	IK10
Protection against direct contacts open door	IP00 - protection against accidental direct contact
Controller	
VarPlus Logic	VPL06 / VPL12 with Modbus communication
Head circuit breaker protection	
Without circuit breaker	Without circuit breaker
	LV bank must be protected by a circuit breaker on upstream switchboard
With circuit breaker	iC60 up to 30 kVar, Easypact CVS from 32 kVar to 300 kvar, Compact NS above 300 kvar
	Rotary handle above 100 kVAr
Step	
Capacitors Type	EasyCan 400 V - 50 Hz
	Maximum over current: 1.5 In
	Overpressure protection
	Discharge resistance 50 V - 1 min
Contactors	Dedicated to capacitor switching
Temperature control	
Double control	By controller Varplus Logic VPL6 or VPL12
Communication	
ModBUS	RS485
Installation	
Auxiliary supply	Transformer 400/230 V included from 82 kVAr
TI not included	5 VA - secondary 1 A or 5 A
	To be installed upstream of the load and capacitor bank
GenSet contact	Must be connected with the generator
Alarm contact	Available for remote warning signal

Automatic compensation

400 V / 50 Hz

VarSet Easy

No polluted network

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Breaking Capacity	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker										
Wall-mounted - Top connection										
VLVAW0L007A40A	7.5	2.5	2.5 + 5	3	2	15 kA	IC60H 20A	VLVAW0L	600 x 500 x 250 mm	57
VLVAW0L015A40A	15	5	5 + 10	3	2		IC60H 32A			
VLVAW0L017A40A	17.5	2.5	2.5 + 5 + 10	7	3		IC60H 40A			
VLVAW0L020A40A	20	5	5 + 5 + 10	4	3		IC60H 40A			
VLVAW0L025A40A	25	5	5 + 10 + 10	5	3		IC60H 50A			
VLVAW0L030A40A	30	5	5 + 10 + 15	6	3		IC60H 63A			
VLVAW0L037A40A	37.5	7.5	7.5 + 15 + 15	5	3	35 kA	CVS100F 80A			
VLVAW0L045A40A	45	7.5	7.5 + 15 + 22.5	6	3		CVS100F 100A			
VLVAW0L050A40A	50	10	10 + 20 + 20	5	3		CVS100F 100A			
VLVAW1L060A40A	60	10	10 + 20 + 30	6	3		CVS160F 125A	VLVAW1L	800 x 600 x 250 mm	73
VLVAW1L070A40A	70	10	10 + 20 + 40	7	3		CVS160F 125A			
VLVAW1L075A40A	75	15	15 + 30 + 30	5	3		CVS160F 125A			
VLVAW1L082A40A	82.5	7.5	7.5 + 15 + 30 + 30	11	4		CVS160F 125A			
VLVAW1L090A40A	90	15	15 + 15 + 30 + 30	6	4		CVS250F 200A			
VLVAW1L100A40A	100	20	20 + 40 + 40	5	3		CVS250F 200A			
VLVAW2L125A40A	125	25	25 + 50 + 50	5	3		CVS400F 320A	VLVAW2L	1000 x 800 x 300 mm	131
VLVAW2L150A40A	150	25	25 + 25 + 50 + 50	6	4		CVS400F 320A			
VLVAW2L175A40A	175	25	25 + 3x50	7	4		CVS630F 500A			
VLVAW2L200A40A	200	25	25 + 25 + 3x50	8	5		CVS630F 500A			
Floor-standing - bottom connection										
VLVAF3L225A40A	225	25	25 + 4x50	9	5	35 kA	CVS630F 500A	VLVAF3L	1100 x 800 x 400 mm	140
VLVAF3L250A40A	250	25	25 + 25 + 4x50	10	6		CVS630F 500A			
VLVAF3L275A40A	275	25	25 + 5x50	11	6		CVS630F 600A			
VLVAF3L300A40A	300	50	6x50	6	6		CVS630F 600A			
VLVAF5L350A40A	350	50	7x50	7	7		NS800N			
VLVAF5L400A40A	400	50	8x50	8	8		NS800N	VLVAF5L	2200 x 800 x 600 mm	340
VLVAF5L450A40A	450	50	9x50	9	9		NS1000N			
VLVAF5L500A40A	500	50	10x50	10	10		NS1000N			
VLVAF5L550A40A	550	50	11x50	11	11		NS1250N			
VLVAF5L600A40A	600	50	12x50	12	12		NS1250N			

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Short-time withstand current Icw	Preconised upstream protection	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
Without circuit breaker										
Wall-mounted - Top connection										
VLVAW0L007A40B	7.5	2.5	2.5 + 5	3	2	30 kA/1s	IC60H 20A	VLVAW0L	600 x 500 x 250 mm	57
VLVAW0L015A40B	15	5	5 + 10	3	2		IC60H 32A			
VLVAW0L017A40B	17.5	2.5	2.5 + 5 + 10	7	3		IC60H 40A			
VLVAW0L020A40B	20	5	5 + 5 + 10	4	3		IC60H 40A			
VLVAW0L025A40B	25	5	5 + 10 + 10	5	3		IC60H 50A			
VLVAW0L030A40B	30	5	5 + 10 + 15	6	3		IC60H 63A			
VLVAW0L037A40B	37.5	7.5	7.5 + 15 + 15	5	3		CVS100F 80A			
VLVAW0L045A40B	45	7.5	7.5 + 15 + 22.5	6	3		CVS100F 100A			
VLVAW0L050A40B	50	10	10 + 20 + 20	5	3		CVS100F 100A			
VLVAW1L060A40B	60	10	10 + 20 + 30	6	3		CVS160F 125A	VLVAW1L	800 x 600 x 250 mm	73
VLVAW1L070A40B	70	10	10 + 20 + 40	7	3		CVS160F 125A			
VLVAW1L075A40B	75	15	15 + 30 + 30	5	3		CVS160F 125A			
VLVAW1L082A40B	82.5	7.5	7.5 + 15 + 30 + 30	11	4		CVS160F 125A			
VLVAW1L090A40B	90	15	15 + 15 + 30 + 30	6	4		CVS250F 200A			
VLVAW1L100A40B	100	20	20 + 40 + 40	5	3		CVS250F 200A			
VLVAW2L125A40B	125	25	25 + 50 + 50	5	3		CVS400F 320A	VLVAW2L	1000 x 800 x 300 mm	131
VLVAW2L150A40B	150	25	25 + 25 + 50 + 50	6	4		CVS400F 320A			
VLVAW2L175A40B	175	25	25 + 3x50	7	4		CVS630F 500A			
VLVAW2L200A40B	200	25	25 + 25 + 3x50	8	5		CVS630F 500A			
Floor-standing - bottom connection										
VLVAF3L225A40B	225	25	25 + 4x50	9	5	30 kA/1s	CVS630F 500A	VLVAF3L	1100 x 800 x 400 mm	140
VLVAF3L250A40B	250	25	25 + 25 + 4x50	10	6		CVS630F 500A			
VLVAF3L275A40B	275	25	25 + 5x50	11	6		CVS630F 600A			
VLVAF3L300A40B	300	50	6x50	6	6		CVS630F 600A			
VLVAF5L350A40B	350	50	7x50	7	7		NS800N			
VLVAF5L400A40B	400	50	8x50	8	8		NS800N	VLVAF5L	2200 x 800 x 600 mm	340
VLVAF5L450A40B	450	50	9x50	9	9		NS1000N			
VLVAF5L500A40B	500	50	10x50	10	10		NS1000N			
VLVAF5L550A40B	550	50	11x50	11	11		NS1250N			
VLVAF5L600A40B	600	50	12x50	12	12		NS1250N			

→ **Dimensions and weight:** see page 48.
Main protection recommendations: see page 64 to 66.

Automatic compensation

400 V / 50 Hz - Bottom entry

Low polluted network

Environment

- Installation: Indoor
- Ambient temperature: -5°C to 45°C
- Average daily temperature: +35°C max
- Humidity: up to 95%
- Maximum altitude: 2000 m

Standards

- IEC 61921
- IEC 61439-1/2

Environment certifications

RoHS compliant, produced in 14001 certified plants, product environmental profile available

General characteristics

Electrical Characteristics	
Rated Voltage	400 V - 50 Hz
Capacitance Tolerance	-5%, +10%
Connection type	Three-phase
Power losses	< 2.5 W/kVAr
Maximum permissible over current (with thermal protection included)	1.43 In
Maximum permissible over voltage	1.1 x Un, 8 h every 24 h
Overload protection	By Thdu management from controller
Insulation voltage	500 V up to 32 kVAr, 690 V from 34 kVAr
Rated Impulse Withstand Voltage (Uimp)	8 kV
Enclosure	
Degree of protection	IP31
Colour	RAL 7035
Degree of mechanical resistance	IK10
Protection against direct contacts open door	IPxxB
Controller	
VarPlus Logic	VPL06 / VPL12 with Modbus communication
Head circuit breaker protection	
Without circuit breaker	Busbar Connection
	LV bank must be protected by a circuit breaker on upstream switchboard
With circuit breaker	Compact NSX or Compact NS
	Rotary handle above 100 kVAr
Step	
Capacitors Type	VarplusCan 400 V - 50 Hz
	Maximum over current: 1.8 In
	Overpressure protection
	Discharge resistance 50 V - 1 min
Contactors	Dedicated to capacitor switching
Fuse protection	Type gG above 300 kVar
Temperature control	
Double control	By thermostat and controller
Communication	
ModBUS	RS485
Installation	
Auxiliary supply	Transformer 400/230 V included from 50 kVAr
TI not included	5 VA - secondary 1 A or 5 A
	To be installed upstream of the load and capacitor bank
GenSet contact	Must be connected with the generator
Alarm contact	Available for remote warning signal

Options available through configurator (see page 43):

- Step protection by circuit breaker
- Top or Bottom connection
- Plinth for wall mounted banks
- Short-time withstand current 65 kA/1s
- Breaking capacity 65 kA

Automatic compensation

Bottom entry - 400 V / 50 Hz

Low polluted network

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Breaking Capacity	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker										
Wall-mounted - Bottom connection										
VLVAW0N03526AA	6	3	3 + 3	2	2	15 kA	IC60H 13A	VLVAW0N	650 x 450 x 250 mm	57
VLVAW0N03501AA	9	3	3 + 6.25	3	2		IC60H 20A			
VLVAW0N03527AA	12.5	3	3 + 3 + 6.25	4	3		IC60H 32A			
VLVAW0N03502AA	16	3	3 + 6.25 + 6.25	5	3		IC60H 40A			
VLVAW0N03503AA	22	3	3 + 6.25 + 12.5	7	3		IC60H 50A			
VLVAW0N03504AA	32	6.25	6.25 + 12.5 + 12.5	5	3		IC60H 63A			
VLVAW1N03505AA	34	3	3 + 6.25 + 12.5 + 12.5	11	4	35 kA	NSX160F 125A	VLVAW1N	700 x 600 x 250 mm	73
VLVAW1N03528AA	37.5	6.25	6.25 + 6.25 + 12.5 + 12.5	6	4		NSX160F 125A			
VLVAW1N03506AA	50	6.25	6.25 + 6.25 + 12.5 + 25	8	4		NSX160F 160A			
VLVAW1N03529AA	69	6.25	6.25 + 12.5 + 25 + 25	11	4		NSX250F 200A			
VLVAW1N03507AA	75	25	25 + 25 + 25	3	3		NSX250F 200A			
VLVAW1N03530AA	87.5	12.5	12.5 + 25 + 25 + 25	7	4		NSX250F 250A			
VLVAW1N03508AA	100	25	25 + 25 + 25 + 25	4	4		NSX250F 250A			
VLVAW2N03509AA	125	25	25 + 50 + 50	5	3	50 kA	NSX400N 400A	VLVAW2N	1200 x 800 x 300 mm	131
VLVAW2N03531AA	137.5	12.5	12.5 + 25 + 50 + 50	11	4		NSX400N 400A			
VLVAW2N03510AA	150	50	50 + 50 + 50	3	3		NSX400N 400A			
VLVAW2N03511AA	175	25	25 + 3x50	7	4		NSX400N 400A			
VLVAW3N03512AA	200	25	25 + 25 + 3x50	8	5		NSX400N 400A	VLVAW3N	1200 x 1000 x 300 mm	175
VLVAW3N03513AA	225	25	25 + 4x50	9	5		NSX630N 630A			
VLVAW3N03532AA	238	12.5	12.5 + 25 + 4x50	19	6		NSX630N 630A			
VLVAW3N03514AA	250	25	25 + 25 + 4x50	10	6		NSX630N 630A			
VLVAW3N03515AA	275	25	25 + 5x50	11	6		NSX630N 630A			
VLVAW3N03516AA	300	50	6x50	6	6		NSX630N 630A			
Floor-standing - Bottom connection										
VLVAF5N03517AA	350	50	50 + 3x100	7	4	50 kA	NS800N	VLVAF5N	2200 x 800 x 600 mm	434
VLVAF5N03518AA	400	50	50 + 50 + 3x100	8	5		NS1000N			
VLVAF5N03519AA	450	50	50 + 4x100	9	5		NS1000N			
VLVAF5N03520AA	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF5N03521AA	550	50	50 + 5x100	11	6		NS1250N			
VLVAF5N03522AA	600	50	50 + 50 + 5x100	12	6		NS1250N			
VLVAF7N03534AA	700	25	25 + 25 + 50 + 6x100	28	9	65 kA	NS800H+NS1000H	VLVAF7N (2 incomings)	2200 x 1600 x 600 mm	868
VLVAF7N03536AA	900	50	50 + 50 +8x100	18	10		NS800H+NS1000H			
VLVAF7N03537AA	1000	50	50 + 50 + 9x100	20	11		2xNS1250H			
VLVAF7N03539AA	1150	50	50 + 10x100	23	12		NS1250H+NS1600H			

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Short-time withstand current Icw	Preconised upstream protection	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
Without circuit breaker										
Wall-mounted - Bottom connection										
VLVAW2N03509AB	125	25	25 + 50 + 50	5	3	30 kA/1s	NSX400N 400A	VLVAW2N	1200 x 800 x 300 mm	131
VLVAW2N03531AB	137.5	12.5	12.5 + 25 + 50 + 50	11	4		NSX400N 400A			
VLVAW2N03510AB	150	50	50 + 50 + 50	3	3		NSX400N 400A			
VLVAW2N03511AB	175	25	25 + 3x50	7	6		NSX400N 400A			
VLVAW3N03512AB	200	25	25 + 25 + 3x50	8	5		NSX400N 400A	VLVAW3N	1200 x 1000 x 300 mm	175
VLVAW3N03513AB	225	25	25 + 4x50	9	5		NSX630N 630A			
VLVAW3N03532AB	238	12.5	12.5 + 25 + 4x50	19	6		NSX630N 630A			
VLVAW3N03514AB	250	25	25 + 25 + 4x50	10	6		NSX630N 630A			
VLVAW3N03515AB	275	25	25 + 5x50	11	6		NSX630N 630A			
VLVAW3N03516AB	300	50	6x50	6	6		NSX630N 630A			
Floor-standing - Bottom connection										
VLVAF5N03517AB	350	50	50 + 3x100	7	4	35 kA/1s	NS800N	VLVAF5N	2200 x 800 x 600 mm	434
VLVAF5N03518AB	400	50	50 + 50 + 3x100	8	5		NS1000N			
VLVAF5N03519AB	450	50	50 + 4x100	9	5		NS1000N			
VLVAF5N03520AB	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF5N03521AB	550	50	50 + 5x100	11	6		NS1250N			
VLVAF5N03522AB	600	50	50 + 50 + 5x100	12	6		NS1250N			
VLVAF7N03534AB	700	25	25 + 25 + 50 +6x100	28	9	65 kA/1s	NS800H+NS1000H	VLVAF7N (2 incomings)	2200 x 1600 x 600 mm	868
VLVAF7N03536AB	900	50	50 + 50 +8x100	18	10		NS800H+NS1000H			
VLVAF7N03537AB	1000	50	50 + 50 + 9x100	20	11		2xNS1250H			
VLVAF7N03539AB	1150	50	50 + 10x100	23	12		NS1250H+NS1600H			

➜ **Dimensions and weight:** see page 48.
Main protection recommendations: see page 64 to 66.

