Exact Technology ● Exact Solution ● Exact Quality

Power Quality
STATCOM

Power factor correction

Load balancing

Voltage regulation

Voltage ride through support

Flicker compensation
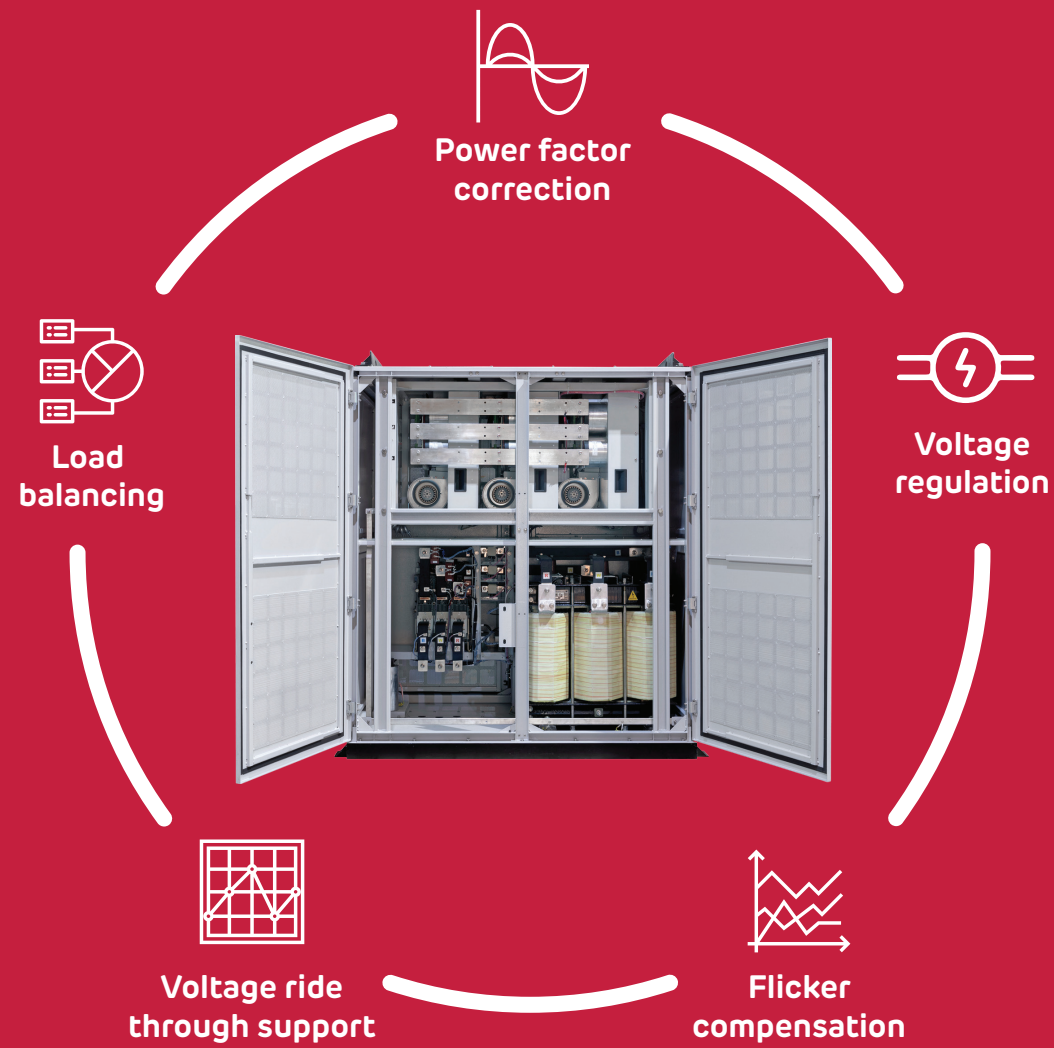
Exactly **Endoks**

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What is STATCOM?

Synchronous Static Compensator (STATCOM) is a state-of-art dynamic shunt compensation system being a member of Flexible AC Transmission System (FACTS) family. STATCOM provides fast and dynamic compensation thanks to its IGBT based voltage-source converter (VSC) technology. Advanced control system of STATCOM enables its VSC to inject dynamic capacitive or inductive reactive power independent of the grid voltage in order to satisfy the compensation requirements. STATCOM can additionally perform load balancing and harmonic filtering that are very beneficial for power quality improvement.

Endoks STATCOM Solution

Endoks offers a powerful and a cost effective STATCOM solutions to fulfill power quality and grid support requirements in a broad range of applications. Endoks STATCOM solution has a cutting-edge modular system design being scalable in a wide compensation range from 100kVAR to 10MVAR.

