



LAYERZERO
POWER SYSTEMS, INC.

The Foundation Layer

Series 70 ePODs: Type-S

Two Transformers → Static Transfer Switch → Distribution



Product Brochure

The LayerZero ePODs: Type-S PDU Increases Operator Safety

ePODs Type-S Is Inspired by NFPA-70E

The Series 70 ePODs: Type-S provides switching between two independent power sources, with two transformers feeding secondary side static transfer switching, providing power distribution capabilities. The unit features a solid-state transfer switch on the secondary side of the transformer with a power distribution section, providing the ability to transfer power between two sources in quarter of an electrical cycle, while delivering that power to up to twelve sub-feed circuit breakers, or up to six 42-circuit panel boards.



LayerZero's ePODs: Type-P Is Equipped Fully-Loaded

Reliability

- ☑ **Optional Triple Modular Redundancy:** TMR Contains Fully-Independent Control Paths With No Single Point-Of-Failure
- ☑ **Safe Bypass Procedure:** Mechanical Bypass Interlock Eliminates Human Error When Performing Bypass Procedures
- ☑ **Voice Guided Bypass:** Step-By-Step Instructions With Audio and Video Guidance To Assist Operators Through Bypass
- ☑ **Convection Cooling:** Natural Convection-Cooled Heat Dissipation System is Maintenance-Free
- ☑ **Epoxy Coated Buswork:** Maximizes Reliability By Eliminating The Possibility of Bus-To-Bus Faults
- ☑ **Silver Plated Terminals:** Silver Has Excellent Conductivity To Provide Superior Electrical Performance and Reliability
- ☑ **Maintenance-Free Joints:** Brazed Joints Are Permanent And Maintenance-Free, Maximizing Product Life
- ☑ **Machined Hardware:** Machined Cap Screws and Engineered Disc Springs Maintain Constant Torque Throughout Product Life
- ☑ **Screw Thread Inserts:** Prevents Screws From Loosening Under Vibration For Long-Term Reliability
- ☑ **Optical Fiber Based Controls:** Eliminates Noise and Interference While Isolating Components from High Voltage
- ☑ **Serialized Critical Board Tracking:** Critical Boards Are Serialized And Cataloged in an Active Database For Traceability
- ☑ **Transformer Vibration Isolation:** Vibro-Elastic Pads to Absorb Vibrations from the Transformer

Safety

- ☑ **InSight™ IR Portholes:** Bolted Connections & Critical Boards Can Be IR Scanned With the Dead-Front Doors Closed
- ☑ **Sectionalized Components:** Isolated Sections That Can Be Safely De-Energized For Performing Maintenance
- ☑ **Polycarbonate Windows:** Allows Critical Board LEDs To Be Viewed With The Dead-Front Door Closed
- ☑ **Front-Only Access:** Installation and Maintenance Can Be Safely Performed Without Side or Rear Access
- ☑ **Dead Front Hinged Doors:** Barrier To Provide A Safe Working Area With No Exposed Live Parts
- ☑ **SafePanel™ Distribution:** NFPA-70E Inspired Finger-Safe Panel Board With No Exposed Live Parts

Connectivity

- ☑ **Ethernet Connectivity:** Secure VPN Router Connects To Network For Advanced Remote Monitoring Capabilities
- ☑ **Modbus/TCP:** Open Connectivity to Existing Monitoring Systems Without Proprietary Limitations
- ☑ **NTP Time Clock Synchronization:** Facilitates Timeline-Based Logging For Post-Event Reconstruction
- ☑ **SNMP Connectivity:** Permits Remote Management Via Simple Network Management Protocol

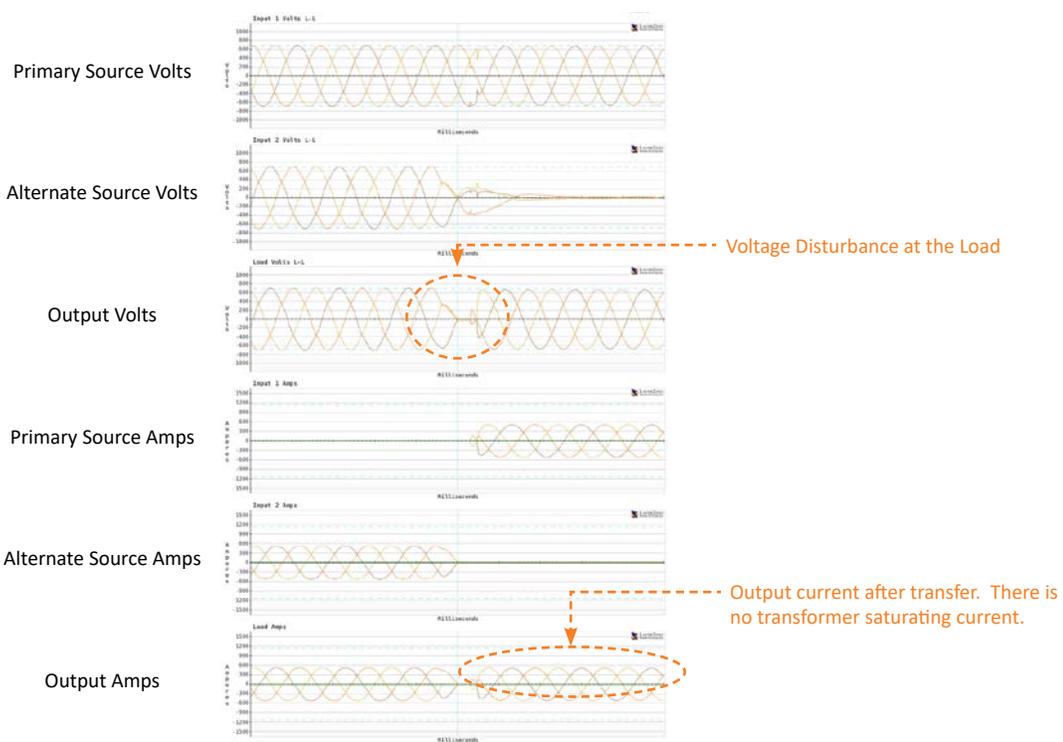


- ☑ **Real-Time Waveform Capture:** Automatically Captures A Picture Of The Power Three-Cycles Before and After Every Event
- ☑ **Local Touch-Screen Interface:** Password-Protected Color Touch-Screen GUI For Local STS Setup/Operation/Administration
- ☑ **Black-Box Forensics:** Captures and Records All Events To Provide Vital Information In Root-Cause Analysis
- ☑ **Waveforms Automatically Emailed:** Capability to Send Waveform Captures To Designated Individuals For Every Transfer

All LayerZero Power Systems products have on-board power quality analyzers that break down power sources into samples. If the power quality goes out of specification on a source, eSTS will transfer to the alternate source, automatically generating waveform captures and ITIC curves of the event. This data is remotely accessible by connecting to the unit via web browser.