VarSet offer

Automatic compensation

400 V / 50 Hz - Bottom entry

Polluted network

Tuning order 3.8 - Tuning frequency 190 Hz

B

General characteristics

Electrical Characteristics	
Rated Voltage	400 V - 50 Hz
Capacitance Tolerance	-5%, +10%
Connection type	Three-phase
Power losses	< 6 W/kVAr for polluted network
Maximum permissible over current (with thermal protection included)	1.19 In for polluted network with 3.8 tuning factor
Maximum permissible over voltage	1.1 x Un, 8 h every 24 h
Overload protection	By Thdu management from controller
Insulation voltage	690 V up to 200 kVAr, 800 V from 225 kVAr
Rated Impulse Withstand Voltage (Uimp)	8 kV
Enclosure	
Degree of protection	IP31
Colour	RAL 7035
Degree of mechanical resistance	IK10
Protection against direct contacts open door	IPxxB
Controller	
VarPlus Logic	VPL06 / VPL12 with Modbus communication
Head circuit breaker protection	
Without circuit breaker	Busbar Connection
	LV bank must be protected by a circuit breaker on upstream switchboard
With circuit breaker	Compact NSX or Compact NS
	Rotary handle
Step	
Capacitors Type	VarplusCan 480 V - 50 Hz
	Maximum over current: 1.8 In
	Overpressure protection
	Discharge resistance 50 V - 1 min
Detuned Reactor	Varplus DR
	Overheating protection by thermostat
Contactors	TeSys range
Fuse protection	Type gG
Temperature control	
Double control	By thermostat and controller
Communication	
ModBUS	RS485
Installation	
Auxiliary supply	Transformer 400/230 V included from 50 kVAr
TI not included	5 VA - secondary 1 A or 5 A
	To be installed upstream of the load and capacitor bank
GenSet contact	Must be connected with the generator
Alarm contact	Available for remote warning signal

Environment

- Installation: Indoor
- Ambient temperature: -5°C to 45°C
- Average daily temperature: +35°C max
- Humidity: up to 95%
- Maximum altitude: 2000 m

Standards

- IEC 61921
- IEC 61439-1/2

Environment certifications

RoHS compliant, produced in 14001 certified plants, product environmental profile available

Options available through configurator (see page 43):

- Step protection by circuit breaker
- Short-time withstand current 65 kA/1s
- Breaking capacity 65 kA
- Top or Bottom connection

Automatic compensation

Bottom entry - 400 V / 50 Hz

Polluted network

Tuning order 3.8 - Tuning frequency 190 Hz

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Breaking Capacity	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker										
Floor-standing - Bottom connection										
VLVAF2P03506AA	50	12.5	12.5 + 12.5 + 25	4	3	50 kA	NSX250N 250A	VLVAF2P	1400 x 800 x 600 mm	350
VLVAF2P03507AA	75	25	25 + 50	3	2		NSX250N 250A			
VLVAF2P03508AA	100	25	25 + 25 + 50	4	3		NSX250N 250A			
VLVAF2P03509AA	125	25	25 + 50 + 50	5	3		NSX250N 250A			
VLVAF2P03531AA	137.5	12.5	12.5 + 25 + 50 + 50	11	4		NSX250N 250A			
VLVAF2P03510AA	150	25	25 + 25 + 50 + 50	6	4		NSX400N 400A			
VLVAF2P03511AA	175	25	25 + 50 + 100	7	3		NSX400N 400A			
VLVAF2P03512AA	200	50	50 + 50 + 100	4	3		NSX400N 400A			
VLVAF3P03513AA	225	25	25 + 50 + 50 + 100	9	4	50 kA	NSX630N 630A	VLVAF3P	2000 x 800 x 600 mm	400
VLVAF3P03514AA	250	50	50 + 2x100	5	3		NSX630N 630A			
VLVAF3P03515AA	275	25	25 + 50 + 2x100	11	4		NSX630N 630A			
VLVAF3P03516AA	300	50	50 + 50 + 2x100	6	4		NSX630N 630A			
VLVAF5P03517AA	350	50	50 + 3x100	7	4		NS800N	VLVAF5P	2200 x 800 x 600 mm	450
VLVAF5P03518AA	400	50	50 + 50 + 3x100	8	5		NS800N			
VLVAF6P03519AA	450	50	50 + 4x100	9	5		NS1000N	VLVAF6P	2200 x 1400 x 600 mm	952
VLVAF6P03520AA	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF6P03521AA	550	50	50 + 5x100	11	6		NS1250N			
VLVAF6P03522AA	600	50	6 x 100	6	6		NS1600N			
VLVAF8P03534AA	700	50	50 + 50 + 6x100	14	8	65 kA	NS630BH+NS1000H	VLVAF8P (2 incomings)	2200 x 2800 x 600 mm	1904
VLVAF8P03535AA	800	50	50 + 50 + 7x100	16	9		NS630BH+NS1000H			
VLVAF8P03536AA	900	50	50 + 50 + 8x100	18	10		NS800H+NS1000H			
VLVAF8P03537AA	1000	50	50 + 50 + 9x100	20	11		NS800H+NS1000H			
VLVAF8P03538AA	1100	50	50 + 50 + 10x100	22	12		NS1000H+NS1250H			
VLVAF8P03539AA	1150	50	50 + 11x100	23	12		2xNS1250H			

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Short-time withstand current Icw	Preconised upstream protection	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
Without circuit breaker										
Floor-standing - Bottom connection										
VLVAF2P03506AB	50	12.5	12.5 + 12.5 + 25	4	3	35 kA/1s	NSX250N 250A	VLVAF2P	1400 x 800 x 600 mm	350
VLVAF2P03507AB	75	25	25 + 50	3	2		NSX250N 250A			
VLVAF2P03508AB	100	25	25 + 25 + 50	4	3		NSX250N 250A			
VLVAF2P03509AB	125	25	25 + 50 + 50	5	3		NSX250N 250A			
VLVAF2P03531AB	137.5	12.5	12.5 + 25 + 50 + 50	11	4		NSX250N 250A			
VLVAF2P03510AB	150	25	25 + 25 + 50 + 50	6	4		NSX400N 400A			
VLVAF2P03511AB	175	25	25 + 50 + 100	7	3		NSX400N 400A			
VLVAF2P03512AB	200	50	50 + 50 + 100	4	3		NSX400N 400A			
VLVAF3P03513AB	225	25	25 + 50 + 50 + 100	9	4	35 kA/1s	NSX630N 630A	VLVAF3P	2000 x 800 x 600 mm	400
VLVAF3P03514AB	250	50	50 + 2x100	5	3		NSX630N 630A			
VLVAF3P03515AB	275	25	25 + 50 + 2x100	11	4		NSX630N 630A			
VLVAF3P03516AB	300	50	50 + 50 + 2x100	6	4		NSX630N 630A			
VLVAF5P03517AB	350	50	50 + 3x100	7	4		NS800N	VLVAF5P	2200 x 800 x 600 mm	450
VLVAF5P03518AB	400	50	50 + 50 + 3x100	8	5		NS800N			
VLVAF6P03519AB	450	50	50 + 4x100	9	5		NS1000N	VLVAF6P	2200 x 1400 x 600 mm	952
VLVAF6P03520AB	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF6P03521AB	550	50	50 + 5x100	11	6		NS1250N			
VLVAF6P03522AB	600	50	6 x 100	6	6		NS1600N			
VLVAF8P03534AB	700	50	50 + 50 + 6x100	14	8	65 kA/1s	NS630BH+NS1000H	VLVAF8P (2 incomings)	2200 x 2800 x 600 mm	1904
VLVAF8P03535AB	800	50	50 + 50 + 7x100	16	9		NS630BH+NS1000H			
VLVAF8P03536AB	900	50	50 + 50 + 8x100	18	10		NS800H+NS1000H			
VLVAF8P03537AB	1000	50	50 + 50 + 9x100	20	11		NS800H+NS1000H			
VLVAF8P03538AB	1100	50	50 + 50 + 10x100	22	12		NS1000H+NS1250H			
VLVAF8P03539AB	1150	50	50 + 11x100	23	12		2xNS1250H			

Dimensions and weight: see page 48.
Main protection recommendations: see page 64 to 66.

Automatic compensation
400 V / 50 Hz - Bottom entry
Polluted network
Tuning order 4.2 - Tuning frequency 210 Hz

Environment
- Installation: Indoor
- Ambient temperature: -5°C to 45°C
- Average daily temperature: +35°C max
- Humidity: up to 95%
- Maximum altitude: 2000 m

Standards
- IEC 61921
- IEC 61439-1/2

Environment certifications
RoHS compliant, produced in 14001 certified plants, product environmental profile available

General characteristics

Electrical Characteristics	
Rated Voltage	400 V - 50 Hz
Capacitance Tolerance	-5%, +10%
Connection type	Three-phase
Power losses	< 6 W/kVAr for polluted network
Maximum permissible over current (with thermal protection included)	1.31 In for polluted network with 4.2 tuning factor
Maximum permissible over voltage	1.1 x Un, 8 h every 24 h
Overload protection	By Thdu management from controller
Insulation voltage	690 V up to 200 kVAr, 800 V from 225 kVAr
Rated Impulse Withstand Voltage (Uimp)	8 kV
Enclosure	
Degree of protection	IP31
Colour	RAL 7035
Degree of mechanical resistance	IK10
Protection against direct contacts open door	IPxxB
Controller	
VarPlus Logic	VPL06 / VPL12 with Modbus communication
Head circuit breaker protection	
Without circuit breaker	Busbar Connection
	LV bank must be protected by a circuit breaker on upstream switchboard
With circuit breaker	Compact NSX or Compact NS
	Rotary handle
Step	
Capacitors Type	VarplusCan 480 V - 50 Hz
	Maximum over current: 1.8 In
	Overpressure protection
	Discharge resistance 50 V - 1 min
Detuned Reactor	Varplus DR
	Overheating protection by thermostat
Contactors	TeSys range
Fuse protection	Type gG
Temperature control	
Double control	By thermostat and controller
Communication	
ModBUS	RS485
Installation	
Auxiliary supply	Transformer 400/230 V included from 50 kVAr
TI not included	5 VA - secondary 1 A or 5 A
	To be installed upstream of the load and capacitor bank
GenSet contact	Must be connected with the generator
Alarm contact	Available for remote warning signal

Options available through configurator (see page 43):
- Step protection by circuit breaker
- Short-time withstand current 65 kA/1s
- Breaking capacity 65 kA
- Top or Bottom connection

Automatic compensation

Bottom entry - 400 V / 50 Hz

Polluted network

Tuning order 4.2 - Tuning frequency 210 Hz

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Breaking Capacity	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker										
Floor-standing - Bottom connection										
VLVAF2P03530AD	87.5	12.5	12.5 + 25 + 50	7	3	50 kA	NSX250N 250A	VLVAF2P	1400 x 800 x 600 mm	350
VLVAF2P03508AD	100	25	25 + 25 + 50	4	3		NSX250N 250A			
VLVAF2P03509AD	125	25	25 + 50 + 50	5	3		NSX250N 250A			
VLVAF2P03510AD	150	25	25 + 25 + 50 + 50	6	4		NSX400N 400A			
VLVAF2P03511AD	175	25	25 + 50 + 100	7	3		NSX400N 400A			
VLVAF2P03512AD	200	50	50 + 50 + 100	4	4		NSX400N 400A			
VLVAF3P03513AD	225	25	25 + 50 + 50 + 100	9	4	50 kA	NSX630N 630A	VLVAF3P	2000 x 800 x 600 mm	400
VLVAF3P03514AD	250	50	50 + 2x100	5	3		NSX630N 630A			
VLVAF3P03515AD	275	25	25 + 50 + 2x100	11	4		NSX630N 630A			
VLVAF3P03516AD	300	50	50 + 50 + 2x100	6	4		NSX630N 630A			
VLVAF5P03517AD	350	50	50 + 3x100	7	4		NS800N	VLVAF5P	2200 x 800 x 600 mm	450
VLVAF5P03518AD	400	50	50 + 50 + 3x100	8	5		NS800N			
VLVAF6P03519AD	450	50	50 + 4x100	9	5		NS1000N	VLVAF6P	2200 x 1400 x 600 mm	952
VLVAF6P03520AD	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF6P03522AD	600	50	6x100	6	6		NS1600N			
VLVAF8P03534AD	700	50	50 + 50 + 6x100	14	8	65 kA	NS630BH+NS1000H	VLVAF8P (2 incomings)	2200 x 2800 x 600 mm	1904
VLVAF8P03535AD	800	50	50 + 50 + 7x100	16	9		NS630BH+NS1000H			
VLVAF8P03536AD	900	50	50 + 50 + 8x100	18	10		NS800H+NS1000H			
VLVAF8P03537AD	1000	50	50 + 50 + 9x100	20	11		NS800H+NS1000H			
VLVAF8P03538AD	1100	50	50 + 50 + 10x100	22	12		NS1000H+NS1250H			
VLVAF8P03539AD	1150	50	50 + 11x100	23	12		2xNS1250H			

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Short-time withstand current Icw	Preconised upstream protection	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
Without circuit breaker										
Floor-standing - Bottom connection										
VLVAF2P03530AE	87.5	12.5	12.5 + 25 + 50	7	3	35 kA/1s	NSX250N 250A	VLVAF2P	1400 x 800 x 600 mm	350
VLVAF2P03508AE	100	25	25 + 25 + 50	4	3		NSX250N 250A			
VLVAF2P03509AE	125	25	25 + 50 + 50	5	3		NSX250N 250A			
VLVAF2P03510AE	150	25	25 + 25 + 50 + 50	6	4		NSX400N 400A			
VLVAF2P03511AE	175	25	25 + 50 + 100	7	3		NSX400N 400A			
VLVAF2P03512AE	200	50	50 + 50 + 100	4	4		NSX400N 400A			
VLVAF3P03513AE	225	25	25 + 50 + 50 + 100	9	4	35 kA/1s	NSX630N 630A	VLVAF3P	2000 x 800 x 600 mm	400
VLVAF3P03514AE	250	50	50 + 2x100	5	3		NSX630N 630A			
VLVAF3P03515AE	275	25	25 + 50 + 2x100	11	4		NSX630N 630A			
VLVAF3P03516AE	300	50	50 + 50 + 2x100	6	4		NSX630N 630A			
VLVAF5P03517AE	350	50	50 + 3x100	7	4		NS800N	VLVAF5P	2200 x 800 x 600 mm	450
VLVAF5P03518AE	400	50	50 + 50 + 3x100	8	5		NS800N			
VLVAF6P03519AE	450	50	50 + 4x100	9	5		NS1000N	VLVAF6P	2200 x 1400 x 600 mm	952
VLVAF6P03520AE	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF6P03522AE	600	50	6x100	6	6		NS1600N			
VLVAF8P03534AE	700	50	50 + 50 + 6x100	14	8	65 kA/1s	NS630BH+NS1000H	VLVAF8P (2 incomings)	2200 x 2800 x 600 mm	1904
VLVAF8P03535AE	800	50	50 + 50 + 7x100	16	9		NS630BH+NS1000H			
VLVAF8P03536AE	900	50	50 + 50 + 8x100	18	10		NS800H+NS1000H			
VLVAF8P03537AE	1000	50	50 + 50 + 9x100	20	11		NS800H+NS1000H			
VLVAF8P03538AE	1100	50	50 + 50 + 10x100	22	12		NS1000H+NS1250H			
VLVAF8P03539AE	1150	50	50 + 11x100	23	12		2*NS1250H			

→ **Dimensions and weight:** see page 48.
Main protection recommendations: see page 64 to 66.

