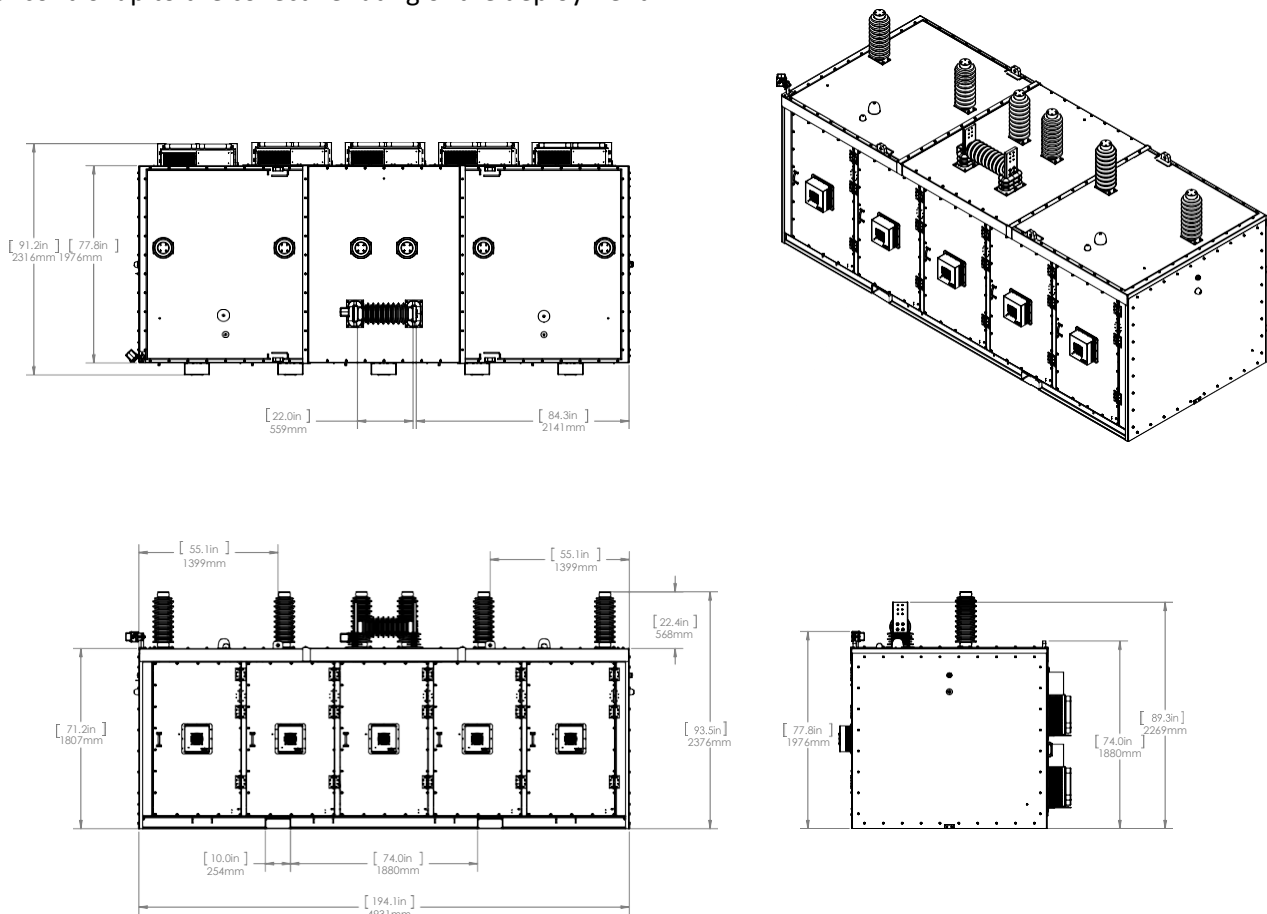


The SmartValve™ builds upon the success of its predecessors. By using revolutionary power electronics, the SmartValve effectively increases or decreases the reactance of a given circuit, enabling real-time control of power flow. A modular, Static Synchronous Series Compensator (SSSC), the SmartValve injects a leading or lagging voltage in quadrature with the line current, providing the functionality of a series capacitor or series reactor respectively. However, unlike conventional series capacitors or reactors, the SmartValve can inject the voltage independently of the line current, thus increasing the ohmic injection when operated below the rated value. Also, the SmartValve does not have the negative characteristics of these passive devices, such as the risk of sub-synchronous resonance (SSR) with series capacitors and the constant VAR consumption of series reactors. As a modular device that can be deployed and re-deployed, the solution size of an installation can be scaled up or down to support the dynamic needs of the transmission grid. Given the fast response of the unit's power electronics, the unit can provide dynamic services and its set-point can be changed frequently to actively manage power flows with no degradation in unit life.