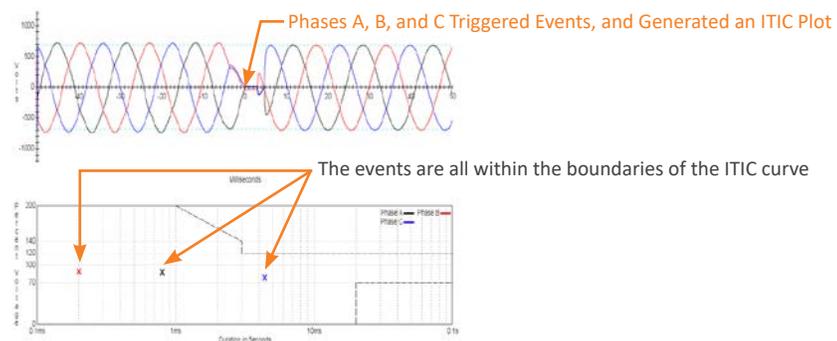
In the test below, the STS was connected to two sources 150 degrees out-of-phase. Source 2 breaker was opened, causing the STS to perform an automatic transfer to the primary source. A delayed transfer occurred, causing events on Phases A, B, and C, automatically generating ITIC plots. Unlike waveform captures, ITIC plots are easy-to-read, and do not require expert analysis to understand.

Example Waveform Capture of Source 2 to Source 1 Transfer Event, 150 Degrees Out-of-Phase



Source 2 to Source 1 Transfer Event, 150 Degrees Out-of-Phase - WFC & ITIC Plot

Dynamic Transfer was enabled during these tests in order to mitigate transformer inrush while completing the transfer within the boundaries set by the Information Technology Industry Council (ITIC).



The ability to keep the transfers within the ITIC limits was verified through the Voltage Disturbance Analysis Tool (VDAT) plot shown above in the captured waveform.

Equipment Layout

eSTS:

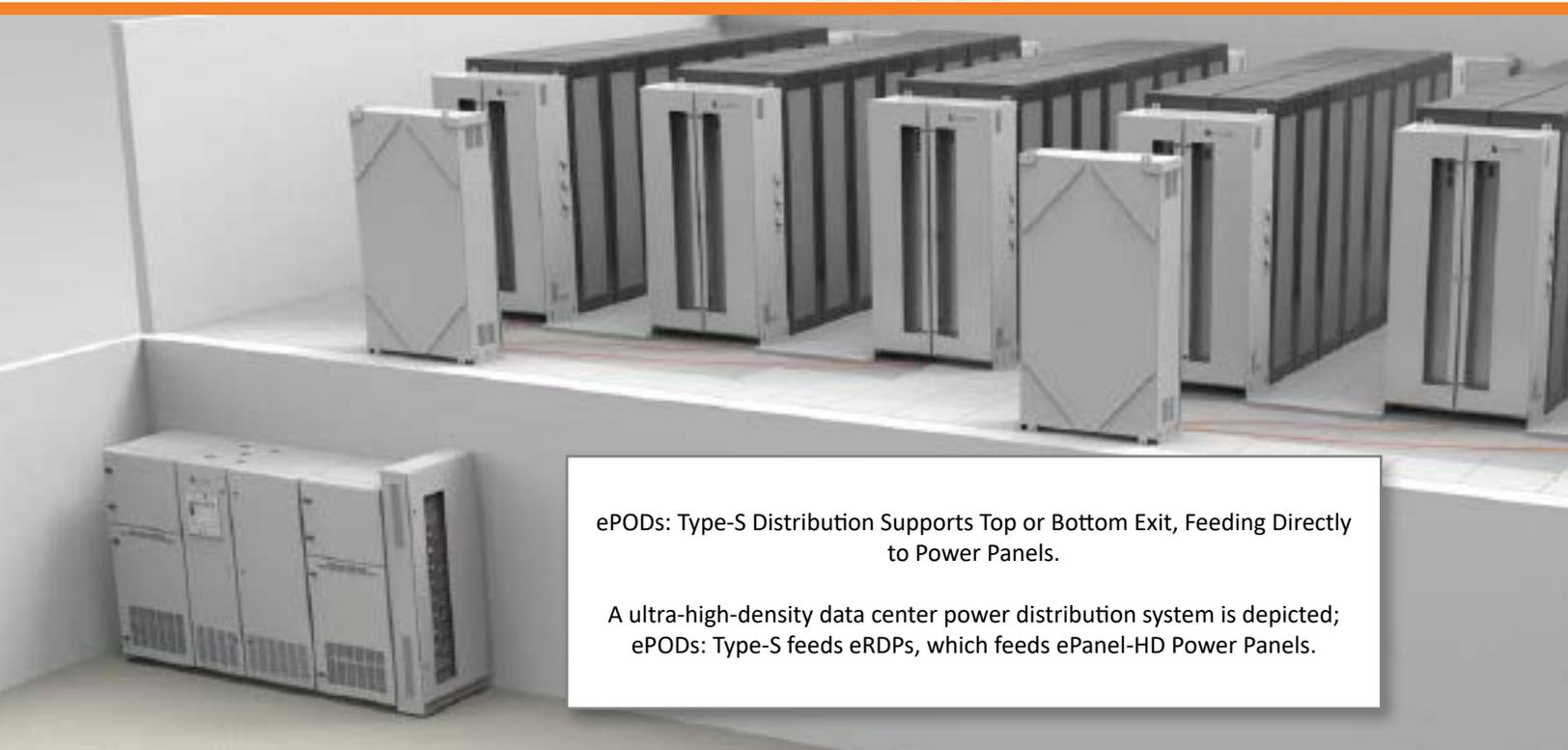
Size: 250A, 400A, 600A, 800A
Voltage: 120/208V 3-phase, 4-wire + G; or 240/415V 3-phase, 4-wire + G; or 230/400V 3-phase, 4-wire + G
Output Switch: Redundant Standard; Non-redundant Option
Redundancy:
Triple Modular Redundant (TMR)
Single Module Redundant (SMR)
Output Switch: Redundant, Non-redundant