Automatic compensation

400 V / 50 Hz - Bottom entry

Polluted Network

Tuning order 2.7 - Tuning frequency 135 Hz

General characteristics

Electrical Characteristics	
Rated Voltage	400 V - 50 Hz
Capacitance Tolerance	-5%, +10%
Connection type	Three-phase
Power losses	< 6 W/kVAr for polluted network
Maximum permissible over current (with thermal protection included)	1.12 In for polluted network with 2.7 tuning factor
Maximum permissible over voltage	1.1 x Un, 8 h every 24 h
Overload protection	By Thdu management from controller
Insulation voltage	690 V up to 200 kVAr, 800 V from 225 kVAr
Rated Impulse Withstand Voltage (Uimp)	8 kV
Enclosure	
Degree of protection	IP31
Colour	RAL 7035
Degree of mechanical resistance	IK10
Protection against direct contacts open door	IPxxB
Controller	
VarPlus Logic	VPL06 / VPL12 with Modbus communication
Head circuit breaker protection	
Without circuit breaker	Busbar Connection
	LV bank must be protected by a circuit breaker on upstream switchboard
Step	
Capacitors Type	VarplusCan 480 V - 50 Hz
	Maximum over current: 1.8 In
	Overpressure protection
	Discharge resistance 50 V - 1 min
Detuned Reactor	Varplus DR
	Overheating protection by thermostat
Contactors	TeSys range
Fuse protection	Type gG
Temperature control	
Double control	By thermostat and controller
Communication	
ModBUS	RS485
Installation	
Auxiliary supply	Transformer 400/230 V included from 50 kVAr
TI not included	5 VA - secondary 1 A or 5 A
	To be installed upstream of the load and capacitor bank
GenSet contact	Must be connected with the generator
Alarm contact	Available for remote warning signal

Environment

- Installation: Indoor
- Ambient temperature: -5°C to 45°C
- Average daily temperature: +35°C max
- Humidity: up to 95%
- Maximum altitude: 2000 m

Standards

- IEC 61921
- IEC 61439-1/2

Environment certifications

RoHS compliant, produced in 14001 certified plants, product environmental profile available

Options available through configurator (see page 43):

- Step protection by circuit breaker
- Incomer circuit breaker protection
- Short-time withstand current 65 kA/1s
- Breaking capacity 65 kA
- Top or Bottom connection

Automatic compensation

Bottom entry - 400 V / 50 Hz

Polluted Network

Tuning order 2.7 - Tuning frequency 135 Hz

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Short-time withstand current Icw	Preconised upstream protection	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
Without circuit breaker										
Floor-standing - Bottom connection										
VLVAF2P03506AG	50	12.5	12.5 + 12.5 + 25	4	3	35 kA/1s	NSX250N 250A	VLVAF2P	1400 x 800 x 600 mm	350
VLVAF2P03507AG	75	25	25 + 50	3	2		NSX250N 250A			
VLVAF2P03508AG	100	25	25 + 25 + 50	8	3		NSX250N 250A			
VLVAF2P03509AG	125	25	25 + 50 + 50	3	4		NSX250N 250A			
VLVAF2P03510AG	150	25	25 + 25 + 50 + 50	6	4		NSX400N 400A			
VLVAF2P03511AG	175	25	25 + 50 + 100	7	3		NSX400N 400A			
VLVAF3P03512AG	200	50	50 + 50 + 100	4	3	35 kA/1s	NSX400N 400A	VLVAF3P	2000 x 800 x 600 mm	400
VLVAF3P03513AG	225	25	25 + 50 + 50 + 100	9	4		NSX630N 630A			
VLVAF3P03514AG	250	50	50 + 2x100	5	3		NSX630N 630A			
VLVAF3P03515AG	275	25	25 + 50 + 2x100	11	4		NSX630N 630A			
VLVAF5P03516AG	300	50	50 + 50 + 2x100	6	4		NSX630N 630A	VLVAF5P	2200 x 800 x 600 mm	450
VLVAF5P03517AG	350	50	50 + 3x100	7	4		NS800N			
VLVAF6P03518AG	400	50	50 + 50 + 3x100	8	5		NS800N	VLVAF6P	2200 x 1400 x 600 mm	952
VLVAF6P03519AG	450	50	50 + 4x100	9	5		NS1000N			
VLVAF6P03520AG	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF6P03521AG	550	50	50 + 5x100	11	8		NS1250N			
VLVAF6P03522AG	600	50	6x100	6	6		NS1600N			

➜ **Dimensions and weight:** see page 48.
Main protection recommendations: see page 64 to 66.

VarSet offer

Automatic compensation

400 V / 50 Hz - Top entry

Low polluted network

Polluted network - Tuning order 3.8

Environment

- Installation: Indoor
- Ambient temperature: -5°C to 45°C
- Average daily temperature: +35°C max
- Humidity: up to 95%
- Maximum altitude: 2000 m

Standards

- IEC 61921
- IEC 61439-1/2

Environment certifications

RoHS compliant, produced in 14001 certified plants, product environmental profile available

General characteristics

Electrical Characteristics	
Rated Voltage	400 V - 50 Hz
Capacitance Tolerance	-5%, +10%
Connection type	Three-phase
Power losses	< 2.5 W/kVAr for low polluted network
	< 6 W/kVAr for polluted network
Maximum permissible over current (with thermal protection included)	1.43 In for low polluted network
	1.19 In for polluted network with 3.8 tuning factor
Maximum permissible over voltage	1.1 x Un, 8 h every 24 h
Overload protection	By Thdu management from controller
Insulation voltage	500 V up to 32 kVAr, 690 V from 37.5 kVAr for low polluted network
	690 V up to 200 kVAr, 800 V from 225 kVAr for polluted network
Rated Impulse Withstand Voltage (Uimp)	8 kV
Enclosure	
Degree of protection	IP31
Colour	RAL 7035
Degree of mechanical resistance	IK10
Protection against direct contacts open door	IPxxB
Controller	
VarPlus Logic	VPL06 / VPL12 with Modbus communication
Head circuit breaker protection	
Without circuit breaker	Busbar Connection
	LV bank must be protected by a circuit breaker on upstream switchboard
With circuit breaker	Compact NSX with rotary handle
Step	
Capacitors Type	VarplusCan 400 V - 50 Hz for low polluted network
	VarplusCan 480 V - 50 Hz for polluted network
	Maximum over current: 1.8 In
	Overpressure protection
	Discharge resistance 50 V - 1 min
Detuned Reactor	Varplus DR
	Overheating protection by thermostat
Contactors	TeSys range
Fuse protection	Type gG
Temperature control	
Double control	By thermostat and controller
Communication	
ModBUS	RS485
Installation	
Auxiliary supply	Transformer 400/230 V included from 50 kVAr
TI not included	5 VA - Secondary 1 A or 5 A
	To be installed upstream of the load and capacitor bank
GenSet contact	Must be connected with the generator
Alarm contact	Available for remote warning signal

Options available through configurator (see page 43):

- Step protection by circuit breaker
- Short-time withstand current 65 kA/1s
- Breaking capacity 65 kA
- Top or Bottom connection
- Plinth for wall-mounted type

Automatic compensation

Top entry - 400 V / 50 Hz

Low polluted network

Polluted network - Tuning order 3.8

Low polluted network

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Breaking Capacity	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker										
Wall-mounted - Top connection										
VLVAW0N03527AK	12.5	3	3 + 3 + 6.25	4	4	15 kA	IC60H 32A	VLVAW0N	650 x 450 x 250 mm	57
VLVAW0N03504AK	32	6.25	6.25 + 2x12.5	4	3		IC60H 63A			
VLVAW1N03528AK	37.5	6.25	6.25 + 6.25 + 12.5 + 25	6	4	35 kA	NSX160F 125A	VLVAW1N	700 x 600 x 250 mm	73
VLVAW1N03506AK	50	6.25	6.25 + 6.25 + 12.5 + 25	8	4		NSX160F 160A			
VLVAW1N03507AK	75	25	25 + 25 + 25	3	3		NSX250F 200A			
VLVAW1N03508AK	100	25	4x25	4	4		NSX250F 250A			
VLVAW2N03509AK	125	25	25 + 50 + 50	5	3	50 kA	NSX400N 400A	VLVAW2N	1200 x 800 x 300 mm	131
VLVAW2N03510AK	150	50	3x50	3	3		NSX400N 400A			
VLVAW2N03511AK	175	25	25 + 3x50	7	4		NSX400N 400A			
VLVAW3N03512AK	200	25	25 + 25 + 3x50	8	5		NSX400N 400A	VLVAW3N	1200 x 1000 x 300 mm	175
VLVAW3N03516AK	300	50	6x50	6	6		NSX630N 630A			
Floor-standing - Top connection										
VLVAF5N03517AK	350	50	50 + 3x100	7	4	50 kA	NS800N	VLVAF5N	2200 x 800 x 600 mm	434
VLVAF5N03518AK	400	50	50 + 50 + 3x100	8	5		NS1000N			

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Short-time withstand current Icw	Preconised upstream protection	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
Without circuit breaker										
Wall-mounted - Top connection										
VLVAW2N03509AC	125	25	25 + 50 + 50	5	3	30 kA/ 1s	NSX400N 400A	VLVAW2N	1200 x 800 x 300 mm	131
VLVAW2N03510AC	150	50	3x50	3	3		NSX400N 400A			
VLVAW2N03511AC	175	25	25 + 3x50	7	4		NSX400N 400A			
VLVAW3N03512AC	200	25	25 + 25 + 3x50	8	5		NSX400N 400A	VLVAW3N	1200 x 1000 x 300 mm	175
VLVAW3N03516AC	300	50	6x50	6	6		NSX630N 630A			
Floor-standing - Top connection										
VLVAF5N03517AC	350	50	50 + 3x100	7	4	35 kA/1s	NS800N	VLVAF5N	2200 x 800 x 600 mm	434
VLVAF5N03518AC	400	50	50 + 50 + 3x100	8	5		NS1000N			

Polluted network - Tuning order 3.8 / Tuning frequency 190 Hz

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Breaking Capacity	Preconised upstream protection	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker										
Floor-standing - Top connection										
VLVAF2P03506AK	50	12.5	12.5 + 12.5 + 25	4	3	50 kA	NSX250N 250A	VLVAF2P	1400 x 800 x 600 mm	350
VLVAF2P03507AK	75	25	25 + 50	3	2		NSX250N 250A			
VLVAF2P03508AK	100	25	25 + 25 + 50	4	3		NSX250N 250A			
VLVAF2P03509AK	125	25	25 + 50 + 50	5	3		NSX250N 250A			
VLVAF2P03531AK	137.5	12.5	12.5 + 25 + 50 + 50	11	4		NSX400N 400A			
VLVAF2P03510AK	150	25	25 + 25 + 50 + 50	6	4		NSX400N 400A			
VLVAF2P03512AK	200	50	50 + 50 + 100	4	3		NSX400N 400A			
VLVAF3P03513AK	225	25	25 + 50 + 50 + 100	9	5		NSX630N 630A	VLVAF3P	2000 x 800 x 600 mm	400
VLVAF3P03514AK	250	50	50 + 2x100	5	3		NSX630N 630A			
VLVAF3P03516AK	300	50	50 + 50 + 2x100	6	4		NSX630N 630A			
VLVAF5P03517AK	350	50	50 + 3x100	7	4		NS800N	VLVAF5P	2200 x 800 x 600 mm	450
VLVAF5P03518AK	400	50	50 + 50 + 3x100	8	5		NS800N			
VLVAF6P03519AK	450	50	50 + 4x100	9	5		NS1000N	VLVAF6P	2200 x 1400 x 600 mm	952
VLVAF6P03520AK	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF6P03522AK	600	50	6x100	6	6		NS1600N			

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Short-time withstand current Icw	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
Without circuit breaker										
Floor-standing - Top connection										
VLVAF2P03506AC	50	12.5	12.5 + 12.5 + 25	4	3	35 kA/1s	NSX250N 250A	VLVAF2P	1400 x 800 x 600 mm	350
VLVAF2P03507AC	75	25	25 + 50	3	2		NSX250N 250A			
VLVAF2P03508AC	100	25	25 + 25 + 50	4	3		NSX250N 250A			
VLVAF2P03509AC	125	25	25 + 50 + 50	5	3		NSX250N 250A			
VLVAF2P03531AC	137.5	12.5	12.5 + 25 + 50 + 50	11	4		NSX400N 400A			
VLVAF2P03510AC	150	25	25 + 25 + 50 + 50	6	4		NSX400N 400A			
VLVAF2P03512AC	200	50	50 + 50 + 100	4	3		NSX400N 400A			
VLVAF3P03513AC	225	25	25 + 50 + 50 + 100	9	5		NSX630N 630A	VLVAF3P	2000 x 800 x 600 mm	400
VLVAF3P03514AC	250	50	50 + 2x100	5	3		NSX630N 630A			
VLVAF3P03516AC	300	50	50 + 50 + 2x100	6	4		NSX630N 630A			
VLVAF5P03517AC	350	50	50 + 3x100	7	4		NS800N	VLVAF5P	2200 x 800 x 600 mm	450
VLVAF5P03518AC	400	50	50 + 50 + 3x100	8	5		NS800N			
VLVAF6P03519AC	450	50	50 + 4x100	9	5		NS1000N	VLVAF6P	2200 x 1400 x 600 mm	952
VLVAF6P03520AC	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF6P03522AC	600	50	6x100	6	6		NS1600N			

→ **Dimensions and weight:** see page 48. / **Main protection recommendations:** see page 64 to 66.