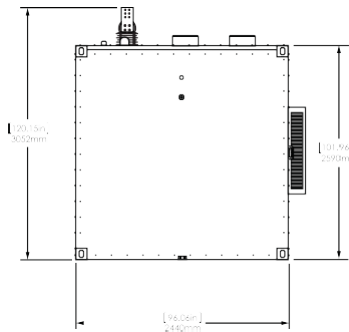
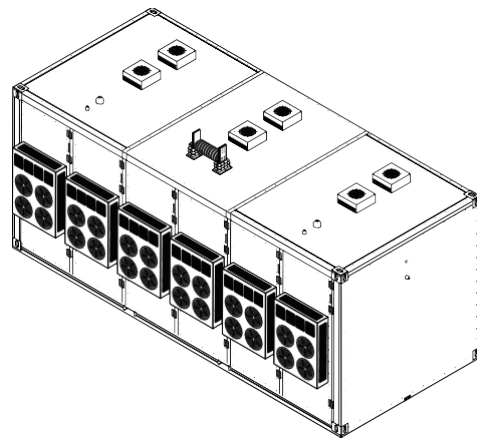
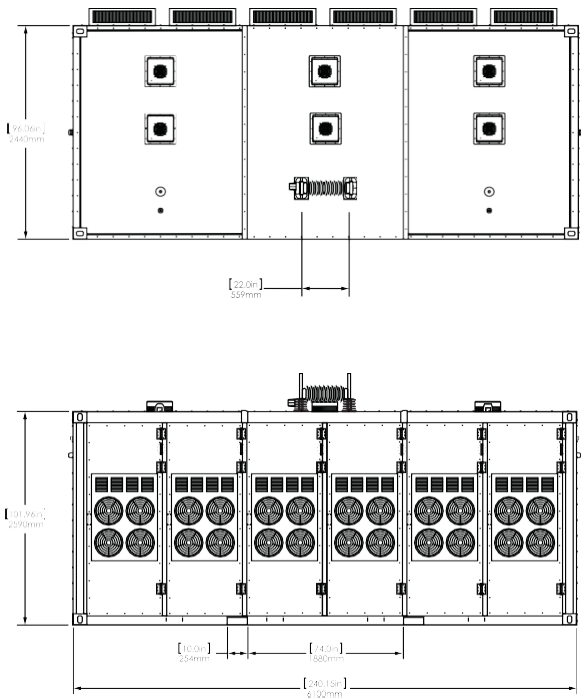
The SmartValve enables utilities to get more from their existing grid by:

- Addressing short-duration and emergency needs with rapidly deployable and easily re-deployable solutions
- Accommodating changes in generation and load by deploying a fleet of units in weeks rather than years
- Pushing power away from overloaded transmission facilities or pulling power onto underutilized facilities
- Avoiding the use of precious substation space
- Providing high uptime via a modular solution with no single point of failure

The SmartValve is available with 10 MVAR and 16 MVAR ratings. The first number in the Model number designates the MVAR rating, the second is the maximum continuous current rating, the “i” indicates that a bypass is incorporated within the SmartValve and the third number is the 1 second fault rating in kA RMS. For example, Model 16-2700i-63 has a reactive power rating of 16 MVAR, a maximum continuous current rating of 2700 A RMS, an integrated bypass and 1 second fault current rating of 63 kA RMS. These units are typically installed as part of a fleet and enable a continuous range of control up to the collective rating of the deployment.



SmartValve 10-1800i and SmartValve 10-3600i Dimensions



SmartValve 16-2700i Dimensions

Technical Specifications

Electrical

Maximum Voltage Injection	See Model Table below
Minimum Current for Monitoring ⁽¹⁾	50 A RMS
Minimum Current for Injection ⁽¹⁾	100 A RMS
Maximum Rate of Change of Frequency (ROCOF) Withstand	1 Hz/sec for 1s, 2 Hz/s for 0.25s

Physical

Mass	See Model Table Below
Dimensions	See Figure Above
Conductor Size Capacity	Agnostic
Mounting	Deployed in a bank, suspended from structure via insulators or as part of a Mobile SmartValve Unit
Cooling	Liquid-cooling interface between power semiconductors and redundant-fan-equipped liquid-to-air heat exchangers using redundant pumps all at line potential. Sealed intercoolers for controlling internal ambient temperature