Source 1 Input Isolation Section

Source 1 Transformer Section

Source 2 Input Isolation Section

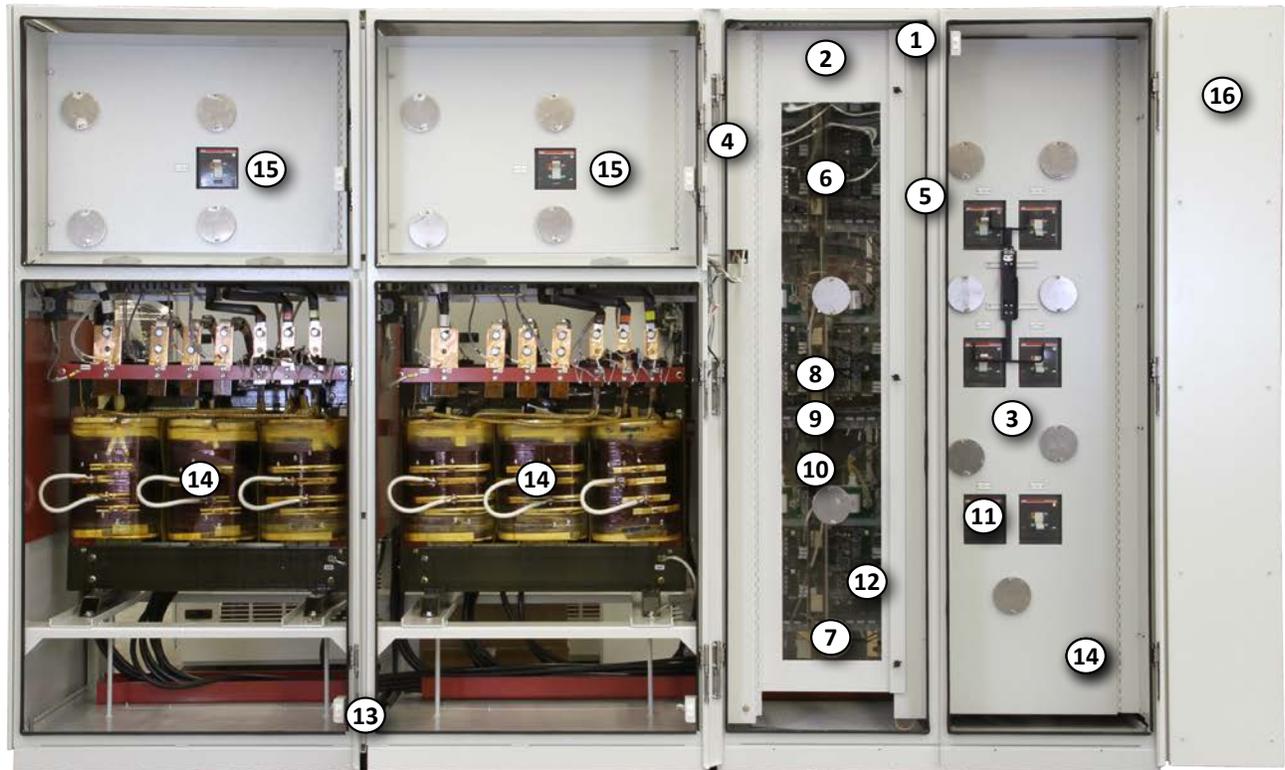
Source 2 Transformer Section



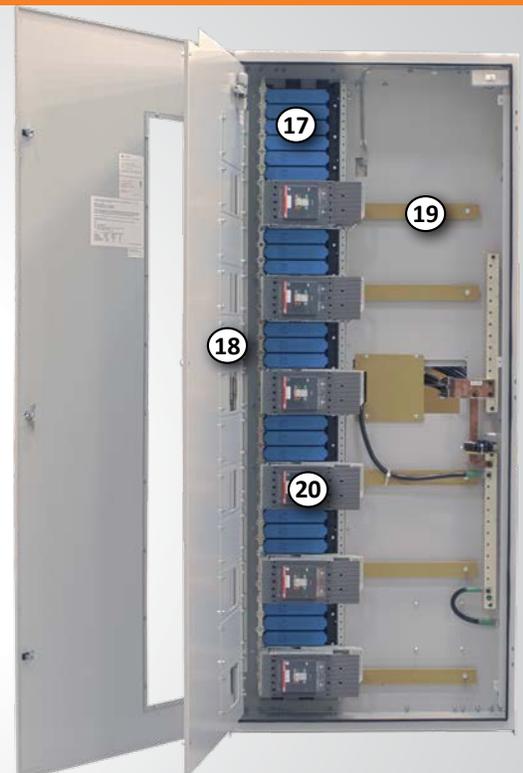
ePODs: Type-S Distribution Supports Top or Bottom Exit, Feeding Directly to Power Panels.

A ultra-high-density data center power distribution system is depicted; ePODs: Type-S feeds eRDPs, which feeds ePanel-HD Power Panels.