Automatic compensation

400 V / 60 Hz - Bottom entry

Low polluted network

Polluted network - Tuning order 2.7 & 3.8

B

Environment

- Installation: Indoor
- Ambient temperature: -5°C to 45°C
- Average daily temperature: +35°C max
- Humidity: up to 95%
- Maximum altitude: 2000 m

Standards

- IEC 61921
- IEC 61439-1/2

Environment certifications

RoHS compliant, produced in 14001 certified plants, product environmental profile available

General characteristics

Electrical Characteristics	
Rated Voltage	400 V - 60 Hz
Capacitance Tolerance	-5%, +10%
Connection type	Three-phase
Power losses	< 2.5 W/kVAr for low polluted network
	< 6 W/kVAr for polluted network
Maximum permissible over current (with thermal protection included)	1.43 In for low polluted network
	1.19 In for polluted network with 3.8 tuning factor
	1.12 In for polluted network with 2.7 tuning factor
Maximum permissible over voltage	1.1 x Un, 8 h every 24 h
Overload protection	By Thdu management from controller
Insulation voltage	690 V for low polluted network
	690 V for 200 kVAr, 800 V from 300 kVAr for polluted network
Rated Impulse Withstand Voltage (Uimp)	8 kV
Enclosure	
Degree of protection	IP31
Colour	RAL 7035
Degree of mechanical resistance	IK10
Protection against direct contacts open door	IPxxB
Controller	
VarPlus Logic	VPL06 / VPL12 with Modbus communication
Head circuit breaker protection	
With circuit breaker	Compact NSX
	Rotary handle
Step	
Capacitors Type	VarplusCan 400 V - 60 Hz for low polluted network
	VarplusCan 480 V - 60 Hz for polluted network
	Maximum over current: 1.8 In
	Overpressure protection
	Discharge resistance 50 V - 1 min
Detuned Reactor	Varplus DR
	Overheating protection by thermostat
Contactors	TeSys range
Fuse protection	Type gG
Temperature control	
Double control	By thermostat and controller
Communication	
ModBUS	RS485
Installation	
Auxiliary supply	Transformer 400/230 V included from 50 kVAr
TI not included	5 VA - secondary 1 A or 5 A
	To be installed upstream of the load and capacitor bank
GenSet contact	Must be connected with the generator
Alarm contact	Available for remote warning signal

Options available through configurator (see page 43):

- Step protection by circuit breaker
- No incomer circuit breaker
- Short-time withstand current 65 kA/1s
- Breaking capacity 65 kA
- Top or Bottom connection

Automatic compensation

Bottom entry - 400 V / 60 Hz

Low polluted network

Polluted network - Tuning order 2.7 & 3.8

Low polluted network

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Breaking Capacity	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker										
Floor-standing - Bottom connection										
VLVAW2N03608CB	100	25	25 + 25 + 50	4	3	50 kA	NSX400N 400A	VLVAW2N	1300 x 800 x 300 mm	131
VLVAW2N03609CB	125	25	25 + 2x50	4	3		NSX400N 400A			
VLVAW2N03610CB	150	25	25 + 25 + 2x50	6	4		NSX400N 400A			
VLVAW2N03612CB	200	50	4x50	4	4		NSX400N 400A			
VLVAW3N03614CB	250	50	5x50	5	5		NSX630N 630A	VLVAW3N	1300 x 1000 x 300 mm	175
VLVAW3N03616CB	300	50	6x50	6	6		NSX630N 630A			
VLVAF5N03617CB	350	50	50 + 3x100	7	4	50 kA	NS800N	VLVAF5N	2200 x 800 x 600 mm	434
VLVAF5N03618CB	400	50	50 + 50 + 3x100	8	5		NS1000N			
VLVAF5N03619CB	450	50	50 + 4x100	9	5		NS1000N			
VLVAF5N03620CB	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF5N03621CB	550	50	50 + 5x100	11	6		NS1250N			
VLVAF5N03622CB	600	50	50 + 50 + 5x100	12	7		NS1250N			

Polluted network - Tuning order 3.8

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Breaking Capacity	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker										
Floor-standing - Bottom connection										
VLVAF2P03608CA	100	25	25 + 25 + 50	4	3	50 kA	NSX250N 250A	VLVAF2P	1400 x 800 x 600 mm	350
VLVAF2P03609CA	125	25	25 + 2x50	4	3		NSX250N 250A			
VLVAF2P03610CA	150	25	25 + 25 + 2x50	4	4		NSX400N 400A			
VLVAF2P03612CA	200	50	50 + 50 + 100	4	3		NSX400N 400A			
VLVAF3P03614CA	250	50	50 + 100 + 100	5	3		NSX630N 630A	VLVAF3P	2000 x 800 x 600 mm	400
VLVAF3P03616CA	300	50	50 + 50 + 2x100	6	4		NSX630N 630A			
VLVAF5P03617CA	350	50	50 + 3x100	7	4		NS800N	VLVAF5P	2200 x 800 x 600 mm	450
VLVAF5P03618CA	400	50	50 + 50 + 3x100	8	5		NS800N			
VLVAF6P03619CA	450	50	50 + 4x100	9	5		NS1000N	VLVAF6P	2200 x 1400 x 600 mm	952
VLVAF6P03620CA	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF6P03621CA	550	50	50 + 5x100	11	6		NS1250N			
VLVAF6P03622CA	600	50	50 + 50 + 5x100	12	7		NS1600N			

Polluted network - Tuning order 2.7

References	Power (kVAr)	Smallest step	Regulation	No. of electrical Steps	No. of physical Steps	Breaking Capacity	Main Circuit breaker	Enclosure type	Enclosure size (H x W x D)	Max weight (kg)
With circuit breaker										
Floor-standing - Bottom connection										
VLVAF2P03608CH	100	25	25 + 25 + 50	4	3	50 kA	NSX250N 250A	VLVAF2P	1400 x 800 x 600 mm	350
VLVAF2P03609CH	125	25	25 + 2x50	4	3		NSX250N 250A			
VLVAF2P03610CH	150	25	25 + 25 + 2x50	4	4		NSX400N 400A			
VLVAF3P03612CH	200	50	50 + 50 + 100	4	3		NSX400N 400A	VLVAF3P	2000 x 800 x 600 mm	400
VLVAF3P03614CH	250	50	50 + 100 + 100	5	3		NSX630N 630A			
VLVAF3P03616CH	300	50	50 + 50 + 2x100	6	4		NSX630N 630A	VLVAF5P	2200 x 800 x 600 mm	450
VLVAF5P03617CH	350	50	50 + 3x100	7	4		NS800N			
VLVAF6P03618CH	400	50	50 + 50 + 3x100	8	5		NS800N	VLVAF6P	2200 x 1400 x 600 mm	952
VLVAF6P03619CH	450	50	50 + 4x100	9	5		NS1000N			
VLVAF6P03620CH	500	50	50 + 50 + 4x100	10	6		NS1250N			
VLVAF6P03621CH	550	50	50 + 5x100	11	6		NS1250N			

➜ **Dimensions and weight:** see page 48.
Main protection recommendations: see page 64 to 66.

VarSet accessories

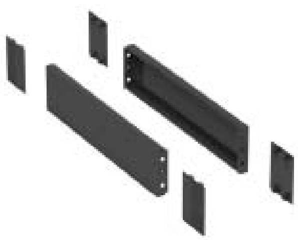
Plinth for enclosure, IP54 kits

Due to installation constraint or by preference, you want to install your wall-mounted LV banks on the floor or due to harsh and dusty environments, you want to increase IP level of your enclosure or cubicle.

These accessories and kits are made for you.

You can easily transform enclosures of size W2N & W3N into a floor-standing type.

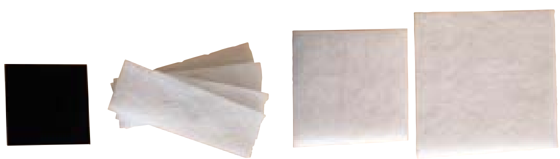
Accessory for plinth assembly	
Accessory for VarSet plinth mounting	**VLVACCESS001**



Plinth for VLV*W2N size	
Accessory for VarSet plinth mounting	**VLVACCESS001**
Front plinth 100 x 800	**NSYSPF8100**
2 Plinth side panels 300 x 100	**NSYSPS3100SD**

Plinth for VLV*W3N size	
Accessory for VarSet plinth mounting	**VLVACCESS001**
Front plinth 100 x 1000	**NSYSPF10100**
2 Plinth side panels 300 x 100	**NSYSPS3100SD**

You can easily move from an IP31 performance to an IP54 performance.



Kits Option IP54	
Kit for enclosures size VLV*W0N,VLV*W1N	**VLVIP54KIT01**
Kit for enclosures size VLV*W2N,VLV*W3N	**VLVIP54KIT02**
Kit for cubicles size VLVF5N	**VLVIP54KIT02**
Kit for cubicles size VLVF7N	**2 x VLVIP54KIT02**
Kit for cubicles size VLV*F2P, VLVAF3P, VLVAF5P, VLVAF6P	**VLVIP54KIT03**
Kit for cubicles size VLVAF8P	**2 x VLVIP54KIT03**

Configured offer

400 V / 50 Hz - 400 V / 60 Hz

Fixed or automatic compensation

A large range of power in kvar are available and some options can be choosen by our customers, to adapt the offer to exact and specifics needs.

Options available

Tuning Order

- 2.7
- 3.8
- 4.2

Incomer protection

- 35 kA circuit breaker protection, with rotary handle
- 65 kA circuit breaker protection, with rotary handle
- No incomer protection

Step protection

- Circuit breaker
- Fuse or smart protection

Installation

- Top connection
- Bottom connection
- with or without plinth

Packaging

- Standard or maritime

VarSet Configurator

> Available from your **http://Schneiderelectric.com**

1 - Search for VarSet LV
2 - On VarSet LV homepage
3 - Click on product configurator

Configured offer

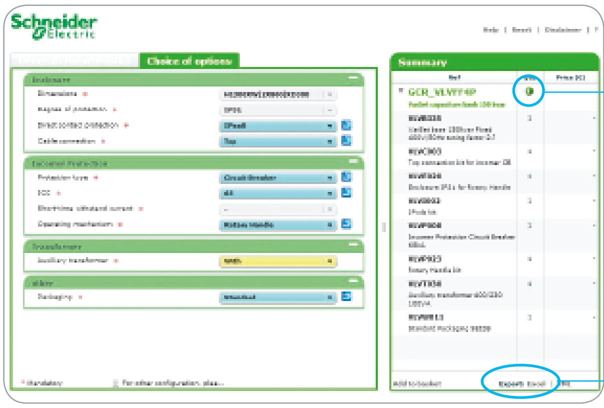
400 V / 50 Hz - 400 V / 60 Hz

Fixed or automatic compensation

B

1 Enter the electrical characteristics

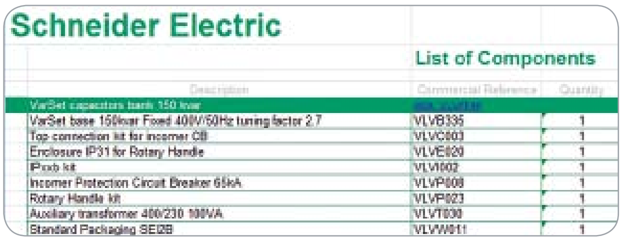
2 Choose the options



Look at the characteristics of your capacitor bank

Export your configuration reference list to Excel

3 Send your order document to your Schneider Electric Contact



Schneider Electric

List of Components

Description	Commercial Reference	Quantity
VarSet capacitors bank 150 kvar	[illegible]	
VarSet base 150kvar Fixed 400V/50Hz tuning factor 2.7	VLVB335	1
Top connection kit for incomer CB	VLVC003	1
Enclosure IP31 for Rotary Handle	VLVE020	1
IPxxb kit	VLVI002	1
Incomer Protection Circuit Breaker 65kA	VLVP008	1
Rotary Handle kit	VLVP023	1
Auxiliary transformer 400/230 100VA	VLVT030	1
Standard Packaging SEI2B	VLVW011	1

4 Receive your capacitor bank in the best lead time

Construction of references VarSet Easy

V	L V	A	W 0	L	0 2 0	A	4 0	A
1	2	3	4	5	6	7	8	9

1 **Range**
V: VarSet

2 **Low Voltage**
LV: Low Voltage

3 **Type of compensation**
A: Automatic
F: Fixed

4 **Type of enclosure**
W: Wall-mounted
F: Floor-standing

Size of enclosure
From 0: small cabinet
to 8: big cubicle

5 **Pollution**
L: No polluted

6 **Power**

Power Code	kVAr
007	7.5
015	15
017	17.5
020	20
025	25
030	30
037	37.5
045	45
050	50
060	60
070	70
075	75
082	82.5
090	90
100	100

Power Code	kVAr
125	125
150	150
175	175
200	200
225	225
250	250
275	275
300	300
350	350
400	400
450	450
500	500
550	550
600	600

7 **Frequency**
A: 50 Hz
B: 60 Hz

8 **Design voltage**

Voltage	Voltage code
400 V	40

9 **Options**
A: Head CB & no step protection & no additional voltage supply
B: No Head CB & no step protection & no additional voltage supply

B

Construction of references VarSet

V	LV	A	W0	N	03	5	10	AA
1	2	3	4	5	6	7	8	9

1 Range
V: VarSet

2 Low Voltage
LV: Low Voltage

3 Type of compensation
A: Automatic
F: Fixed

4 Type of enclosure
W: Wall-mounted
F: Floor-standing

Size of enclosure
From 0: small cabinet
to 8: big cubicle

5 Pollution
N: Low polluted
P: Polluted

6 Voltage

Voltage	Voltage code
01	230 V
02	240 V
03	400 V
05	440 V
06	480 V
07	600 V
08	690 V

7 Frequency
A: 50 Hz
B: 60 Hz

8 Power

Power Code	kVAr	Power Code	kVAr	Power Code	kVAr	Power Code	kVAr
26	6	29	69	13	225	20	500
1	9	7	75	32	238	21	550
27	12.5	30	87.5	14	250	22	600
2	16	8	100	15	275	34	700
3	22	9	125	16	300	35	800
4	32	31	137.5	17	350	36	900
5	34	10	150	18	400	37	1000
28	37.5	11	175	33	425	38	1100
6	50	12	200	19	450	39	1150

9 Options
Used to differentiate other options: for example, with and without incoming circuit-breaker

Low polluted Network	
AA	Head CB
AB	Without Head CB
AC	Without Head CB & Top Entry
AK	Head CB & Top entry
CB	Head CB & network frequency 60hz

Polluted Network	
AA	Head CB & Tuning factor 3.8
AB	Without Head CB & Tuning factor 3.8
AC	Without Head CB & Tuning factor 3.8 & Top entry
AD	Head CB & Tuning factor 4.2
AE	Without Head CB & Tuning factor 4.2
AG	Without Head CB & Tuning factor 2.7
AH	Head CB & Tuning factor 2.7
AK	Head CB & Tuning factor 3.8 & Top entry
CB	With Head CB & Tuning factor 3.8 & network frequency 60Hz
CH	With Head CB & Tuning factor 2.7 & network frequency 60Hz

