

CSD100

Circuit Breaker Controller

GE Vernova's CSD100 is an advanced controlled switching device for high-voltage AC circuit breakers, also known as a point-on-wave controller. The ability to mitigate switching transients is becoming a key issue for today's grids as the resulting stresses can lead to power quality problems and accelerated aging. CSD100 provides utilities with a cost-effective, streamlined solution to preserve valuable assets and improves system reliability with seamless circuit breaker operations.

More Grid Reconfigurations

As power systems evolve and more intermittent renewable generation is brought online, the number of intentional circuit breaker operations increases. These power sources present new operational challenges for power system operators, including:

- Grid instability
- Daily load variation, requiring reactive power compensation
- The need to transmit large amounts of energy since power sources are often distant from main consumption centers

Additionally, several years of digitalization have brought new challenges, including:

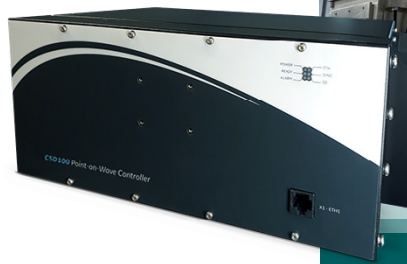
- Transitioning towards the next generation of digital substations
- Easier acquisition and retrieval of data from primary assets
- Managing and operating substations with large amounts of data and intelligent electronic devices (IEDs)

A Versatile and State-of-the-Art Solution

- Switching performance evaluation
- High-speed transient recorder (COMTRADE standard)
- Multiple load switching in ring layouts, including tie circuit breakers or variable loads
- Built-in cybersecurity features in line with the latest NERC, IEC, and IEEE standards
- Simplified integration into digital substations and associated secondary systems
- Monitoring features for an all-in-one solution
- Flexible mounting options (local cubicle or 19-inch bay mounting)

Self-Adaptation to Maintain Accuracy

To ensure and maintain switching accuracy, CSD100 evaluates key circuit breaker condition data, including ambient temperature, control voltage, driving pressure of hydraulic mechanisms, circuit breaker idle time, and long-term operation time drift.



Controlled Switching Applications

- Shunt-reactors
- Capacitor banks and AC filters
- Power transformers
- Overhead lines (uncompensated and compensated) including auto-reclose
- Compensated transmission cables

Monitoring Features

Extensive data acquisition

- High resolution (40 kHz) / High bandwidth acquisition
- Extensive storage capabilities (10,000+ records)

Power quality indicators

- Voltage dip, peak current, reignitions

Circuit breaker condition monitoring

- Electric wear (I^2t), insulating gas density, travel curve

Advanced Communications

- Digital communication interface : SFP transceivers 10/100/1000BASE-T, 100BASE-FX, 1000BASE-SX
- Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR) (IEC 62439-3)
- IEC 61850 MMS server Ed 2.1
- GOOSE publisher / subscriber
- Sampled Values subscriber (IEC 61869-9 and 9.2LE compatible)
- Time synchronization over PTP (IEC/IEEE 61850-9-3)

Cybersecurity

- IEC 62443-4-2 certified
- Authentication, RBAC
- Security events logging, Syslog
- Network segregation, VLAN
- Host hardening
- Software integrity



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Key Characteristics – Local Cubicle Integration

CSD100 is a very compact form-factor rack, available off-the-shelf, as an all-in-one box, with a versatile range of fully isolated Inputs and Outputs. A single hardware version integrating all controlled switching functionalities, monitoring features and communication capabilities is provided.

By design, CSD100 can be integrated in Low Voltage Cubicles. When used within Grid Solutions' Digital-Native circuit breakers, equipped with low scattering drives and the latest mechanical sensors technology, the solution reduces commissioning time and improves controlled operations accuracy.

Safe Switching for Reactive Power Compensation

To accommodate daily load variations, Capacitor Banks and Shunt Reactors help stabilize and improve the power factor. Acting as reactive power generators, their switching needs to be controlled precisely to mitigate the related electrical transients. This limits damageable stress on the circuit breaker and the compensation load.

Silent Connection of Transformers to the Grid

Connecting and disconnecting intermittent power sources such as wind or solar farms, pumped storage, gas power plants or even interconnection transformers from the grid may generate switching transients.

These transients can cause electrical stresses on critical substation equipment, and can introduce power quality issues, such as high inrush currents and voltage dips in the system.

With active recording of voltage signals and other key electrical parameters during switching events, CSD100 automatically calculates residual magnetic flux in the transformer's core and automatically adjusts control operations. Matching source flux to transformer's residual flux (low-flux grading), minimizes inrush currents and voltage dips, and thereby improves power quality and extends transformer life.

Seamless Switching of Overhead Lines

Power generation sources are often located far from main consumption areas. As a result, large amounts of energy need to be transmitted over long distances. Random switching of no-load lines generates a traveling voltage wave which, when reflected from the open end of the line causes an over-voltage along the length of the line.

In auto-reclose situation, overvoltage is even larger because of the increased probability that a line has retained a trapped charge with opposite polarity.

CSD100 is the preferred solution to limit overvoltage during closing and auto-reclosing of line circuit-breakers. In auto-reclose situation, its capability to identify in real-time best close targets (three phases or single-phase auto-reclose) is unique. It can also be configured to eliminate current zero missing phenomena when energizing highly compensated lines and transmission cables.

The conventional approach of adding **closing resistors** to the circuit breaker, **can be effectively replaced by the CSD100.**

Automatic Reconfiguration

In many substation architectures, a single circuit breaker can switch different loads (e.g., one breaker-and-a-half scheme, ring scheme).

CSD100 provides multiple loads switching feature, allowing to use one single controller per circuit breaker whatever the substation architecture (layout with tie-circuit breaker) and whatever the operating mode.

The switching configuration is automatically selected from the positions of the substation switchgears (circuit breakers, disconnecter switches...).

Asset Performance Management

With extensive data acquisition and storage capabilities, CSD100 allows for extensive monitoring and improved switching to protect equipment. Together with its digital communication abilities, CSD100 can be placed at the center of an Asset Performance Management (APM) strategy. High resolution records created upon each circuit breaker operation are available for the entire service life of the primary equipment, **for controlled and uncontrolled operations.**

General Ratings

DESCRIPTION	VALUE
Dimensions	19" rack or local cubicle mounting Height: 3U, Depth: 250mm
Weight	5.8 kg (12.8 lbs)
Operation temperature	-40 °C to +70 °C
Enclosure class	IP5x
Product safety	IEC 61010-1; IEC 60255-27
EMC compliance	IEC 61000-6-5; IEC 60255-26; EN 55032
Eco-design compliance	RoHS directive and REACH regulation
Power consumption	< 30 W
Switching time accuracy	< 10 µs
Transient data acquisition	10,000+ records, 40 kHz sampling rate
Universal Input/Output range	Voltage inputs up to 250 VAC Current inputs up to 20 A Binary inputs from 48 VDC to 250 VDC Control voltage up to 250 VDC

For more information, visit
governova.com/grid-solutions

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