Equipment Construction Detail



- | | |
|--|---------------------------------------|
| 1. Alarmed Doors | 14. Transformer |
| 2. Hinged Dead Front Doors | 15. Transformer Circuit Breaker |
| 3. Silver Plated Terminals | 16. SafePanel™ |
| 4. 15" Color Touch Screen GUI (not shown) | 17. SafePanel™ Shrouds |
| 5. Printed Bypass Instructions (not shown) | 18. Universal Dead Front Door |
| 6. Polycarbonate Window | 19. Cable Organization Clips |
| 7. InSight™ IR Portholes | 20. Up to 12 Subfeed Circuit Breakers |
| 8. Convection Cooled Heat Sinks | |
| 9. Staggered Gate Drive Arrangement | |
| 10. Epoxy Coated Buswork | |
| 11. Circuit Breakers | |
| 12. Redundant Power Supplies | |
| 13. Louvered Convection Cooled Intake | |
- (not shown)

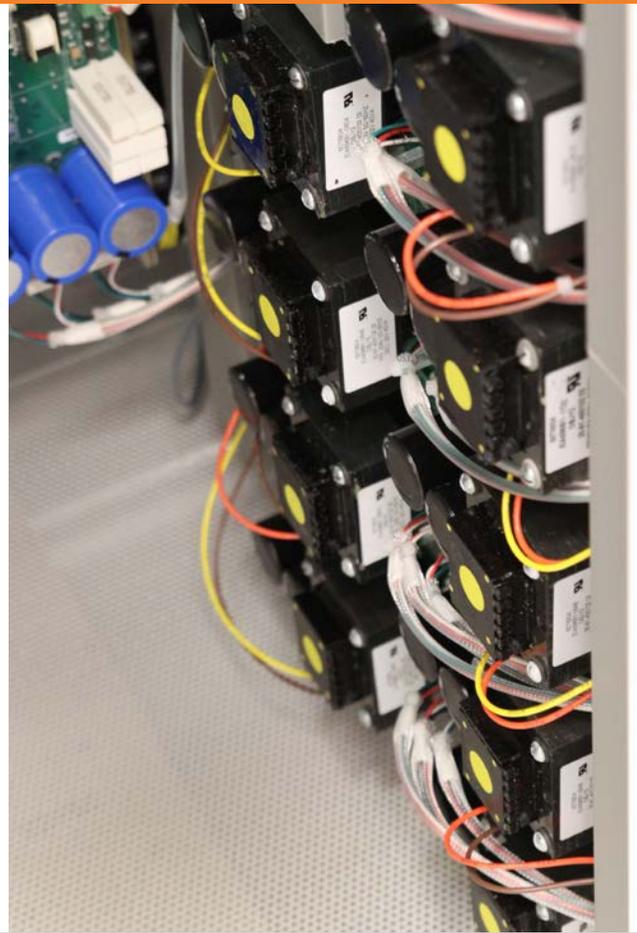


Reliability Overview

LayerZero ePODs: Type-S Reliability Overview

The LayerZero ePODs: Type-S Provides Many Dimensions of Reliability:

- Control System Reliability
 - SMR (Single Module Redundancy, Standard)
 - TMR (Triple Modular Redundancy, Optional)
- Control Power Supply Reliability
- Signal Reliability
- Operator Procedural Reliability

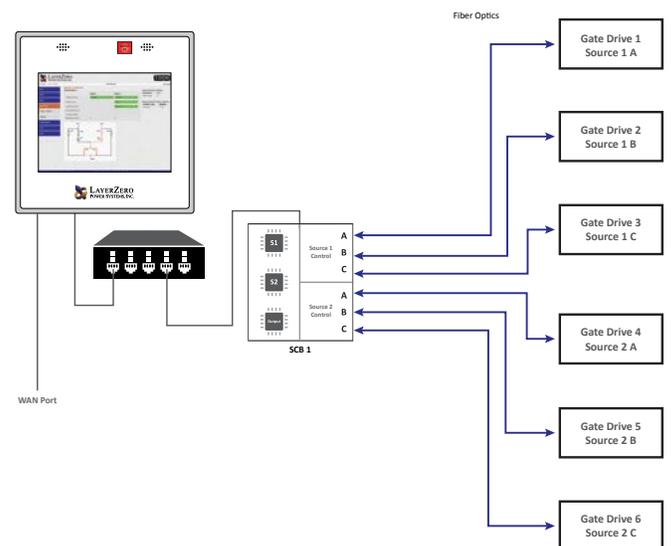


Single Module Redundancy (SMR) Reliability (Standard)

Single Module Redundancy is a cost-effective topology that provides redundant power paths to mission-critical equipment. In SMR systems, sources each have built-in triple redundancy of processors.

In addition, every phase is controlled with a separate gate drive board.

LayerZero Single Modular Redundant topology is unique that it the system is fail-safe, maintaining full switching functionality even if a critical board were to fail.



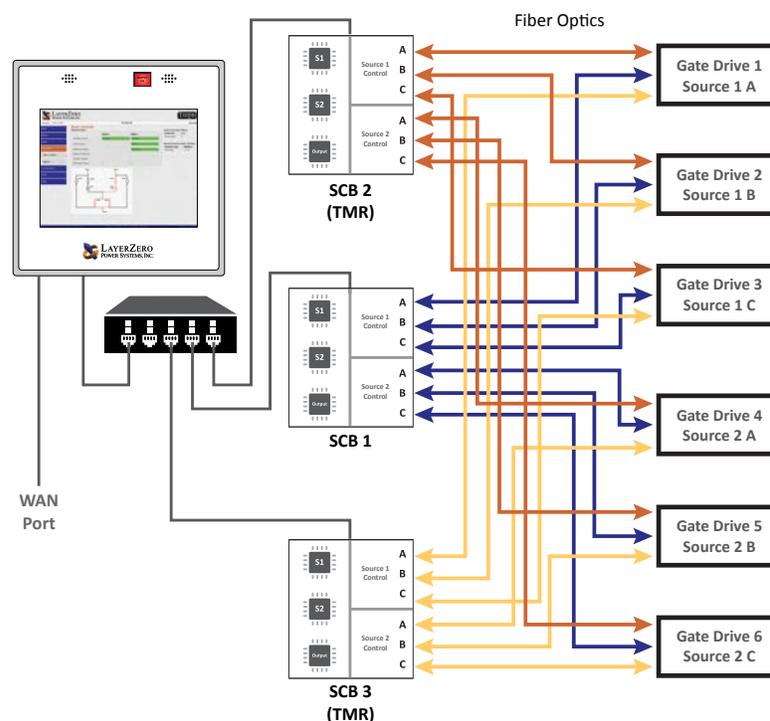
Reliability Features: Triple Modular Redundancy (TMR) *Optional

Triple Modular Redundancy (TMR) Reliability (Optional)

LayerZero TMR has all the redundancy of SMR, plus each STS has three independent sets of analog and digital data acquisition and control systems. There is no direct communication between the three systems. The three systems do not even share a common system clock.