Benefits

- Improves power quality in industries and utilities
- Prevents penalties against power quality parameters
- Increases voltage stability and transmission network transfer capability
- Reduces system losses and maintenance costs
- Ensures grid compliance and maximizes productivity for wind and solar power plants
- Damps system disturbances and oscillations

Features

- Step-less dynamic compensation
- Fast response time (<5ms)
- Modular and scalable system configuration from 100kVAR to 10MVAR.
- High availability & reliability and easy maintenance thanks to the modular design
- Easy integration to new or existing plants thanks to the small footprint
- Fully programmable interface including industrial communication protocols and monitoring options

Functions

- Reactive Power Compensation & Power Factor Control
- Voltage Regulation
- Flicker Compensation
- Unbalance Compensation
- High and Low Voltage Ride Through Support
- Harmonic Compensation (only 3rd, 5th, 7th, 11th & 13th orders)
- Active Oscillation and Resonance Damping

Applications

- Transmission and Distribution Utilities
- Metal Industry
- Mining Industry
- Oil and Gas Industry
- Cement Production Industry
- Automotive Industry
- Railway Transmission Systems
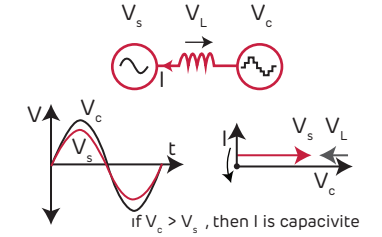- Grid code compliance applications of solar and wind energy systems

Fundamental Operating Principles and Characteristic
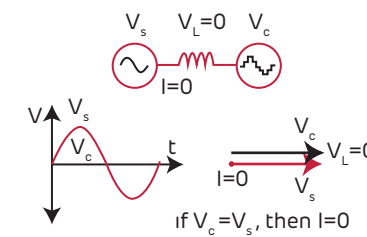
STATCOM in standby mode with zero current output. When VSC voltage equal in magnitude to system voltage
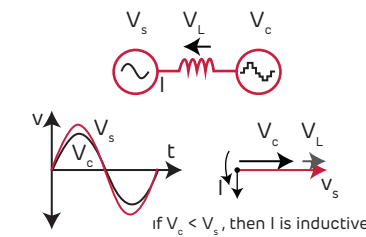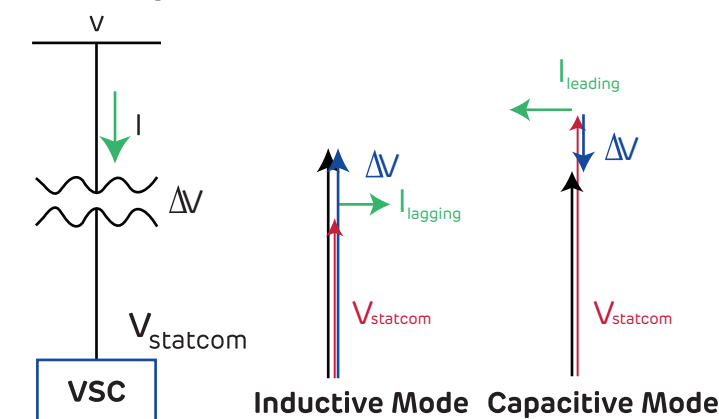
STATCOM in Inductive mode with lagging current output. When VSC voltage smaller in magnitude than system voltage

STATCOM in Capative mode with leading current output. When VSC voltage greater in magnitude than system voltage

Principle

[Inductive mode] If $V_{statcom}$ is lower than V, the inductive current flows from the AC system to the converter [Capacitive mode] If $V_{statcom}$ is higher than V, the capacitive current flows the converter to the AC system

Functions of Transmission Line

- Voltage Stability
- Enhancement of Trasmission Capability
- Improvement of Transiebt Stability

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Characteristics

STATCOM can be operated in two different modes:
- In voltage regulation mode (The voltage is regulated within limits as explained below)
- In VAR control mode
  (STATCOM reactive power output is kept constant)

When STATCOM is operated in voltage regulation mode, it implements the following V-I characteristic. STATCOM can be operated over its full output current range even at very low system voltage levels.

In other words, the maximum capacitive or inductive output current of STATCOM can be maintained independently of the AC system voltage, and the maximum VAR generation or absorption changes linearly with the ac system voltage.
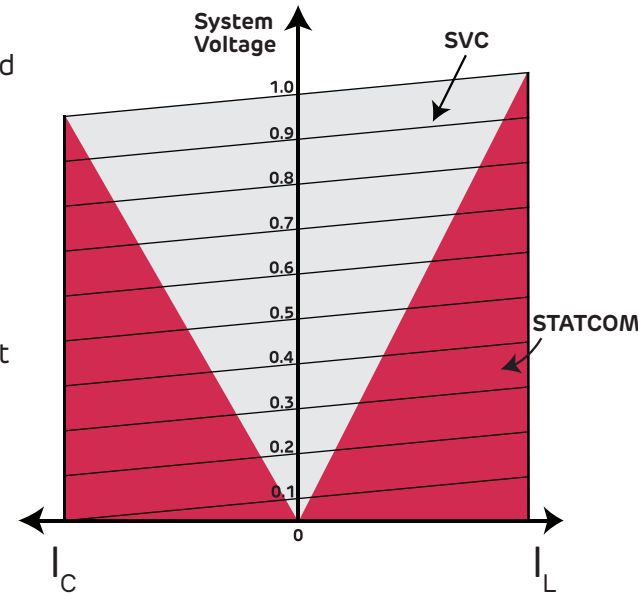
Operation Principles