Maximum Voltage (Corona-free)	550 kV RMS line-to-line
Power	Powered by line current
Operational Frequency Range	47.00 Hz – 52.00 Hz 57.00 Hz – 61.00 Hz
Fault Current Rating ⁽²⁾	63 kA RMS for 1 second
Peak Fault Current Rating ⁽²⁾	164 kA @ 60Hz 158 kA @ 50 Hz

Environmental

Operating Ambient Temperature Range ⁽³⁾	-40°F to 122°F (-40°C to 50°C)
Storage Temperature Range	-40°F to 122°F (-40°C to 50°C)
Condensing Operating Humidity Range	5% to 100%
Maximum Sustained Rain	4.0 in/hr (102 mm/hr)
Intrusion Protection	IEC 60529, Designed to IP 55, Tested to IP X5

Communication

Communication Architecture	EMS integration via PowerLine Gateway™ located at substation
Communication Security Features	Multilevel ISM band wireless protocol optimized for fast telemetry. Protocol uses SHA-256 to ensure cryptographic integrity of all messages while supporting full observability by utility firewalls

Other

Software and Firmware	Conforms to IEC 61508 SIL-2
Electrical Connections	ANSI C119.4

Sensor Accuracy

AC Line Current	± 3 %
-----------------	-------

Model	Injection Mode Continuous Current Rating (A RMS) ⁽³⁾	Maximum Voltage Injection at 50 Hz or 60 Hz (V RMS) ⁽⁴⁾	Mass (lbs (kg))	Maximum Ramp Rate (kV/sec) ⁽⁵⁾	Monitoring Mode Continuous Current Rating (A RMS) ^(3, 6)	Maximum 2-Hour Emergency Current (A RMS) ^(3, 6, 7)
<i>SmartValve 16-2700i-63</i>	2700	± 6000	26500 (12020)	25	3000	3000
<i>SmartValve 10-3600i-63</i>	3600	± 2830	16000 (7257)	4	3600	4320
<i>SmartValve 10-1800i-63</i>	1800	± 5660	16000 (7257)	8	1800	2160

Notes:

1. In Monitoring Mode, the SmartValve is bypassed and does not inject voltage, while telemetry data is still transmitted. In Injection Mode, the SmartValve injects voltage in series with the line and telemetry data is transmitted.
2. The following lower Fault Current Ratings are available upon request - 50.4 kA RMS for 1 second, 38 kA RMS for 1 second, 25.2 kA RMS for 1 second and 12.6 kA RMS for 1 second.
3. Current ratings of the SmartValve are dependent on the altitude and solar radiation, variations in these conditions may vary the temperature or current ratings of the SmartValve model.
4. Maximum RMS AC of the output voltage for an individual unit. Total voltage injection determined by the number of units per phase.
5. The value shown is for an individual unit. For multiple units in series, N, the maximum ramp rate of the set is N * Maximum Voltage Ramp Rate.
6. The ratings given are for operation at 50°C. Temperature-dependent ratings are available upon request.
7. Emergency current ratings apply to the SmartValve in both Injection Mode and Monitoring Mode.

About Smart Wires

Smart Wires is the world's leader in modular power flow control. Smart Wires technology enables utilities to unlock the large amounts of spare capacity that exists on their systems today. This means they can reduce congestion to save customers money and more quickly connect new renewables and demand. Increasing the use of the existing grid is more cost-effective and less disruptive to communities and the environment than traditional solutions. Smart Wires technology is quick to install and easy to scale or redeploy, providing valuable flexibility given today's rapidly changing electric system. Based in California, with offices in Ireland and Australia, Smart Wires partners with utilities around the globe to address the unique challenges they face.

While Smart Wires strives to make the content of its marketing materials as timely and accurate as possible, Smart Wires makes no claims, promises, or guarantees about the accuracy, completeness, or adequacy of, and expressly disclaims liability for errors and omissions in, such materials. No warranty of any kind, implied, expressed, or statutory, including but not limited to the warranties of non-infringement of third party rights, title, merchantability, and fitness for a particular purpose, is given with respect to the content of these marketing materials. © Copyright 2020, Smart Wires Inc. All rights reserved.

Smart Wires Inc.
3292 Whipple Road
Union City, CA 94587
Tel: (415) 800-5555
www.smartwires.com

D000813 Rev 200814

Regulatory Compliance User Notice:

FCC:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual may cause harmful interference to radio communications.

Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

ISED :

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- 1. This device may not cause interference.*
- 2. This device must accept any interference, including interference that may cause undesired operation of the device.*

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- 1. L'appareil ne doit pas produire de brouillage;*
- 2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

CAUTION:

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTES:

- *. 866 Mhz. operation is not supported in this version.