VarSet characteristics

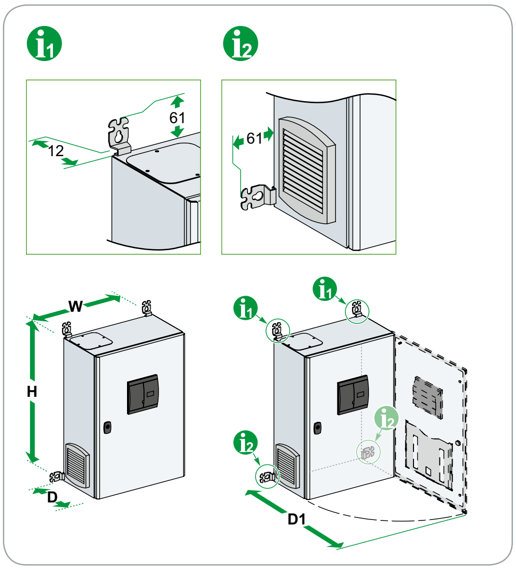
Physical & Electrical steps

Type	Power kVAr	Smallest step	Regulation	No. of steps		Sequence	Network frequency	Tuning order
				physical	elec.		Frequency	
No polluted								
VLVAW0L	7.5	2.5	2.5 + 5	2	3	1.2.2.2	50 Hz	NA
	15	5	5 + 10	2	3	1.2.2.2		
	17.5	2.5	2.5 + 5 + 10	3	7	1.2.4.4		
	20	5	2x5 + 10	3	4	1.1.2.2		
	25	5	5 + 2x10	3	5	1.2.2.2		
	30	5	5 + 10 +15	3	6	1.2.3.3		
	37.5	7.5	7.5 + 2x15	3	5	1.2.2.2		
	45	7.5	7.5 + 15 + 22.5	3	6	1.2.3.3		
	50	10	10 + 2x20	3	5	1.2.2.2		
VLVAW1L	60	10	10 + 20 + 30	3	6	1.2.3.3		
	70	10	10 + 20 + 40	3	7	1.2.4.4		
	75	15	15 + 2x30	3	5	1.2.2.2		
	82.5	7.5	7.5 + 15 + 2x30	4	11	1.2.4.4		
	90	15	2x15 + 2x30	4	6	1.1.2.2		
	100	20	20 + 2x40	3	5	1.2.2.2		
VLVAW2L	125	25	25 + 2x50	3	5	1.2.2.2		
	150	25	2x25 + 2x50	4	6	1.1.2.2		
	175	25	25 + 3x50	4	7	1.2.2.2		
	200	25	2x25 + 3x50	5	8	1.1.2.2		
VLVAF3L	225	25	25 + 4x50	5	9	1.2.2.2		
	250	25	2x25 + 4x50	6	10	1.1.2.2		
	275	25	25 + 5X50	6	11	1.2.2.2		
	300	50	6x50	6	6	1.1.1.1		
VLVAF5L	350	50	7x50	7	7	1.1.1.1		
	400	50	8x50	8	8	1.1.1.1		
	450	50	9x50	9	9	1.1.1.1		
	500	50	10x50	10	10	1.1.1.1		
	550	50	11x50	11	11	1.1.1.1		
	600	50	12x50	12	12	1.1.1.1		
Low polluted								
VLVAW0N	6	3	2x3	2	2	1.1	50 Hz / 60 Hz	NA
	9	3	3 + 6.25	2	3	1.2		
	12.5	3	3 + 3 + 6.25	3	4	1.1.2		
	16	3	3 + 2x6.25	3	5	1.2.2		
	22	3	3 + 6.25 + 12.5	3	7	1.2.4		
	32	6.25	6.25 + 2x12.5	3	5	1.2.2		
VLVAW1N	34	3	3 + 6.25 + 2x12.5	4	11	1.2.4		
	37.5	6.25	2 x 6.25 + 2x12.5	4	6	1.1.2		
	50	6.25	2x6.25 + 12.5 + 25	4	8	1.1.2.4		
	69	6.25	6.25 + 12.5 + 2x25	4	11	1.2.4		
	75	25	3x25	3	3	1.1.1		
	87.5	12.5	12.5 + 3x25	4	7	1.2.2		
	100	25	4x25	4	4	1.1.1		
VLVAW2N	125	25	25 + 2x50	3	5	1.2.2		
	137.5	12.5	12.5 + 25 + 2x50	4	11	1.2.4		
	150	50	3x50	3	3	1.1.1		
	175	25	25 + 3x50	4	7	1.2.2		
VLVAW3N	200	25	25 + 25 + 3x50	5	8	1.1.2		
	225	25	25 + 4x50	5	9	1.2.2		
	238	12.5	12.5 + 25 + 4x50	6	19	1.2.4		
	250	25	2x25 + 4x50	6	10	1.1.2		
	275	25	25 + 5x50	6	11	1.2.2		
	300	50	6x50	6	6	1.1.1		
VLVAF5N	350	50	50 + 3x100	4	7	1.2.2		
	400	50	2x50 + 3x100	5	8	1.1.2		
	450	50	50 + 4x100	5	9	1.2.2		
	500	50	2x50 + 4x100	6	10	1.1.2		
	550	50	50 + 5x100	6	11	1.2.2		
	600	50	2x50 + 5x100	7	12	1.1.2		
Polluted								
VLVAF2P	50	12.5	12.5 + 25 + 50	3	4	1.2.4	50 Hz / 60 Hz	2.7 / 3.8 / 4.2
	75	25	25 + 50	3	3	1.2.2		2.7 / 3.8 / 4.2
	87.5	12.5	12.5 + 25 + 50	3	7	1.2.4		2.7 / 3.8 / 4.2
	100	25	25 + 25 + 50	3	4	1.2.2		2.7 / 3.8 / 4.2
	125	25	25 + 2x50	3	5	1.2.2		2.7 / 3.8 / 4.2
	137.5	12.5	12.5 + 25 + 2x50	4	11	1.2.4		2.7 / 3.8 / 4.2
	150	25	2x25 + 2x50	4	6	1.2.2		2.7 / 3.8 / 4.2
	175	25	25 + 50 + 100	3	7	1.2.4		2.7 / 3.8 / 4.2
	200	50	50 + 50 + 100	3	4	1.2.2		3.8 / 4.2
VLVAF3P	200	50	50 + 50 + 100	3	4	1.2.2	50 Hz / 60 Hz	2.7
	225	25	25 + 4x50	5	9	1.2.2		2.7 / 3.8 / 4.2
	250	50	50 + 2x100	3	5	1.2.2		2.7 / 3.8 / 4.2
	275	25	25 + 50 + 2x100	4	11	1.2.4		2.7 / 3.8 / 4.2
	300	50	2x50+ 2x100	4	6	1.2.2		3.8 / 4.2
VLVAF5P	300	50	2x50+ 2x100	4	6	1.2.2	50 Hz / 60 Hz	2.7
	350	50	50 + 3x100	4	7	1.2.2		2.7 / 3.8 / 4.2
	400	50	2x50 + 3x100	5	8	1.2.2		3.8 / 4.2
VLVAF6P	400	50	2x50 + 3x100	5	8	1.2.2	50 Hz / 60 Hz	2.7
	450	50	50 + 4x100	5	9	1.2.2	50 Hz / 60 Hz	2.7 / 3.8 / 4.2
	500	50	2x50 + 4x100	6	10	1.2.2	50 Hz / 60 Hz	2.7 / 3.8 / 4.2
	550	50	50 + 5x100	6	11	1.2.2	50 Hz / 60 Hz	2.7 / 3.8 / 4.2
	600	100	6x100	6	6	1.1.1	50 Hz / 60 Hz	2.7 / 3.8 / 4.2
	600	50	2x50 + 5x100	7	12	1.2.2	60 Hz	3.8

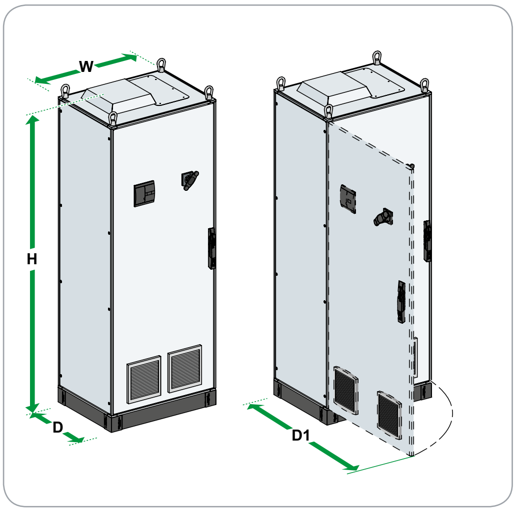
B

Dimensions and weight

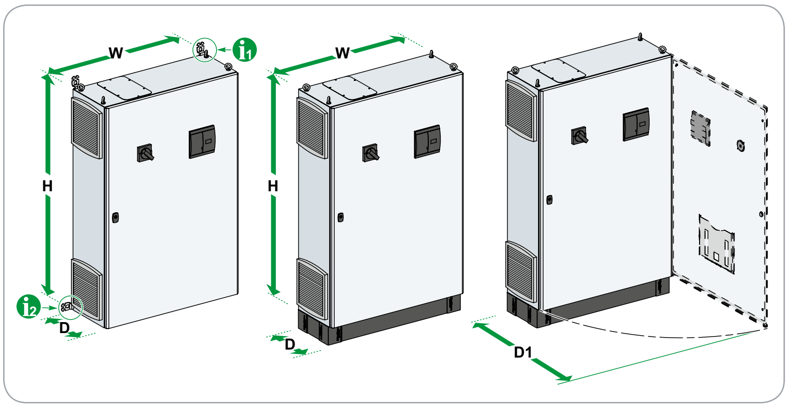
Type	Assembly	Dimensions (mm)				Max. weight
		H	W	D	D1	(kg)
VLVAW0L	Wall-mounted enclosures	600	500	250	735	57
VLVAW0N	Wall-mounted enclosures	650	450	250	686	57
VLVFW0N						48
VLVAW1L	Wall-mounted enclosures	800	600	250	830	73
VLVAW1N	Wall-mounted enclosures	700	600	300	886	73
VLVFW1N						64
VLVAW2L	Wall-mounted enclosures or floor-standing with optional plinth ref. NSYSPF8200	1000 1200 with plinth	800	300	1080	131
VLVAW2N	Wall-mounted enclosures or floor-standing with optional plinth with configurator	1200 1300 with plinth	800	300	1086	131
VLVFW2N						117
VLVAW3N	Wall-mounted enclosures or floor-standing with optional plinth with configurator	1200 1300 with plinth	1000	300	1286	175
VLVAF3L	Floor-standing enclosures	1100	800	400	1175	140
VLVAF5L	Floor-standing enclosures	2200	800	600	1361	340
VLVAF5N	Floor-standing enclosures	2200	800	600	1361	434
VLVAF7N	2 floor-standing enclosures VLVAF5N with 2 incomings	2200	1600	600	1361	868
VLVFF2P	Floor-standing enclosures	1400	800	600	1361	320
VLVAF2P	Floor-standing enclosures	1400	800	600	1361	350
VLVAF3P	Floor-standing enclosures	2000	800	600	1361	400
VLVAF5P	Floor-standing enclosures	2200	800	600	1361	450
VLVAF6P	Floor-standing enclosures	2200	1400	600	1361	952
VLVAF8P	2 floor-standing enclosures VLVAF6P with 2 incomings	2200	2800	600	1361	1904



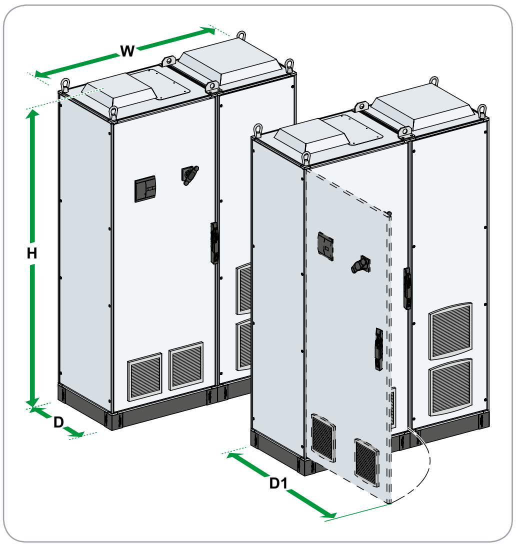
VLV•W0, **VLV•W1** Wall-mounted enclosures.



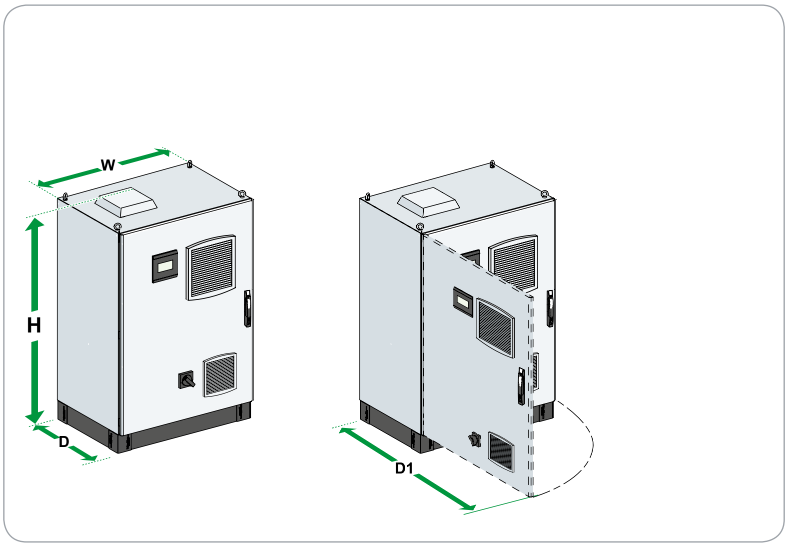
VLVAF5L, **VLVAF5N**, **VLVAF5P** Floor-standing enclosures.



VLV•W2,VLV•W3,VLV•F3 Wall-mounted enclosures or floor-standing with plinth.



VLVAF6P Floor-standing enclosures.



VLV•F2P, **VLVAF3P** Floor-standing enclosures.

Appendix

Appendix

C

Other chapters

Power factor of most common receiving devices

Practical calculation of reactive power

Type of circuit	Apparent power S (kVA)	Active power P (kW)	Reactive power Q (kVAr)
Single phase (Ph + N) Single phase (Ph + Ph)	S = V x I S = U x I	P = V x I x cos φ P = U x I x cos φ	P = V x I x sin φ P = U x I x sin φ
Example: 5 kW load Cos φ= 0.5	10 kVA	5 kW	8.7 kVAr
Three-phase (3Ph or 3Ph+N)	S = √3 x U x I	P = √3 x U x I x cos φ	Q = √3 x U x I x sin φ
Example of Motor with Pn = 51kW cos φ = 0.86 efficiency = 0.91	65 kVA	56 kW	33 kVAr

Calculations in the three-phase example were as follows:

Pn = power supplied to the rotary axis = 51 kW

P = active consumed power = Pn/ρ = 56 kW

S = apparent power = P/cos φ = P/0.86 = 65 kVA

Hence:

$Q = \sqrt{S^2 - P^2} = \sqrt{65^2 - 56^2} = 33$ kVAr

The average power factor values for various loads are given below.

Power factor of the most common loads

Device	Load	cos φ	tg φ
Ordinary asynchronous motor	0%	0.17	5.8
	25%	0.55	1.52
	50%	0.73	0.94
	75%	0.8	0.75
	100%	0.85	0.62
Incandescent lamps		1	0
Fluorescent lamps		0.5	1.73
Discharge lamps		0.4 to 0.6	2.29 to 1.33
Resistance furnaces		1	0
Induction furnaces		0.85	0.62
Dielectric heating furnaces		0.85	0.62
Resistance welding machine		0.8 to 0.9	0.75 to 0.48
Single-phase static arc-welding centres		0.5	1.73
Rotary arc-welding sets		0.7 to 0.9	1.02
Arc-welding transformers/rectifiers		0.7 to 0.9	1.02 to 0.75
Arc furnaces		0.8	0.75

Cos φ of the most commonly-used devices.

When should fixed power factor correction be used?

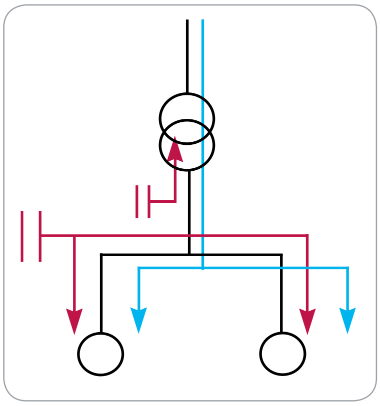


Fig. 7 Power flow in an installation with an uncompensated transformer.