- Each control system acquires voltage and current data independently
- Each control system determines whether a source is good/bad independently
- Upon loss of a source, each control system makes decisions to transfer independently

Even if an entire control path or its subcomponent were to fail; and then if the active power source were to fail, the STS is able to complete its mission of transferring to the alternate source.



Reliability Features: Single Module Redundant (SMR) Redundancy

eSTS SMR Triple Redundant Power Supply Architecture

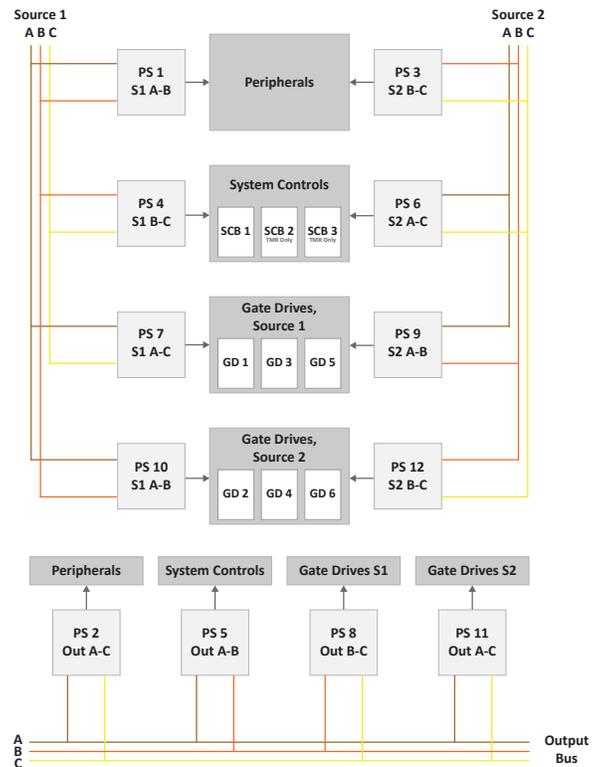
Divided into four (4) logical failure groups:

- System controls
- Source 1 gate drives
- Source 2 gate drives
- Peripherals.

The three (3) available source of power from which to supply control power to each failure group are:

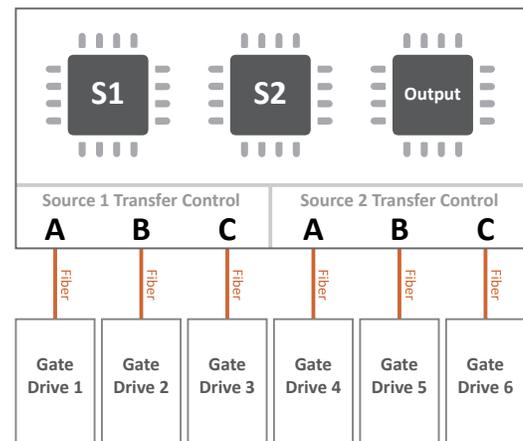
- Source 1
- Source 2
- STS Output.

LayerZero’s STS design incorporates twelve (12) power supplies (3 power sources x 4 failure groups.) The resultant control power topology utilizes all possible power paths to the four logical STS failure groups; and is the most comprehensive and redundant power supply system in existence.



eSTS SMR Triple Redundant Processors

- Separate/independent processors for Source 1, Source 2 and Output power quality analysis
- If Source 1 processor malfunctions then system is able to be commanded to transfer to Source 2; & vice versa.
- If main control system fails then STS continues to conduct power to the load from the existing source of power. (However STS is unable to transfer to the other source)
- Each phase of each source is controlled with a separate gate drive circuit board.



Reliability Features

Mechanical Bypass Interlock

In order to minimize the possibility of operator error during equipment bypass operations, LayerZero provides:

1. Interlocked breakers
2. Mechanisms to ensure that a source cannot be bypassed without the STS on the correct source.
3. Safeguards to make certain that sources cannot be connected to each other inadvertently.
4. A voice-prompted bypass procedure that guides the operator through the sequence.
5. A step-wise pictorial & video presentation is provided on the touch-screen display during bypass.



Voice Guided Bypass

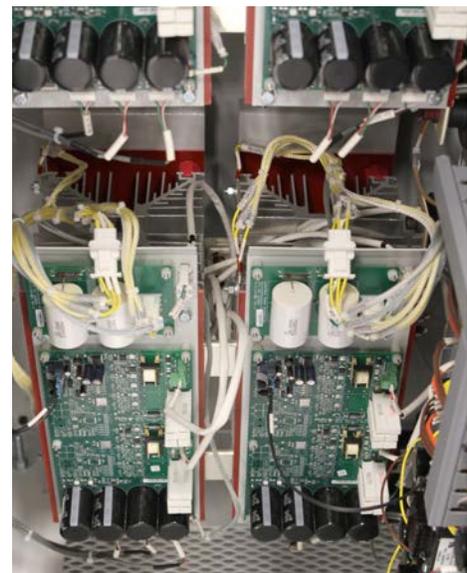
Operator error during maintenance bypass has been known to be a reliability hazard. To help prevent operators from completing the bypass procedure out-of-sequence, our product features a voice prompted bypass procedure. This instructs the operator in a step-by-step course of action of the process, with only one operation per screen. Visual and audio cues provide clear instructions on the bypassing sequence, reducing the probability of operator error.



No Fans, Dust Filters, or Fan Fuses

Fans and fan sensors are one of the most common components to fail. For maximum uptime, Type-S systems do not contain any fans, dust filters to change, or fan fuses to replace. The Series 70 ePODs: Type-S utilizes a natural convection-cooled heat dissipation system.

The heat sink arrangement is staggered between sources and phases to minimize the creation of extreme thermal gradients between heat sink columns when conducting on one source or the other.