- Statcom is a controlled current source device with IGBT based converter technology.
- Reactive power is transferred through a coupling reactor in capacitive and inductive regions by the generation of magnitude-controlled voltage at the converter ouput. STATCOM provides its nominal current irrespective of the network voltage by controlling converter output voltage.
- Statcom is able to inject anti-phase low order harmonic currents to minimize current distortion at supply side. Harmonic filtering is limited to most common LV network harmonics which are 3rd, 5th, 7th, 11th and 13rd harmonics.
- Unsymmetrical load currents are balanced by injecting negative sequence currents to the network.
- STATCOM provides the best voltage regulation performance during voltage sags/swells by using its overload capability in addition to fastest reactive power generation.

Before STATCOM | Harmonic Filtering | Reactive Power Compensation

Before STATCOM | Load Balancing
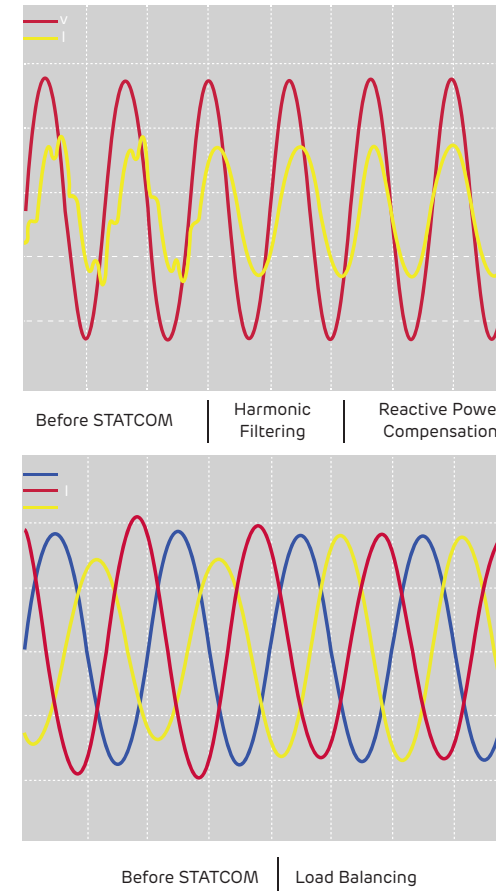
Statcom Product Family

MODELS	ES400 / ES400N	ES690	ES1000
Nominal Reactive Power *	±100 to ±250 kVAr	±250 to ±500 kVAr	±500 to ±1000 kVAr
Nominal Voltage **	400 Vrms (±10 %)	690 Vrms (±10 %)	1000 Vrms (±10 %)
Nominal Current	160 to 400 Arms (x3 Neutral Current for ES400N)	232 to 465 $_{Arms}$	320 to 640 $_{Arms}$
Overload Capability	Optional		
Network Frequency	50-60Hz (±5 %)		
Line Connection	3 phase/3 wire - 3 phase/4 wire	3 phase/3 wire	3 phase/3 wire
Operation Modes	Reactive / Harmonic / Unbalance / Voltage Regulation		
Compensation Modes	Closed Loop / Open Loop / Fixed / Hybrid / Remote		
Harmonics Elimination	Selective / 3 (ES400N) , 5, 7, 11, 13		
Load Balancing ***	Phase to Phase / Phase to Neutral (for ES400 and ES400N)		
Efficiency	<2,7%	<3%	<3%
Response Time	<1ms		
Parallel Operation	Up to 8 Modules in Master / Slave Configuration		
User Interface ****	4.3' Touch Screen	4.3' Touch Screen	10' Touch Screen
Communication	MODBUS RTU / TCP		
Operation Temperature	50'C without derating (IEC60721-3-3, Class 3k3)	50'C without derating (IEC60721-3-3, Class 3k3)	45'C without derating (IEC60721-3-3, Class 3k3)
Cooling Method	Air	Air	Liquid
Noise Leve	<68dBA	<70dBA	<70dBA
Humidity	5% to 85% (IEC60721-3-3, Class 3k3)		
Installation Altitude	1000m without derating (IEC60721-3-3, Class 3k3)		

* Other power ratings available on customer request *** Max 50 % of nominal current
** Other voltage ratings available on customer request **** Other screen sizes up to 10' available on customer request

Interface