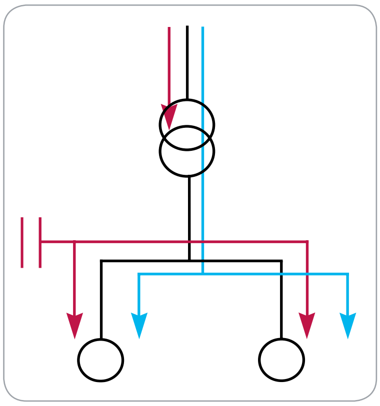


Fig. 8 Power flow in an installation where the transformer is compensated by a fixed power factor correction device.

Fixed power factor correction for transformer

A transformer consumes a reactive power that can be determined approximately by adding:

- a fixed part that depends on the magnetising off-load current Io:
  $Qo = I_0 \times Un \times \sqrt{3}$
- a part that is proportional to the square of the apparent power that it conveys:
  $Q = Usc \times S^2/Sn$

Usc: short-circuit voltage of the transformer in p.u.
S: apparent power conveyed by the transformer
Sn: apparent nominal power of the transformer
Un: nominal phase-to-phase voltage

The total reactive power consumed by the transformer is: Qt = Qo + Q.

If this correction is of the individual type, it can be performed at the actual terminals of the transformer.

If this correction is performed globally with load correction on the busbar of the main switchboard, it can be of the fixed type provided that total power does not exceed 15% of transformer nominal power(otherwise use banks with automatic regulation).

The individual correction values specific to the transformer, depending on transformer nominal power, are listed in the table below.

Transformer		Oil bath		Dry	
S (kVA)	**Usc (%)**	**No-load**	**Load**	**No-load**	**Load**
100	4	2.5	5.9	2.5	8.2
160	4	3.7	9.6	3.7	12.9
250	4	5.3	14.7	5.0	19.5
315	4	6.3	18.3	5.7	24
400	4	7.6	22.9	6.0	29.4
500	4	9.5	28.7	7.5	36.8
630	4	11.3	35.7	8.2	45.2
800	4	20.0	66.8	10.4	57.5
1000	6	24.0	82.6	12	71
1250	5.5	27.5	100.8	15	88.8
1600	6	32	126	19.2	113.9
2000	7	38	155.3	22	140.6
2500	7	45	191.5	30	178.2

When should fixed power factor correction be used?

Fixed power factor correction for asynchronous motor

The cos φ of motors is normally very poor off-load and when slightly loaded, and poor in normal operating conditions. Installation of capacitors is therefore recommended for this type of load. The table opposite gives, by way of an example, the values for capacitor bank power in kVAr to be installed according to motor power.

Rated power		Number of revolutions per minute Reactive power in kVAr			
kW	HP	3000	1500	1000	750
11	15	2.5	2.5	2.5	5
18	25	5	5	7.5	7.5
30	40	7.5	10	11	12.5
45	60	11	13	14	17
55	75	13	17	18	21
75	100	17	22	25	28
90	125	20	25	27	30
110	150	24	29	33	37
132	180	31	36	38	43
160	218	35	41	44	52
200	274	43	47	53	61
250	340	52	57	63	71
280	380	57	63	70	79
355	485	67	76	86	98
400	544	78	82	97	106
450	610	87	93	107	117

When a motor drives a high inertia load, it may, after breaking of supply voltage, continue to rotate using its kinetic energy and be self-excited by a capacitor bank mounted at its terminals. The capacitors supply the reactive energy required for it to operate in asynchronous generator mode. Such self-excitation results in voltage holding and sometimes in high overvoltages.

Correction requirements of asynchronous motors

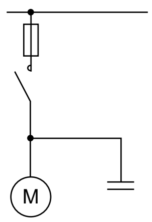


Fig. 9 Mounting capacitors at motor terminals.

- **Case of mounting capacitors at the motor terminals**

To avoid dangerous overvoltages caused by the self-excitation phenomenon, you must ensure that capacitor bank power verifies the following equation:

$Qc \leq 0,9 \times \sqrt{3} \times U_n \times I_0$

- I_0: motor off-load current Io can be estimated by the following expression: $I_0 = 2 \times I_n \times (I - \cos \varphi_n)$
- I_n: value of motor nominal current
- $\cos \varphi_n$: cos φ of the motor at nominal power
- U_n: nominal phase-to-phase voltage

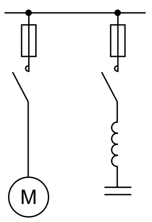


Fig. 10 Parallel-mounting of capacitors with separate operating mechanism.

- **Case of parallel-mounting of capacitors with separate operating mechanism**

To avoid dangerous overvoltages due to self-excitation or in cases in which the motor starts by means of special switchgear (resistors, reactors,autotransformers), the capacitors will only be switched after starting.

Likewise, the capacitors must be disconnected before the motor is de-energised. In this case, motor reactive power can be fully corrected on full load.

Caution: if several banks of this type are connected in the same network, inrush current limiting reactors should be fitted.

Automatic compensation: installation advice

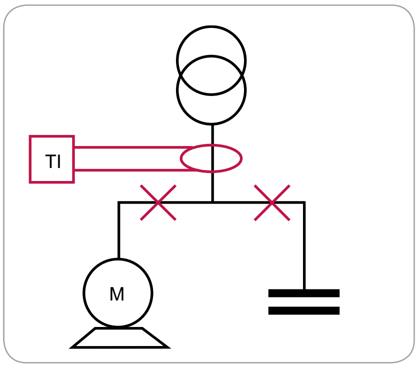


Fig. 11 Diagram of connection to a single LV busbar and CT location.

Single busbar compensation

General

An installation with a single LV busbar is that most often encountered. This type of installation requires that the reactive power can change with respect to the methods defined previously.

Compensation uses all the receiving devices of the installation and the amperage of the current transformer is determined according to the total current conducted through the main protection circuit breaker.

Precautions during installation

As mentioned previously, it will be necessary to ensure a complementary installation of the current transformer so that it can read the total consumption of the installation.

It is indispensable to set up the current transformer (CT) in accordance with **Fig. 11**, and installing the system at any of the points indicated by a cross would result in the system malfunctioning.

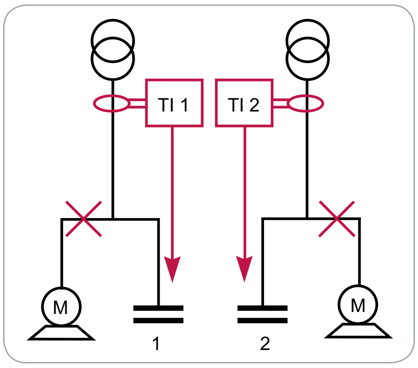


Fig. 12 Diagram of connection to independent LV busbars and CT location.

Compensation with several busbars

Independent LV busbars

Another installation possibility is to have the various independent busbars which do not require to be connected to two identical transformers. For this reason: the reactive power requirement will be different for each busbar and need to be evaluated separately using the methods defined previously.

Compensation will use all the receiving devices and the amperage of each current transformer will be determined according to the total current through the main protection circuit breaker of each busbar.

Installation precautions

In a similar manner to the previous case, the location of each current transformer (CT) will need to be decided upon in the same way so that some transformers can read the consumption in each part of the installation separately.

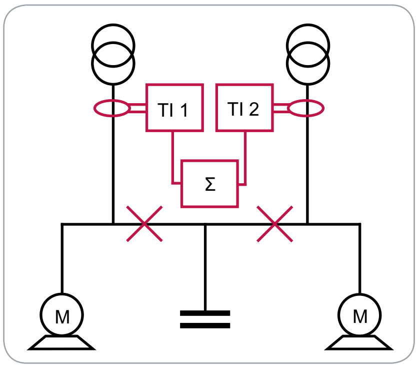


Fig. 13 Diagram of various transformers connected in parallel and TI location.

Compensation for a busbar supplied by various transformers

An installation differing from the above is one in which there are many transformers connected in parallel on the low voltage side.

Separate distribution transformers

Compensation in this installation can be obtained by placing together the two automatic batteries and their respective current transformers.

Equal distribution transformers

In this case, it will be possible to obtain compensation with a single bank in which the controller is powered by a summing transformer, itself powered by the two CTs of each transformer.

The maximum number of summing inputs is 5 (**Fig. 13**).

Installation precautions

■ Separate distribution transformers:
Each bank is powered by a separate CT connected to the output of each transformer. The settings and the installation must be made as if these were independent busbars.

■ Equal distribution transformers:
Compensation uses a single bank and the only precaution is to be made on start up: the C/K relation that needs to be programmed into the controller must consider the sum of all the CTs feeding the summing circuit.

C

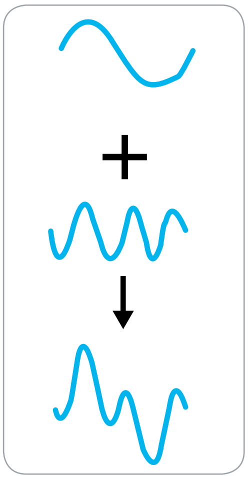


Fig. 14 Decomposition of a distorted wave.

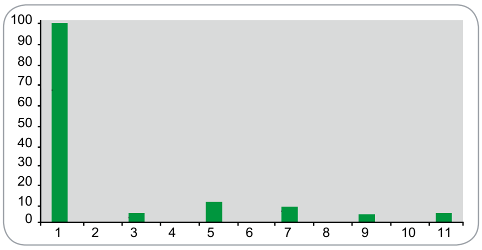


Fig. 15 Typical graph of the frequency spectrum
The frequency spectrum, also known as the spectral analysis, indicates the types of harmonic generator present on the network.

Introduction

Harmonics are usually defined by two main characteristics:

- Their amplitude:
value of the harmonic voltage or current.
- Their order:
value of their frequency with respect to the fundamental frequency (50 Hz).

Under such conditions, the frequency of a 5th order harmonic is five times greater than the fundamental frequency, i.e. 5 x 50 Hz = 250 Hz.

The root mean square value

The rms value of a distorted wave is obtained by calculating the quadratic sum of the different values of the wave for all the harmonic orders that exist for this wave:

Rms value of I:

$I\ (A) = \sqrt{I_1^2 + I_2^2 + \ldots + I_n^2}$

The rms value of all the harmonic components is deduced from this calculation:

$I_h\ (A) = \sqrt{I_2^2 + \ldots + I_n^2}$

This calculation shows one of the main effects of harmonics, i.e. the increased rms current passing through an installation, due to the harmonic components with which a distorted wave is associated.

Usually, the switchgear and cables or the busbar trunking of the installation is defined from the rated current at the fundamental frequency; all these installation components are not designed to withstand excessive harmonic current.

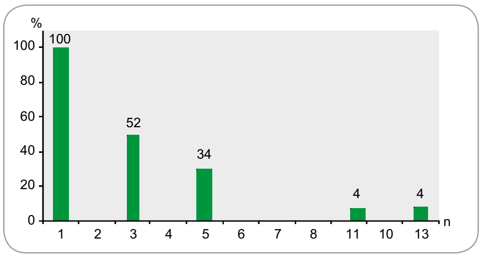


Fig. 16 Harmonic spectrum for single phase industrial devices, induction furnaces, welding machines, rectifiers,etc.

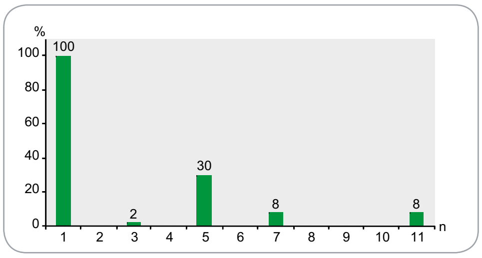


Fig. 17 Harmonic spectrum for 3 phases variable speed drives, asynchronous motors or direct current motors.

Harmonic measurement: distortion

The presence of varying amounts of harmonics on a network is called distortion.
It is measured by the harmonic distortion rates:

■ **Th: individual distortion rate**
It indicates, as a %, the magnitude of each harmonic with respect to the value of the fundamental frequency:

Th (%) = Ah / A1

Where:

Ah = the value of the voltage or current of the h-order harmonic.

A1 = the value of the voltage or current at the fundamental frequency (50 Hz).

■ **THD: Total Harmonic Distortion**

It indicates, as a %, the magnitude of the total distortion with respect to the fundamental frequency or with respect to the total value of the wave.

$$THD_{CIGREE} = \frac{\sqrt{\Sigma_2^h A_h^2}}{A_1} \qquad THD_{IEC\ 555} = \frac{\sqrt{\Sigma_2^h A_h^2}}{\Sigma_1^h A_h^2}$$

The operating values used to find the true situation of the installations with respect to the degree of harmonic contamination are:

■ **The total harmonic voltage distortion [THD(U)]** indicating the voltage wave distortion and the ratio of the sum of the harmonic voltages to the fundamental frequency voltage, all expressed as a %.

■ **The total harmonic current distortion [THD(I)]** determining the current wave distortion and the ratio of the sum of the harmonic currents to the fundamental frequency current, expressed as a %.

■ **The frequency spectrum (TFT)** is a diagram that gives the magnitude of each harmonic according to its order.
By studying it, we can determine which harmonics are present and their respective magnitude.

Interharmonics

Interharmonics are sinusoidal components with frequencies that are not integral multiples of the fundamental frequency (and therefore situated between the harmonics). They are the result of periodic or random variations of the power absorbed by different loads such as arc furnaces, welding machines and frequency converters (variable speed drives, cycloconvertors).

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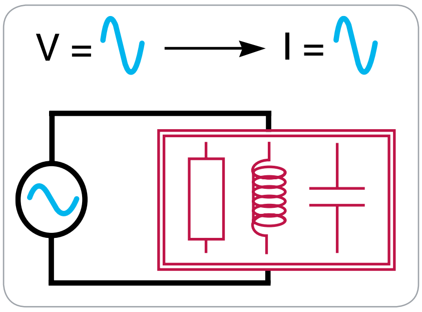


Fig. 18 Linear loads such as inductors, capacitors and resistors do not generate harmonics.

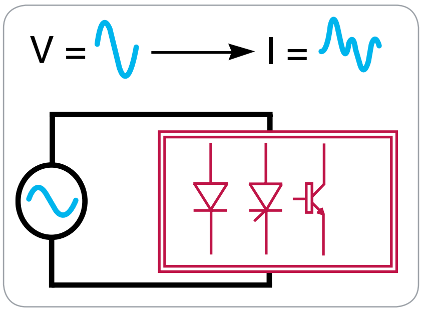


Fig. 19 Non-linear loads are those that generate harmonics.

Harmonic generators

Harmonics are generally produced by non-linear loads which, although powered by a sinusoidal voltage, absorb a non-sinusoidal current.

In short, non-linear loads are considered to behave as current sources that inject harmonics into the network.

The most common non-linear harmonic loads are those found in devices fed by power electronics, such as variable speed drives, rectifiers, converters, etc.

Loads such as saturable reactors, welding equipment, arc furnaces etc. also inject harmonics.

Other loads have a linear behaviour and do not generate harmonics: inductors, resistors and capacitors.