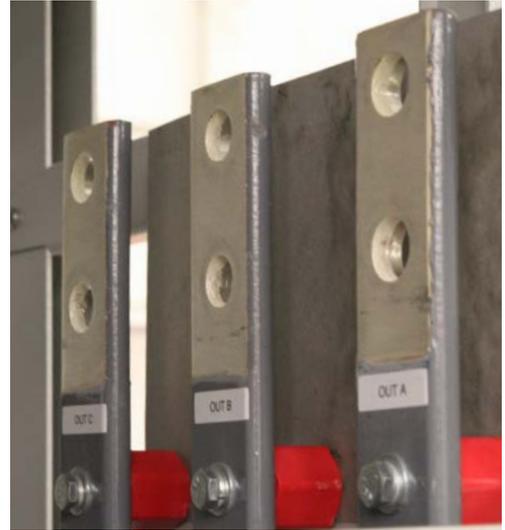
Reliability Features

Epoxy Coated Buswork/Maintenance Free Joints

Our usage of epoxy coated buswork helps ensure safety, and makes the system inherently more reliable by eliminating the possibility of bus-to-bus faults. Bus joints are permanently brazed and maintenance-free.

Silver Plating

LayerZero utilizes silver plating on all bus joints and terminals to be able to provide the highest performance. Silver has high conductivity and low resistance - which makes for a great contact.



Machined Hardware

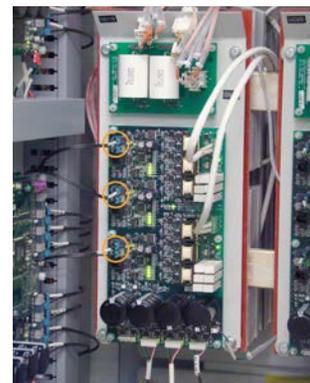
Our bolted connections utilize machined cap screws and engineered disc springs. The result is a flat pressure vs deflection profile to ensure that all bolted connections maintain constant torque through the life of the product.

These technologies have been well tested in disparate environments of wide temperature ranges to help ensure that, once connections have been tightened, they stay that way.



Fiber Optic Controls Increase System Reliability

Fiber optic based controls eliminate noise and interference, while isolating components from high voltage. Optical fiber allows service to be reliably connected, while protecting the equipment. In LayerZero's design, the gate drives (at Power Circuit Voltage) receive control signals via optical fibers.



Ease of Maintenance

Fiber Optic Controls Increase System Reliability

Fiber optic based controls eliminate noise and interference, while isolating components from high voltage.

Optical fiber allows service to be reliably connected, while protecting the equipment.

In LayerZero's ePODs: Type-P design, the gate drives (at Power Circuit Voltage) receive control signals via optical fibers.

**Vibration Isolation Damper Mounts**

Transformers in the Series 70: ePODs Type-S Power Distribution Unit are equipped with vibration isolation damper mounts, helping to reduce the amount of vibration and noise that originates from transformers, ultimately leading to a higher reliability of electrical and mechanical connections over the life of the product.

**Sectionalization Maximizes Operator Safety**

Operators are well-protected from exposed connections. Normal operator sections (breakers/switches) are physically separated from the power electronics and control electronics sections, so that maintenance on a section can be safely performed. If maintenance is required on a particular section, power can be bypassed to another section to allow for safe repairs to be made.



Ease of Maintenance

InSight™ IR Portholes Permit Scanning of Bolted Connections with Dead-Front Doors Closed

Strategically positioned IR-scan portholes to enable safe thermal scanning of all bolted connections with the deadfront closed, without exposing the operator to power circuit voltage. Thermal scans can be done from the front – without ever having to open the dead-front door.

The IR window swivels upward and unlocks with key-hole access to reveal a mesh, allowing the operator to point-and-shoot thermal cameras to obtain readings.



View Status LEDs and Distribution CB Positions With Dead-Front Doors Closed

Our Series 70 product line was inspired by NFPA-70E, to help data centers drastically reduce the risks of their energy distribution systems.

Operators can view the status of diagnostic LEDs without exposure to the energized power electronics section. In addition, SafePanel circuit breaker positions can be viewed with the dead-front door closed.



Safety Features

The LayerZero SafePanel™

The Series 70 ePODs: Type-S features an IP-20, finger-safe panel board, meaning that the opening will not allow ingress of ½” (12.5mm) diameter probe, for maximum operator safety.

An arc can form as two live conductors are separated – such as the removal of a circuit breaker from a panel board. The SafePanel design ensures that a potential arc would be contained in the connection well so that even if a branch breaker were to be removed, the arc would be contained in the connection well.

Insulated with the components deeply isolated, removal of the breaker is safe and easy.



