



LAYERZERO

POWER SYSTEMS, INC.

The Foundation Layer

Series 70 eSTS

4-Pole STS + Optional SafePanel™ Distribution

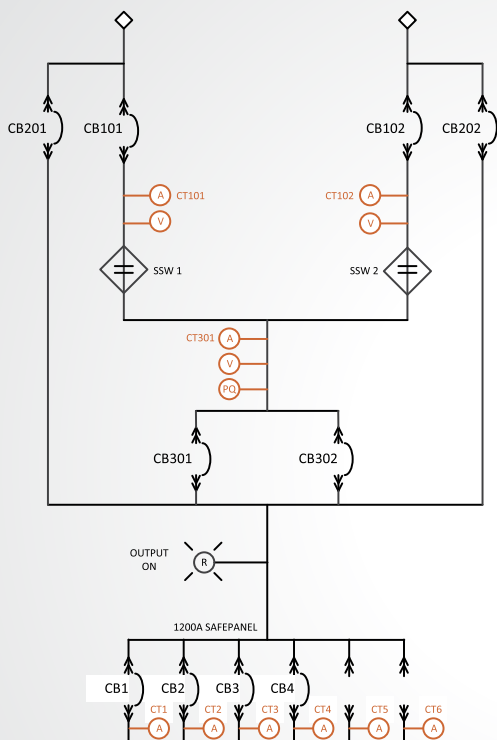


Product Brochure

The LayerZero Integrated Solution: eSTS + Distribution Maximizes Power Reliability

eSTS Automatically Transfers Between Two Power Sources

The Series 70 eSTS is a solid-state transfer switch that automatically or manually provides solid state transfers between two in-phase AC sources in a quarter cycle. The eSTS performs open-transition transfer in such a manner that the connected load disruption is minimized without ever cross-connecting the power sources. One power source is selected to be the preferred source. If the preferred source fails the load is automatically and seamlessly connected to the alternate source by means of an open-transition static transfer.