Main harmonic sources

We differentiate between these loads, according to whether they are used for industrial or residential applications:

- Industrial loads:
  - power electronics devices: variable speed drives, rectifiers, UPS, etc.
  - loads using an electric arc: arc furnaces, welding machines, lighting (fluorescent lamps, etc.); harmonics (temporary) are also generated when motors are started with an electronic starter and when power transformers come into service.
- Residential loads: TVs, microwave ovens, induction plates, computers, printers, fluorescent lamps, etc.

The following table is a guide to the various loads with information on the injected harmonic current spectrum.

Indications about the harmonic spectrum injected by various loads

Type of load	Harmonics generated	Comments
Transformer	Even and odd order	DC component
Asynchronous motors	Odd order	Interharmonics and subharmonics
Discharge lamp	3.° + odd	Can reach 30% of I1
Arc welding	3.°	
AC arc furnaces	Unstable variable spectrum	Non linear - asymmetric
Inductive filter rectifier	h = K x P ± 1 Ih = I1/h	UPS - variable speed drives V
Capacitive filter rectifier	h = K x P ± 1 Ih = I1/h	Electronic device power supply
Cycloconvertor	Variables	Variable speed drives V
PWM controllers	Variables	UPS - DC - AC converter

Fig. 20 Cables.

Fig. 21 Induction furnace.

Fig. 22 VarplusCan capacitor.

The effects of harmonics on loads

The following two types of effects appear in the main equipment: immediate or short-term effects and long-term effects.

Immediate or short-term effects:
- Unwanted tripping of protection devices,
- Induced interference from LV current systems (remote control, telecommunications),
- Abnormal vibrations and noise,
- Damage due to capacitor thermal overload,
- Faulty operation of non-linear loads.

Long-term effects associated with current overload that causes overheating and premature deterioration of the equipment.

Affected devices and effects:
- Power capacitors:
  - additional losses and overheating,
  - fewer possibilities of use at full load,
  - vibrations and mechanical wear,
  - acoustic disComfort.
- Motors:
  - additional losses and overheating,
  - fewer possibilities of use at full load,
  - vibrations and mechanical wear,
  - acoustic disComfort.
- Transformers:
  - additional losses and overheating,
  - mechanical vibrations,
  - acoustic disComfort.
  - automatic switch:
  - unwanted tripping due to the peak current being exceeded.
- Cables:
  - additional dielectric and chemical losses, especially on the neutral, when 3rd order harmonics are present,
  - overheating.
- Computers:
  - functional disruptions causing data losses or faulty operation of control equipment.
- Power electronics:
  - waveform interference: switching, synchronisation, etc.

Summary table of effects, causes and consequences of harmonics

Effects of the harmonics	Causes	Consequences
On the conductors	■ The harmonic currents cause the Irms to increase ■ The skin effect reduces the effective crosssection of the conductors as the frequency increases	■ Unwanted tripping of the protection devices ■ Overheated conductors
On the neutral conductor	■ A balanced three-phase + neutral load generates 3rd order multiple odd harmonics	■ Closure of homopolar harmonics on the neutral, causing overheating and overcurrents
On the transformers	■ Increased IRMS ■ Foucault losses are proportional to the frequency	■ Increased overheating due to the Joule effect in the windings ■ Increased losses in iron
On the motors	■ Similar to those for the transformers and generation of a field added to the main one	■ Similar to those of transformers, plus efficiency losses
On capacitors	■ Decreased capacitor impedance with increased frequency	■ Premature ageing, amplification of the existing harmonics

C

Appendix

VarPlus Logic series

VL6, VL12

VarPlus Logic has all what you need for the simple and efficient operation of your automatic power factor correction equipment to maintain your power factor.

It is a simple and intelligent relay which measure, monitor and controls the reactive energy. Easy commissioning, step size detection and monitoring makes it different from others in the market.

VarPlus Logic VL6, VL12

Capacitor bank step monitoring

- Monitoring of all the connected capacitor steps.
- Real time power in "kvar" for the connected steps .
- Remaining step capacity per step as a % of the original power since installation.
- Derating since installation.
- Number of switching operations of every connected step.

System Measurement and monitoring

- THD(u) and THD(u) Spectrum 3rd to 19th – Measurement, Display and Alarm.
- Measurement of DQ – "kvar" required to achieve target cos phi.
- Present cabinet temperature and maximum recorded temperature.
- System parameters – Voltage, Current, Active, reactive and apparent power.
- Large LCD display to monitor real step status and other parameters.

Easy Commissioning

- Automatic Initialization and automatic step detection to do a auto commissioning.
- Automatic wiring correction - voltage and current input wiring correction.
- 1 A or 5 A CT secondary compatible.

Flexibility to the panel builder and retrofitting

- No step sequence restriction like in the traditional relays.
- Any step sequences with auto detect. No programming needed.
- Easy to retrofit the faulty capacitor with different power.
- Quick and simple mounting and wiring.
- Connect to the digitized Schindler solutions through RS485 communication in Modbus protocol.
- Seamless connection to the Schneider software and gateways.

Do more with VarPlus Logic

- Programmable alarms with last 5 alarms log.
- Suitable for medium voltage applications.
- Suitable for 4 quadrant operations.
- Dual cos phi control through digital inputs or export power detection.
- Dedicated alarm and fan control relays.
- Advance expert programming Menu to configure the controller the way you need.
- New control algorithm designed to reduce the number of switching operations and quickly attain the targeted power fact.

Alarms

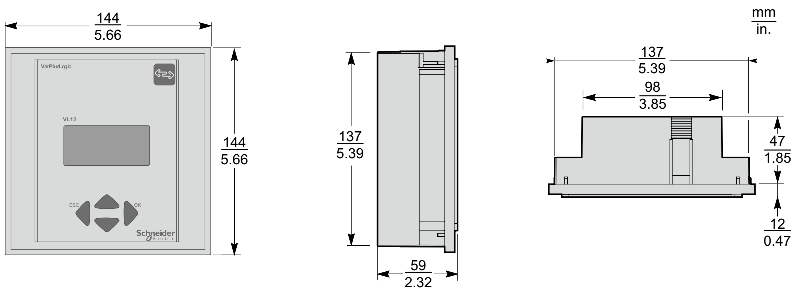
- Faulty Step.
- Configurable alarm for step derating.
- THDu Limit alarm.
- Temperature alarm.
- Self correction by switching off the steps at the event of THDu alarm, temperature alarm and overload limit alarm.
- Under compensation alarm.
- Under/Over Voltage Alarm.
- Low/High Current Alarm.
- Overload limit alarm.
- Hunting alarm.
- Maximum operational limits - Time and number of switching.

Range

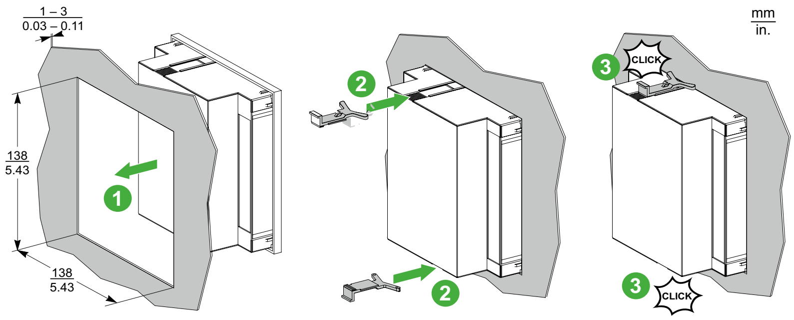
Type	Number of step output contacts	Part number
VL6	06	VPL06N
VL12	12	VPL12N

General characteristics	
Voltage and current Input	
Direct supply voltage	90 – 550 V, 1ph, 50/60 Hz
	VA Burden: 6 VA
	300 V LN / 519 V LL CAT III or 550 V CAT II
Type of input connection	Phase to phase or phase to neutral
Protection against voltage dips	Automatic disconnection of steps for dips > 15 ms (protection of capacitor)
CT secondary	1A or 5A compatible
CT primary range	Up to 9600 A
Current	15 mA – 6 A, 1PH,
	VA Burden : < 1 VA
Connection terminals	Screw type, pluggable. Section: 0.2 – 2.5 mm² (0.2 – 1 mm² for Modbus and digital inputs)
Power factor settings & algorithm selection	
Regulation setting - Programmable	From Cos Phi 0.7c to 0.7i
Reconnection time -Programmable	From 1 to 6500 s
Response time -Programmable	From 1 to 6500 s
Possibility of dual cos Phi target	Yes, Through Digital Input or if export power detected
Program algorithm	AUTOMATIC (best fit) - Default
	LIFO
	PROGRESSIVE
Import export application compatibility	4- Quadrant operation for generator application
Program intelligence	
Automatic Initialization and Automatic bank detection	Yes
Detection and display of power, number of switching & derating of all connected steps	Yes
Capacitor bank step sequence	Any sequence. No restriction/limitation on sequence

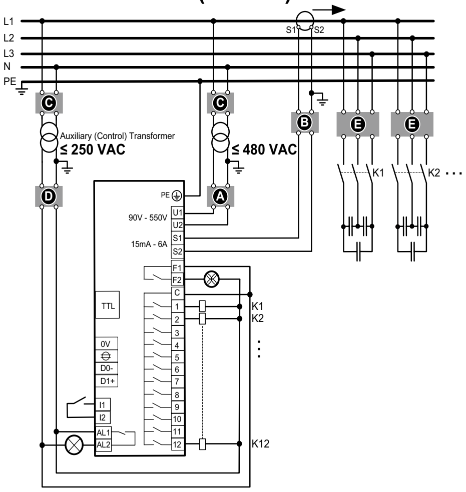
Dimensions



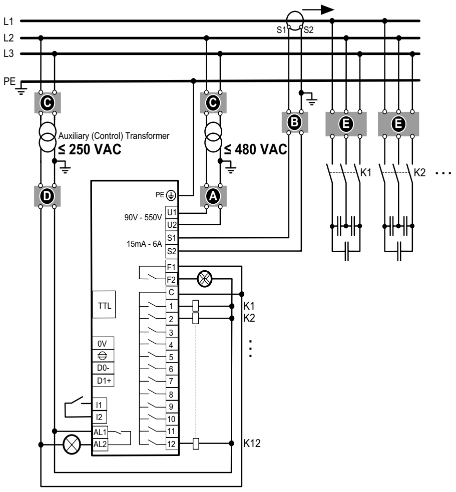
Mounting



Phase-to-Neutral with VTs **(3PH4W)**



Phase-to-Phase with VTs **(3PH3W)**



- **A** Upstream protection
  Voltage input: 2A certified circuit breakers or fuses
- **B** Shorting block for CT
- **C** VT primary fuses and disconnect switch
- **D** Output relays: 10 A (max.) certified circuit breakers or fuses (Applicable for applications with voltage transformers only)
- **E** Capacitor primary fuses or CB's

General characteristics

Alarm and control	
Control outputs (step output)	VL6: 6 relays VL12: 12 relays (NO contact)
	250 V LN or LL (CAT III)
	DC Rating : 48 V DC / 1 A
	AC Rating : 250 V AC / 5 A
	Common root: 10 A max.
Dedicated fan control relay	Yes. Normal open contact (NO)
	48 V DC / 1 A, 250 V AC / 5 A
Alarm contact	The relay contact is open when the controller is energized with no alarm and will close in the event of an alarm.The relay is a NC (Normally Close) when the controller is not energized.
	Rating : 48 V DC / 1 A, 250 V AC / 5 A
Digital Input for Cos phi2 target	Dry contact (internal supply 5 V, 10 mA)
Modbus RS-485 serial port (RTU)	Line polarization / termination, not included
Communication protocol	Modbus
Interface TTL	Service port. Only for internal use
Internal Temperature probe	Yes
Display and measurement	
Display	LCD graphic 56 x 25 (Backlit)
Alarms log	5 last alarms
Voltage Harmonic Distortion measurement	THDu ; Individual odd harmonics distortion from H3 to H19
Measurement displayed and accuracy	Voltage, Current & Frequency: ±1%
	Energy measurements, Cos Phi, THD(u): ±2%
	Individual Voltage harmonics (H3 to H19): ±3%
	Temperature measurement : ±3 °C
Testing standards and conformities	
Standards	IEC 61010-1
	IEC 61000 6-2
	IEC 61000 6-4: level B
	IEC 61326-1
	UL 61010
Conformity and listing	Conformity and listing CE, NRTL, c NRTL, EAC
Mechanical specifications	
Case	Front: Instrument case plastic RAL 7016
	Rear: Metal
Degree of Protection	Front: IP41, (IP54 by using a gasket)
	Rear: IP20
Weight	0.6 kg
Size	144 x 144 x 58 mm (H x W x D)
Panel Cutout	138 x 138 (+0.5) mm, thickness 1 – 3 mm
Panel Mounting	Flush mounting
Storage condition	
Temperature for operation	-20 °C +60 °C
Storage	-40 °C +85 °C
Humidity	0% - 95%, without condensation for operation and storage
Maximum pollution degree	2
Maximum altitude	≤ 2000m

C

Calculation of reactive power: Selection table

The table gives a coefficient, according to the cos φ of the installation before and after power factor correction. Multiplying this figure by the active power gives the reactive power to be installed.

