Opening the future of smart energy...
FACTS are consisted of power electronics and other static components to increase controllability and power transfer capability of AC network. Representative systems are SVC and STATCOM.

- Provide dynamic reactive power support and voltage control.
- Suppression flicker by fluctuating load
- Mitigate potential sub-synchronous resonance problems.
- Improve system stability.

**SVC**

SVC system are consisted of thyristor-controlled reactor (TCR) and the thyristor switched capacitor (TSC) as well as harmonic filters.

SVC is the most widely employed FACTS device around the world.

**STATCOM**

Like an SVC, the STATCOM (Static Synchronous Compensator) enhances the stability of grid voltage by introducing the voltage sourced MMC (Modular Multilevel Converter) technology. LSIS’ most advanced “SVC Compact” provides high-performance in remarkably compact footprint.

**FACTS applications and benefit**

<table>
<thead>
<tr>
<th>Power</th>
<th>Voltage control</th>
<th>Stability improve</th>
<th>Power factor improve</th>
<th>Reactive power control</th>
<th>Power loss reduce</th>
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<tbody>
<tr>
<td>Utility company</td>
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<td>IPP (Independent Power Plant)</td>
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<td>Wind and solar farm</td>
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<thead>
<tr>
<th>Steel</th>
<th>Flicker, THD reduce</th>
<th>Power factor improve</th>
<th>Productivity improve</th>
<th>Voltage control</th>
<th>Reactive power control</th>
<th>Power loss reduce</th>
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<tbody>
<tr>
<td>Steel company</td>
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<tr>
<td>Smelting company</td>
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<tr>
<td>Special steel company</td>
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</table>

<table>
<thead>
<tr>
<th>Mine, Gas &amp; Oil</th>
<th>Productivity improve</th>
<th>Power factor improve</th>
<th>Flicker, THD reduce</th>
<th>Voltage control</th>
<th>Voltage control</th>
<th>Reactive power control</th>
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</thead>
<tbody>
<tr>
<td>Mining company</td>
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<td>Gas plant</td>
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<tr>
<td>Oil plant</td>
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</table>
Electrical grid management
The FACTS system can improve performance of transmission and distribution grid. Installing the FACTS suitable points in the grid can increase transfer capability and reduce losses while maintaining a voltage profile under different network conditions. The dynamic stability of the grid can also be improved, and active power oscillations mitigated.

Power quality stabilization
In industrial applications, the electronic rectifiers applied to the electrolysis power supply and mill machine requires large amount of reactive power. The use of arc furnace usually comes with voltage fluctuation and flicker and large harmonics. Large amount of reactive power demand and reactive power variation result in the voltage fluctuation and flicker, which also reduces the operation efficiency. The FACTS system can supply sufficient reactive power as well as eliminate the harmonics generated by rectifiers and prevent the equipment from the voltage fluctuation.
### SVC main components

- SVC transformers
- Circuit breaker
- Thyristor valve
  - Thyristor Controlled Reactors (TCR)
  - Thyristor Switched Capacitors (TSC)
- Cooling system
- Harmonic filters
- Control & protection

### SVC control & protection system

Standard equipment for closed-loop and open loop control, commercially available and in use for multiple applications. Programming and customization of control functions are simplified by the use of a graphical programming interface. (LSIS’ OPAS : Open Process Automation System)

- Multiple control modes can meet the requirements of different industry fields
  - Voltage control
  - Flicker compensation
  - Manual suscetance regulation
  - Unbalance control
  - Reactive power control
  - Power factor control
  - Negative sequence control

- High accurate control angle(0.01°), large control range(95°-175°)
- Full redundancy system(optional)
- User optimized HMI(Human Man Interface)
- Reliable protection scheme
- Fast response time
Configuration of C&P system

Smart SVC Center in Ulsan, Korea

SVC HMI (OWS)
SVC C&P panel
SVC Eng. tool (EWS)

FACTS (Flexible AC Transmission System)
STATCOM main components

- STATCOM transformers
- Circuit breaker
- MMC valve
- Cooling system
- Control & protection

1. Control and protection
   - Fully redundant system
   - Easy parallel operation
   - Remote control and monitoring
   - Self-diagnosis

2. Submodule and valve tower
   - Modular design
   - High speed bypass switch (Operating time < 2ms)
   - Long life time
   - Easy maintenance

3. AC yard (Reactor)
   - Harmonic filter (optional)
   - Small footprint reactor
   - Simple connection

4. Valve cooling system
   - Easy user interface and maintenance
   - Low acoustic noise
   - Flexible layout of heat exchangers (Roof or Ground)
• Container type 50Mvar STATCOM

• Container type 100Mvar STATCOM
Technology
Due to the MMC (Modular Multilevel Converter) technology, the degree of harmonic generation emission is quite small.

Specifications & VI characteristic
Typical specifications of LSIS can be changed by requirements of customer, also can be optimized according to condition. The STATCOM can be installed in a container or building types, depending on the system voltage and capacity.

<table>
<thead>
<tr>
<th></th>
<th>Rated power</th>
<th>±20Mvar ~ ±200Mvar</th>
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</thead>
<tbody>
<tr>
<td>Rated voltage</td>
<td>Up to 12kV _Lrms [Without Transformer] Above 13kV _Lrms [With Transformer]</td>
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<tr>
<td>Connection type</td>
<td>( \Delta )-connection</td>
<td></td>
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<tr>
<td>System loss</td>
<td>Less than 1.5%</td>
<td></td>
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<tr>
<td>Response time</td>
<td>Less than 16ms</td>
<td></td>
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<tr>
<td>Cooling system</td>
<td>Deionized water</td>
<td></td>
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<tr>
<td>Control mode</td>
<td>Voltage regulation</td>
<td></td>
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<tr>
<td></td>
<td>Reactive power control</td>
<td></td>
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<tr>
<td></td>
<td>Voltage unbalance control</td>
<td></td>
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<tr>
<td></td>
<td>Power factor control</td>
<td></td>
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<tr>
<td></td>
<td>Flicker control</td>
<td></td>
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<tr>
<td>Protection mode</td>
<td>OV, UV, OC, SC, etc.</td>
<td></td>
</tr>
<tr>
<td>Life time</td>
<td>20 years</td>
<td></td>
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<tr>
<td>Installation type</td>
<td>Container [45ft] / Building</td>
<td></td>
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</tbody>
</table>
VI characterstic & control performance

System voltage support and stabilization by smooth but fast (< 16ms) control over a wide range of operating conditions. Control system maintain submodule capacitor voltage ripple lower than 10%. A dynamic response is follow the system contingencies.
Busan HVDC/FACTS plant

LSIS’ busan HVDC plant, established in 2011, is the first and only facility in Korea. HVDC & FACTS valve development, production and various DC tests including C&P (Control & Protection) are available.
LSIS provides total HVDC & FACTS solution from system design, equipment design, manufacture & tests, commissioning, and maintenance. Proposal is optimized by customer’s needs, use condition and location.
Specifications in this catalog are subject to change without notice due to continuous product development and improvement.