Type-S 1200 A Circuit Breaker Installation Process



The Breaker Is Inserted Into The SafePanel



The Handle Is Unlocked

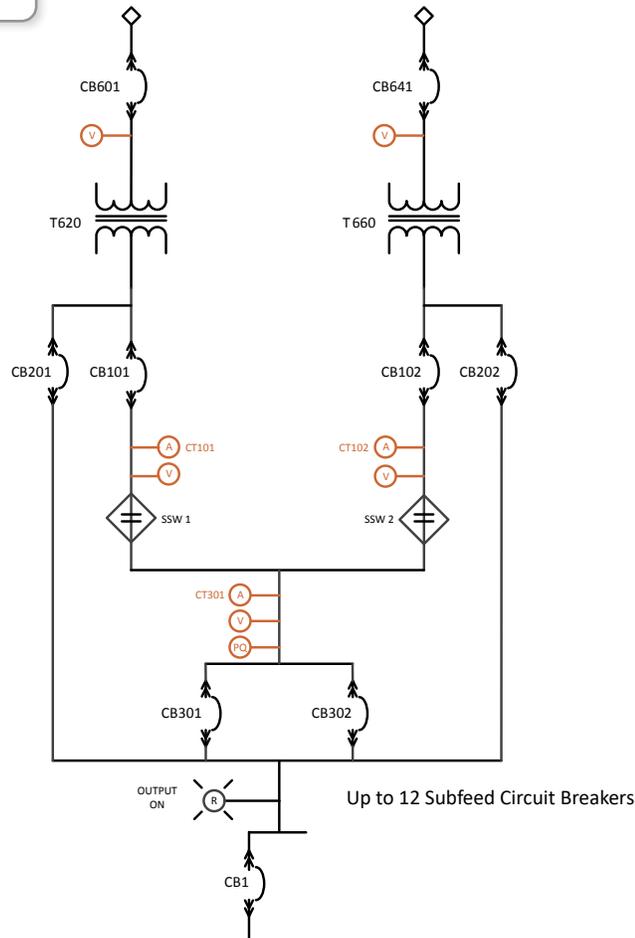
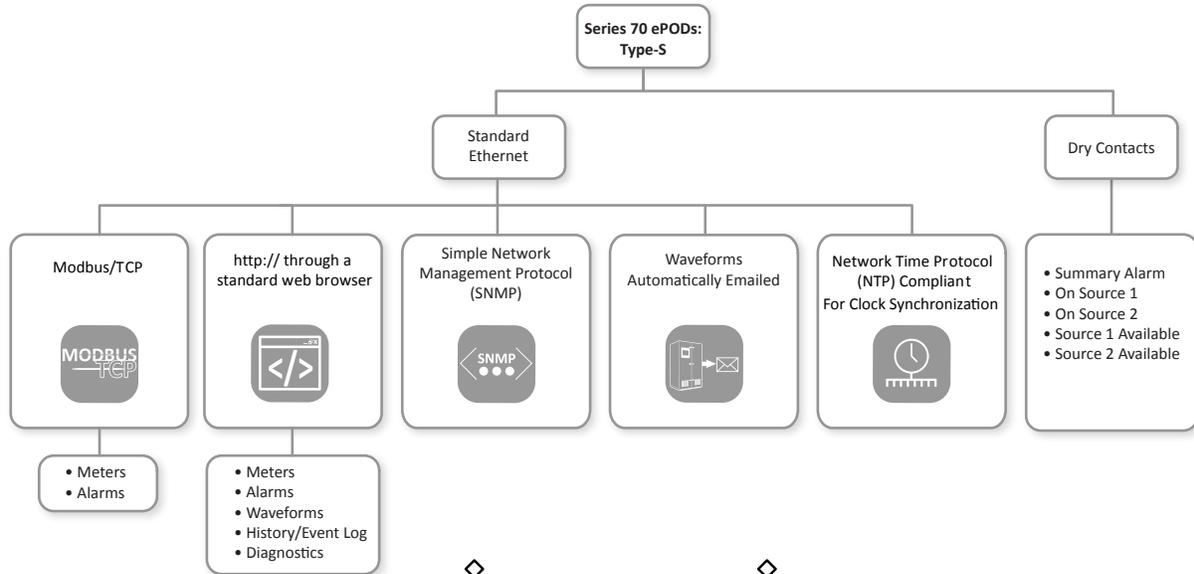


Screws Help Secure The Breaker



For Maximum Safety, The SafePanel Has Recessed Bus Work and Finger Safe Lattice.

Connectivity/Power Quality Monitoring



- Current Metering Point
- Voltage Metering Point
- Power Quality Metering Point
- Branch Current Monitoring

Zen SSQM Technical Specifications



Zen SSQM Parameters		Mains	Subfeeds or Branch Circuits
Voltage Inputs and Output	Voltage	✓	
	Frequency (Hertz)	✓	
	Phase Rotation	✓	
Current Inputs	Current (Amps)	✓	✓
	Current Fraction of Rating (Percent)	✓	✓
	Current Imbalance (Percent)	✓	✓
	Real Power (kilowatts)	✓	✓
	Apparent Power (kilovolt-amperes)	✓	✓
	Reactive Power (kilovolt-amperes reactive)	✓	✓
	Power Factor	✓	✓
	K Factor	✓	✓
	Crest Factor	✓	
Alarms	Summary Alarm	✓	
	Voltage (High, Low)	✓	
	Overload	✓	
	Thermostat (High, Low)	✓	
	THD Over Limit	✓	
	Frequency (Over, Under)	✓	
	I A/B/C K-Factor Over Limit	✓	
	Average K-Factor Over Limit	✓	
	Incorrect Phase Rotation	✓	
	Voltage Failure	✓	
	I G1/G2 Over Ground Fault Limit	✓	
	I G1/G2 Over Ground Overcurrent Limit	✓	✓
	TVSS 1/2/3/4 Failure	✓	

All product specifications are subject to change without notice.

Technical Specifications

ePODs: Type-S Models with Withstand Ratings			
	480 V	575 V	600 V
225 A	65kAIC; 50kAIC; 25kAIC		
250 A	150kAIC; 100kAIC; 65kAIC; 35kAIC; 25kAIC	100kAIC; 65kAIC; 35kAIC; 25kAIC; 18kAIC	
400 A			
600 A			
800 A	100kAIC; 65kAIC; 50kAIC; 35kAIC	42kAIC; 35kAIC; 25kAIC; 20kAIC	

Mechanical Characteristics		
	75 kVA - 300 kVA	400 kVA
Dimensions (side facing distribution):	142"W x 86"H x 36"D (3607mm x 2032 mm x 914 mm)	166"W x 86"H x 36"D (4216 mm x 2032 mm x 914 mm)
Dimensions (front facing distribution):	166"W x 86"H x 36"D (4216 mm x 2032 mm x 914 mm)	190"W x 86"H x 36"D (4826 mm x 2032 mm x 914 mm)
Weight	2,150 - 3,500 lbs (975 kg - 1588 kg) Varies on Configuration, Please Contact LayerZero Engineering	
Heat Dissipation	Varies on Transformer Efficiency, Please Contact LayerZero Engineering.	
Frame Construction	Welded Frame	
Electrical Connections	Flexible Laminated Bus, Silver-Plated Solid Busbar	
Color	Textured Powder Coat White (RAL 7035), Blue (RAL 5017), Black, Custom	
Seismic Floor Anchors	Optional	
Seismic Floor Stand	Optional	
Sectionalization	Engineered Composite Insulation, Dead Front Doors	

Electrical Characteristics	
Static Transfer Switch	
System Input Voltage	480 V, 3-Phase, 3-Wire + Ground; 575 V, 3-Phase, 3-Wire + Ground; 600 V, 3-Phase, 3-Wire + Ground
System Output Voltage	120/208 V, 3-Phase, 4-Wire + Ground; 240/415 V, 3-Phase, 4-Wire + Ground
Number of Inputs	2, 3 (3 Optional)
eSTS Number of Output CBs	1, 2
Frequency	50 Hz, 60 Hz
Poles	3-pole, 4-pole
Phases	3 Phase, 3 Wire, 4 Wire + Ground
Neutral Rating	100%, 150%, 200%
eSTS Transfer Time	Nominal 1/4- cycle for in-phase sources
eSTS Redundancy	Single Module Redundancy, Triple Modular Redundancy Optional
eSTS Circuit Breaker Type	Molded Case Switch (Standard), Electronic Trip (Optional)
Circuit Breaker Mounting Type	Plug-In
eSTS TVSS	Standard
EPO	Optional
Subfeed Distribution	
Distribution	SafePanel™ Distribution