Before compensation		Capacitor power in kVAr to be installed per kW of load to raise the power factor (cos φ or tg φ)													
tg φ	**cos φ**	**tg φ**	0.75	0.59	0.48	0.45	0.42	0.39	0.36	0.32	0.29	0.25	0.20	0.14	0.00
		cos φ	0.8	0.86	0.9	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1
2.29	0.40		1.541	1.698	1.807	1.836	1.865	1.896	1.928	1.963	2.000	2.041	2.088	2.149	2.291
2.22	0.40		1.475	1.631	1.740	1.769	1.799	1.829	1.862	1.896	1.933	1.974	2.022	2.082	2.225
2.16	0.42		1.411	1.567	1.676	1.705	1735	1.766	1.798	1.832	1.869	1.910	1.958	2.018	2.161
2.10	0.43		1.350	1.506	1.615	1.644	1.674	1.704	1.737	1.771	1.808	1.849	1.897	1.957	2.100
2.04	0.44		1.291	1.448	1.557	1.585	1.615	1.646	1.678	1.712	1.749	1.790	1.838	1.898	2.041
1.98	0.45		1.235	1.391	1.500	1.529	1.559	1.589	1.622	1.656	1.693	1.734	1.781	1.842	1.985
1.93	0.46		1.180	1.337	1.446	1.475	1.504	1.535	1.567	1.602	1.639	1.680	1.727	1.788	1.930
1.88	0.47		1.128	1.285	1.394	1.422	1.452	1.483	1.515	1.549	1.586	1.627	1.675	1.736	1.878
1.83	0.48		1.078	1.234	1.343	1.372	1.402	1.432	1.465	1.499	1.536	1.577	1.625	1.685	1.828
1.78	0.49		1.029	1.186	1.295	1.323	1.353	1.384	1.416	1.450	1.487	1.528	1.576	1.637	1.779
1.73	0.5		0.982	1.139	1.248	1.276	1.306	1.337	1.369	1.403	1.440	1.481	1.529	1.590	1.732
1.69	0.51		0.937	1.093	1.202	1.231	1.261	1.291	1.324	1.358	1.395	1.436	1.484	1.544	1.687
1.64	0.52		0.893	1.049	1.158	1.187	1.217	1.247	1.280	1.314	1.351	1.392	1.440	1.500	1.643
1.60	0.53		0.850	1.007	1.116	1.144	1.174	1.205	1.237	1.271	1.308	1.349	1.397	1.458	1.600
1.56	0.54		0.809	0.965	1.074	1.103	1.133	1.163	1.196	1.230	1.267	1.308	1.356	1.416	1.559
1.52	0.55		0.768	0.925	1.034	1.063	1.092	1.123	1.156	1.190	1.227	1.268	1.315	1.376	1.518
1.48	0.56		0.729	0.886	0.995	1.024	1.053	1.084	1.116	1.151	1.188	1.229	1.276	1.337	1.479
1.44	0.57		0.691	0.848	0.957	0.986	1.015	1.046	1.079	1.113	1.150	1.191	1.238	1.299	1.441
1.40	0.58		0.655	0.811	0.920	0.949	0.969	1.009	1.042	1.076	1.113	1.154	1.201	1.262	1.405
1.37	0.59		0.618	0.775	0.884	0.913	0.942	0.973	1.006	1.040	1.077	1.118	1.165	1.226	1.368
1.33	0.6		0.583	0.740	0.849	0.878	0.907	0.938	0.970	1.005	1.042	1.083	1.130	1.191	1.333
1.30	0.61		0.549	0.706	0.815	0.843	0.873	0.904	0.936	0.970	1.007	1.048	1.096	1.157	1.299
1.27	0.62		0.515	0.672	0.781	0.810	0.839	0.870	0.903	0.937	0.974	1.015	1.062	1.123	1.265
1.23	0.63		0.483	0.639	0.748	0.777	0.807	0.837	0.873	0.904	0.941	1.982	1.030	1.090	1.233
1.20	0.64		0.451	0.607	0.716	0.745	0.775	0.805	0.838	0.872	0.909	0.950	0.998	1.058	1.201
1.17	0.65		0.419	0.672	0.685	0.714	0.743	0.774	0.806	0.840	0.877	0.919	0.966	1.027	1.169
1.14	0.66		0.388	0.639	0.654	0.683	0.712	0.743	0.775	0.810	0.847	0.888	0.935	0.996	1.138
1.11	0.67		0.358	0.607	0.624	0.652	0.682	0.713	0.745	0.779	0.816	0.857	0.905	0.996	1.108
1.08	0.68		0.328	0.576	0.594	0.623	0.652	0.683	0.715	0.750	0.878	0.828	0.875	0.936	1.078
1.05	0.69		0.299	0.545	0.565	0.593	0.623	0.654	0.686	0.720	0.757	0.798	0.846	0.907	1.049
1.02	0.7		0.270	0.515	0.536	0.565	0.594	0.625	0.657	0.692	0.729	0.770	0.817	0.878	1.020
0.99	0.71		0.242	0.485	0.508	0.536	0.566	0.597	0.629	0.663	0.700	0.741	0.789	0.849	0.992
0.96	0.72		0.214	0.456	0.480	0.508	0.538	0.569	0.601	0.665	0.672	0.713	0.761	0.821	0.964
0.94	0.73		0.186	0.427	0.452	0.481	0.510	0.541	0.573	0.608	0.645	0.686	0.733	0.794	0.936
0.91	0.74		0.159	0.398	0.425	0.453	0.483	0.514	0.546	0.580	0.617	0.658	0.706	0.766	0.909
0.88	0.75		0.132	0.370	0.398	0.426	0.456	0.487	0.519	0.553	0.590	0.631	0.679	0.739	0.882
0.86	0.76		0.105	0.343	0.371	0.400	0.429	0.460	0.492	0.526	0.563	0.605	0.652	0.713	0.855
0.83	0.77		0.079	0.316	0.344	0.373	0.403	0.433	0.466	0.500	0.537	0.578	0.626	0.686	0.829
0.80	0.78		0.052	0.289	0.318	0.347	0.376	0.407	0.439	0.574	0.511	0.552	0.559	0.660	0.802
0.78	0.79		0.026	0.262	0.292	0.320	0.350	0.381	0.413	0.447	0.484	0.525	0.573	0.634	0.776
0.75	0.8			0.235	0.266	0.294	0.324	0.355	0.387	0.421	0.458	0.449	0.547	0.608	0.750
0.72	0.81			0.209	0.240	0.268	0.298	0.329	0.361	0.395	0.432	0.473	0.521	0.581	0.724
0.70	0.82			0.183	0.214	0.242	0.272	0.303	0.335	0.369	0.406	0.447	0.495	0.556	0.698
0.67	0.83			0.157	0.188	0.216	0.246	0.277	0.309	0.343	0.380	0.421	0.469	0.530	0.672
0.65	0.84			0.131	0.162	0.190	0.220	0.251	0.283	0.317	0.354	0.395	0.443	0.503	0.646
0.62	0.85			0.105	0.135	0.164	0.194	0.225	0.257	0.291	0.328	0.369	0.417	0.477	0.620
0.59	0.86			0.079	0.109	0.138	0.167	0.198	0.230	0.265	0.302	0.343	0.390	0.451	0.593
0.56	0.87			0.053	0.082	0.111	0.141	0.172	0.204	0.238	0.275	0.316	0.364	0.424	0.567
0.53	0.88			0.029	0.055	0.084	0.114	0.145	0.177	0.211	0.248	0.289	0.337	0.397	0.540
0.51	0.89				0.028	0.057	0.086	0.117	0.149	0.184	0.221	0.262	0.309	0.370	0.512
0.48	0.90					0.029	0.058	0.089	0.121	0.156	0.193	0.234	0.281	0.48	0.484

Main protection recommendations

VarSet Easy PFC Equipment without incomer circuit breaker

Following protection are defined in coordination with embedded protection inside the equipment.

Short circuit withstand current 15 kA		
Power kvar	**References**	**Designation**
7.5	A9F85320	ACTI9 IC60H 3P 20A
15	A9F85332	ACTI9 IC60H 3P 32A
17.5	A9F85340	ACTI9 IC60H 3P 40A
20	A9F85340	ACTI9 IC60H 3P 40A
25	A9F85350	ACTI9 IC60H 3P 50A
30	A9F85363	ACTI9 IC60H 3P 63A

Short circuit withstand current 35 kA		
Power kvar	**References**	**Designation**
37.5	LV510336	CVS100F TM80D 3P3D
45	LV510337	CVS100F TM100D 3P3D
50	LV510337	CVS100F TM100D 3P3D
60	LV516332	CVS160F TM125D 3P3D
70	LV516333	CVS160F TM160D 3P3D
75	LV516333	CVS160F TM160D 3P3D
82.5	LV516333	CVS160F TM160D 3P3D
90	LV525332	CVS250F TM200D 3P3D
100	LV525332	CVS250F TM200D 3P3D
125	LV540305	CVS400F TM320D 3P3D
150	LV540305	CVS400F TM320D 3P3D
175	LV563305	CVS630F TM500D 3P3D
200	LV563305	CVS630F TM500D 3P3D
225	LV563305	CVS630F TM500D 3P3D
250	LV563305	CVS630F TM500D 3P3D
275	LV563306	CVS630F TM600D 3P3D
300	LV563306	CVS630F TM600D 3P3D
350	33466	NS800N MICROLOGIC 2.0
400	33466	NS800N MICROLOGIC 2.0
450	33472	NS1000N MICROLOGIC 2.0
500	33472	NS1000N MICROLOGIC 2.0
550	33478	NS1250N MICROLOGIC 2.0
600	33478	NS1250N MICROLOGIC 2.0

Main protection recommendations

VarSet Low polluted PFC Equipment without incomer circuit breaker

Following protection are defined in coordination with embedded protection inside the equipment.

Short circuit withstand current 15 kA		
Power kvar	References	Designation
6	A9F85313	ACTI9 IC60H 3P 13A
9	A9F85320	ACTI9 IC60H 3P 20A
12.5	A9F85332	ACTI9 IC60H 3P 32A
16	A9F85340	ACTI9 IC60H 3P 40A
22	A9F85350	ACTI9 IC60H 3P 50A
32	A9F85363	ACTI9 IC60H 3P 63A

Short circuit withstand current 35 kA		
Power kvar	References	Designation
34	LV430631	NSX160F TM125D 3P3T
37.5	LV430631	NSX160F TM125D 3P3T
50	LV430630	NSX160F TM160D 3P3T
69	LV431631	NSX250F TM200D 3P3
75	LV431631	NSX250F TM200D 3P3
87.5	LV431630	NSX250F TM250D 3P3T
100	LV431630	NSX250F TM250D 3P3T

Short circuit withstand current 50 kA			Short circuit withstand current 65 kA	
Power kvar	References	Designation	References	Designation
125	LV432693	NSX400N 400A 3P3T MICROLOGIC 2.3	LV432695	NSX400H 400A 3P3T MICROLOGIC 2.3
137.5	LV432693	NSX400N 400A 3P3T MICROLOGIC 2.3	LV432695	NSX400H 400A 3P3T MICROLOGIC 2.3
150	LV432693	NSX400N 400A 3P3T MICROLOGIC 2.3	LV432695	NSX400H 400A 3P3T MICROLOGIC 2.3
175	LV432693	NSX400N 400A 3P3T MICROLOGIC 2.3	LV432695	NSX400H 400A 3P3T MICROLOGIC 2.3
200	LV432693	NSX400N 400A 3P3T MICROLOGIC 2.3	LV432695	NSX400H 400A 3P3T MICROLOGIC 2.3
225	LV432893	NSX630N 630A 3P3T MICROLOGIC 2.3	LV432895	NSX630H 630A 3P3T MICROLOGIC 2.3
237.5	LV432893	NSX630N 630A 3P3T MICROLOGIC 2.3	LV432895	NSX630H 630A 3P3T MICROLOGIC 2.3
250	LV432893	NSX630N 630A 3P3T MICROLOGIC 2.3	LV432895	NSX630H 630A 3P3T MICROLOGIC 2.3
275	LV432893	NSX630N 630A 3P3T MICROLOGIC 2.3	LV432895	NSX630H 630A 3P3T MICROLOGIC 2.3
300	LV432893	NSX630N 630A 3P3T MICROLOGIC 2.3	LV432895	NSX630H 630A 3P3T MICROLOGIC 2.3

Short circuit withstand current 50 kA			Short circuit withstand current 65 kA	
Power kvar	References	Designation	References	Designation
350	33466	NS800N MICROLOGIC 2.0	33467	NS800H MICROLOGIC 2.0
400	33472	NS1000N MICROLOGIC 2.0	33473	NS1000H MICROLOGIC 2.0
450	33472	NS1000N MICROLOGIC 2.0	33473	NS1000H MICROLOGIC 2.0
500	33478	NS1250N MICROLOGIC 2.0	33479	NS1250H MICROLOGIC 2.0
550	33478	NS1250N MICROLOGIC 2.0	33479	NS1250H MICROLOGIC 2.0
600	33478	NS1250N MICROLOGIC 2.0	33479	NS1250H MICROLOGIC 2.0
700	-	-	33467 33473	NS800H MICROLOGIC 2.0 NS1000H MICROLOGIC 2.0
900	-	-	33467 33473	NS800H MICROLOGIC 2.0 NS1000H MICROLOGIC 2.0
1000	-	-	33479 x 2	NS1250H MICROLOGIC 2.0
1150	-	-	33479 33483	NS1250H MICROLOGIC 2.0 NS1600H MICROLOGIC 2.0

Main protection recommendations

VarSet polluted PFC Equipment without incomer circuit breaker

Following protection are defined in coordination with embedded protection inside the equipment.

	Short circuit withstand current 50 kA		Short circuit withstand current 65 kA	
Power kvar	References	Designation	References	Designation
50	LV431830	NSX250N TM250D 3P3T	LV431670	NSX250H TM250D 3P3T
75	LV431830	NSX250N TM250D 3P3T	LV431670	NSX250H TM250D 3P3T
87.5	LV431830	NSX250N TM250D 3P3T	LV431670	NSX250H TM250D 3P3T
100	LV431830	NSX250N TM250D 3P3T	LV431670	NSX250H TM250D 3P3T
125	LV431830	NSX250N TM250D 3P3T	LV431670	NSX250H TM250D 3P3T
137.5	LV432693	NSX400N 400A 3P3T MICROLOGIC 2.3	LV432695	NSX400H 400A 3P3T MICROLOGIC 2.3
150	LV432693	NSX400N 400A 3P3T MICROLOGIC 2.3	LV432695	NSX400H 400A 3P3T MICROLOGIC 2.3
175	LV432693	NSX400N 400A 3P3T MICROLOGIC 2.3	LV432695	NSX400H 400A 3P3T MICROLOGIC 2.3
200	LV432693	NSX400N 400A 3P3T MICROLOGIC 2.3	LV432695	NSX400H 400A 3P3T MICROLOGIC 2.3
225	LV432893	NSX630N 630A 3P3T MICROLOGIC 2.3	LV432895	NSX630H 630A 3P3T MICROLOGIC 2.3
250	LV432893	NSX630N 630A 3P3T MICROLOGIC 2.3	LV432895	NSX630H 630A 3P3T MICROLOGIC 2.3
275	LV432893	NSX630N 630A 3P3T MICROLOGIC 2.3	LV432895	NSX630H 630A 3P3T MICROLOGIC 2.3
300	LV432893	NSX630N 630A 3P3T MICROLOGIC 2.3	LV432895	NSX630H 630A 3P3T MICROLOGIC 2.3
350	33466	NS800N MICROLOGIC 2.0	33467	NS800H MICROLOGIC 2.0
400	33466	NS800N MICROLOGIC 2.0	33467	NS800H MICROLOGIC 2.0
450	33472	NS1000N MICROLOGIC 2.0	33473	NS1000H MICROLOGIC 2.0
500	33478	NS1250N MICROLOGIC 2.0	33479	NS1250H MICROLOGIC 2.0
550	33478	NS1250N MICROLOGIC 2.0	33479	NS1250H MICROLOGIC 2.0
600	33482	NS1600N MICROLOGIC 2.0	33483	NS1600H MICROLOGIC 2.0
700	-	-	33461 33473	NS630BH MICROLOGIC 2.0 NS1000H MICROLOGIC 2.0
800	-	-	33461 33473	NS630BH MICROLOGIC 2.0 NS1000H MICROLOGIC 2.0
900	-	-	33467 33473	NS800H MICROLOGIC 2.0 NS1000H MICROLOGIC 2.0
1000	-	-	33473 x 2	NS1000H MICROLOGIC 2.0
1100	-	-	33473 33479	NS1000H MICROLOGIC 2.0 NS1250H MICROLOGIC 2.0
1150	-	-	33479 x 2	NS1250H MICROLOGIC 2.0

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Relevant documents

Relevant documents published by Schneider Electric

- Electrical Installation Guide.
- Expert Guide n°4: "Harmonic detection & filtering".
- Expert Guide n°6: "Power Factor Correction and Harmonic Filtering Guide"
- Technical Guide 152: "Harmonic disturbances in networks, and their treatment".
- White paper: controlling the impact of Power Factor and Harmonics on Energy Efficiency.

Relevant websites

- http://www.schneider-electric.com
- https://www.solution-toolbox.schneider-electric.com/segment-solutions
- http://engineering.electrical-equipment.org/
- http://www.electrical-installation.org

Relevant standards

- IEC 60831 - Shunt power capacitors of the self healing for a.c. systems up to 1000V
- IEC 61642 - Application of filters and shunt capacitors for industrial a.c. networks affected by harmonics
- IEC 61921 - Power capacitors-low voltage power factor correction capacitor banks

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Notes

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Green Premium is the only label that allows you to effectively develop and promote an environmental policy whilst preserving your business efficiency. This ecolabel guarantees compliance with the most up-to-date environmental regulations, but it does more than this.

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