Power Quality Monitoring	
Power Quality Monitoring Technology	Zen SSQM™ (Static Switch Quality Monitoring)
Waveform Capture	Local Display, Remote Display via Web Browser, Waveforms Automatically Emailed
Voltmeter	Input sources and Output, for each phase
Ammeter	Input sources and Output, for each phase
Frequency Meter	Both Sources
Real-Time Synchroscope	Phase Angle Meter Between Sources
Metering	Apparent Power, Real Power, Power Factor, Output Total Harmonic Distortion
Time Stamped Transfer Count	From First Day Use, From Last Reset
CB Status Indicator	Open/Closed/Tripped Circuit Breaker
Source Indicator	Preferred Source
Phase Indicator	When Any Two Sources Are Within Window
Power Path Indicator	On Live Mimic

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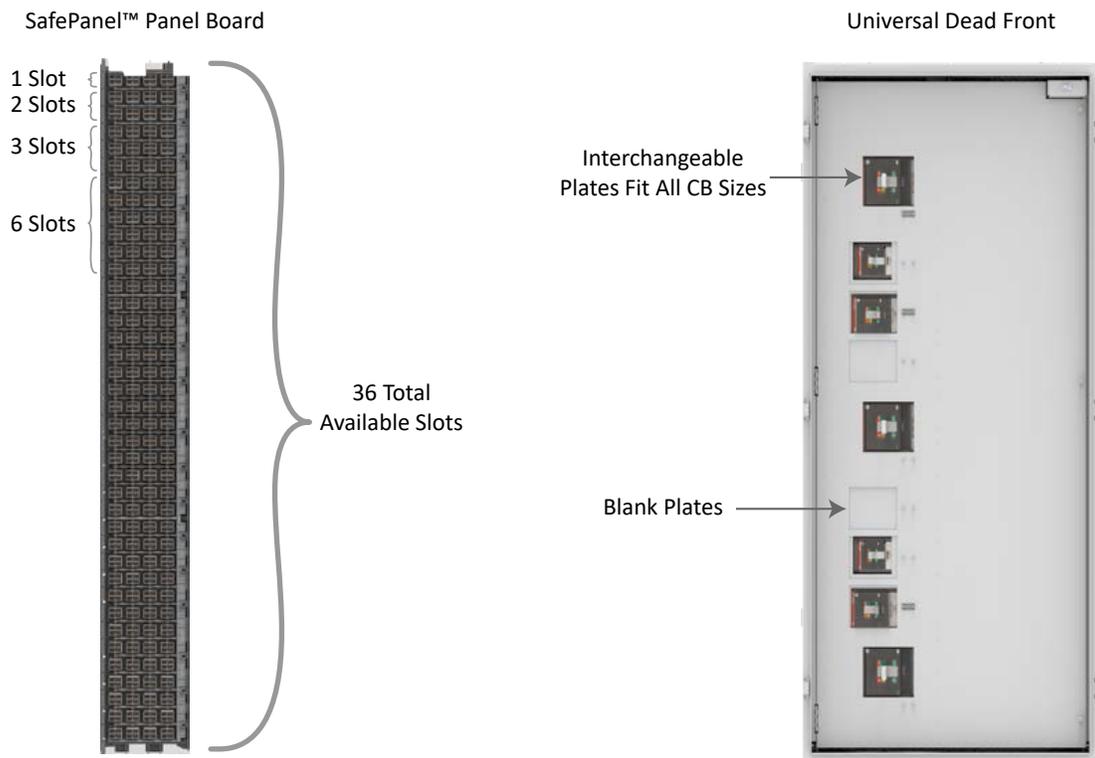
Technical Specifications

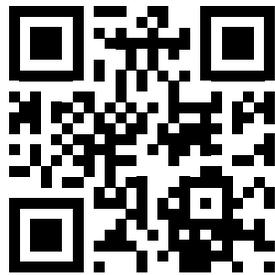
Operational Characteristics	
Transfer Modes	Automatic; Manual (via Preferred Source Selection)
Inrush Mitigation Technology	Patented Dynamic Phase Compensation Algorithm (U.S. Patent 7,589,438 B2)
Cooling	Convection Cooling
Cable Access	Top/Bottom
Service Access	Front Only
Bypass Interlock Mechanism	Mechanical
Noise & Interference Isolation	Optical Fiber in Critical Control Paths
IR Scan Port Type	InSight™ IR Portholes
SCR Type	Puck
Display Type	15" Color Touch Screen
Display Resolution	1024x768
Bypass Assistance	Voice-Guided Bypass
Audio	Bezel-Mounted Stereo Speakers
Languages	English, French
Mimic Panel	Digital
Setpoints Control	Digital
Power Supplies	Redundant
Connectivity	
Meters	Local Display, Ethernet, Modbus/TCP, http via Web Browser (Non-Proprietary)
Alarms	Local Display, Ethernet, Modbus/TCP, http via Web Browser (Non-Proprietary)
Summary Alarm	Dry Contacts
Waveforms	Local Display, Ethernet, http via Web Browser (Non-Proprietary)
History/Event Log	Local Display, Ethernet, http via Web Browser (Non-Proprietary)
Diagnostics	Local Display, Ethernet, http via Web Browser (Non-Proprietary)
Time Synchronization	Network Time Protocol (NTP)
Standards Conformance: Static Transfer Switch	
UL	ETL Listed to UL 1008S
CSA	ETL Listed to C22.22 No 107.
Standards Conformance: SafePanel Distribution	
UL	ETL Listed to UL 60950
CSA	C22.2 No 29-M1989

Contact LayerZero for custom sizes and designs.

All product specifications are subject to change without notice.

Number of Output Circuit Breakers	
Number of Available SafePanel™ Slots	36
CB Rating	Number of Slots Required
100 AF	2
250 AF	3
400 AF	3
400 AF 100%	6
800 AF	6





Learn more at www.LayerZero.com



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