* Optional Sub-feed Monitor

4-Pole eSTS Static Transfer Switch Product Features

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

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

Connectivity

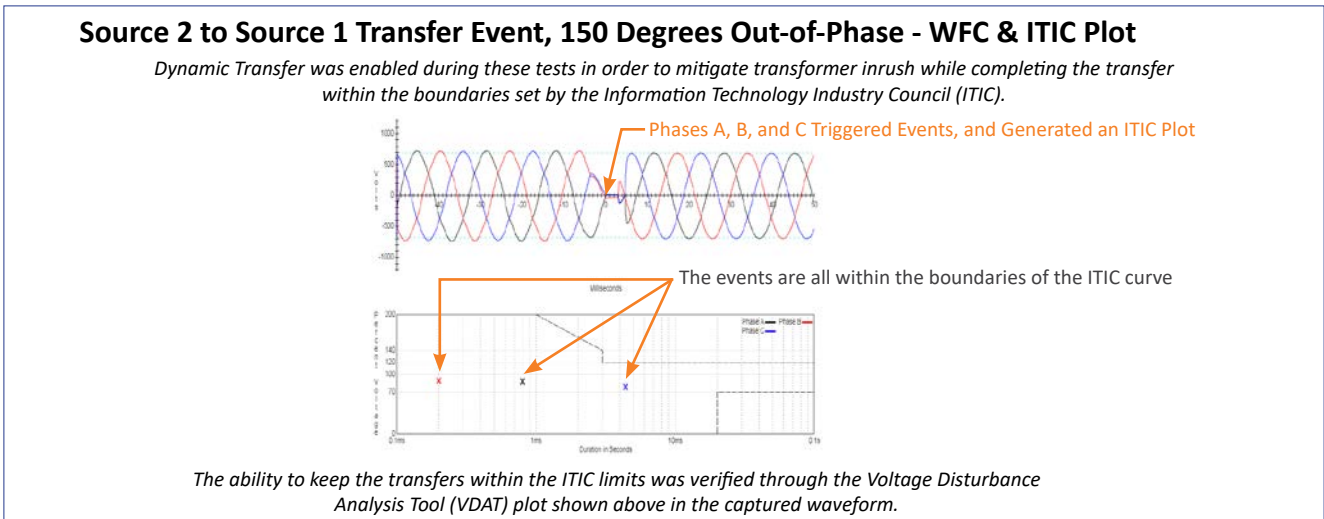
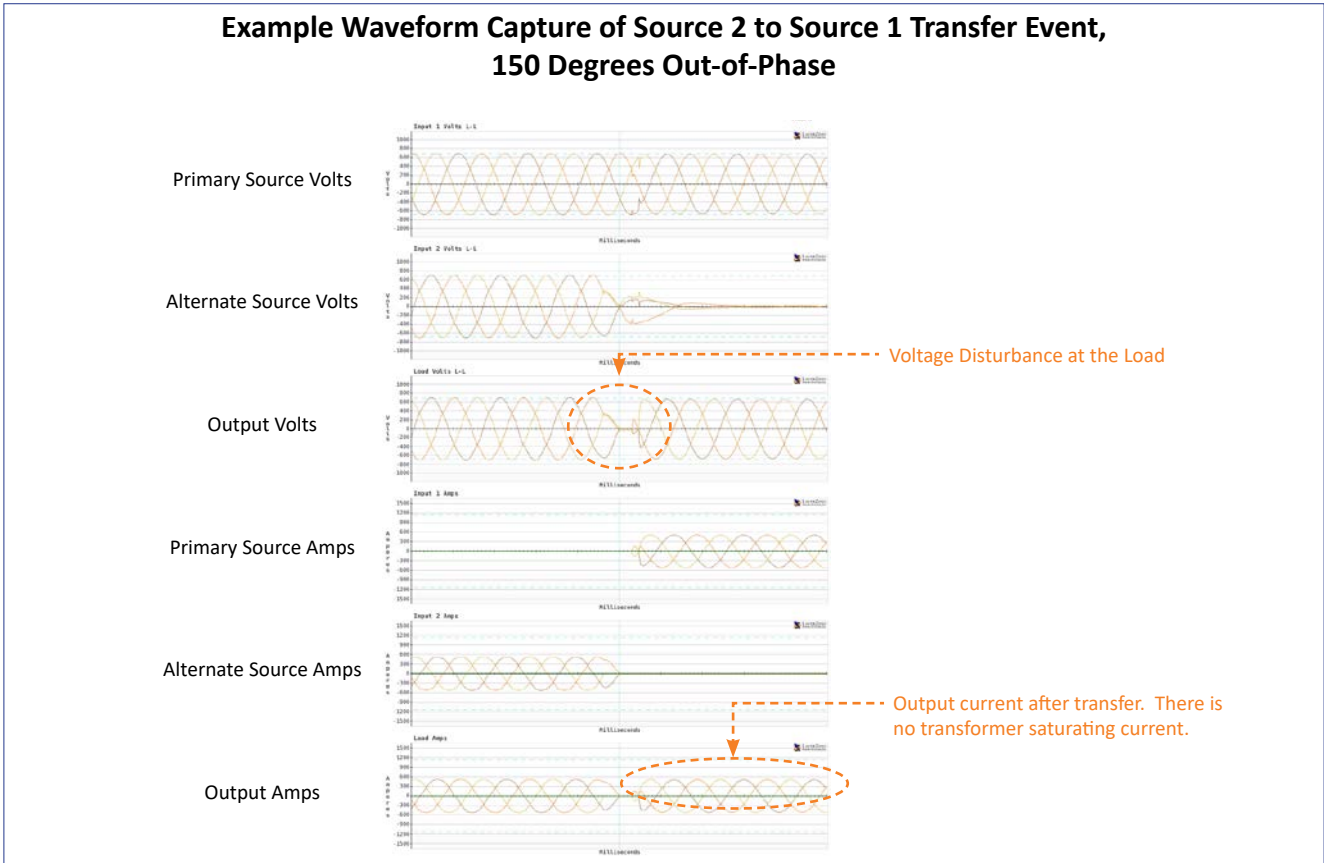
- ☑ **Ethernet Connectivity:** Secure VPN Router Connects To Network For Advanced Remote Monitoring Capabilities
- ☑ **Modbus/TCP:** Open Connectivity to Existing Monitoring Systems Without Proprietary Limitations
- ☑ **NTP Time Clock Synchronization:** Facilitates Timeline-Based Logging For Post-Event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

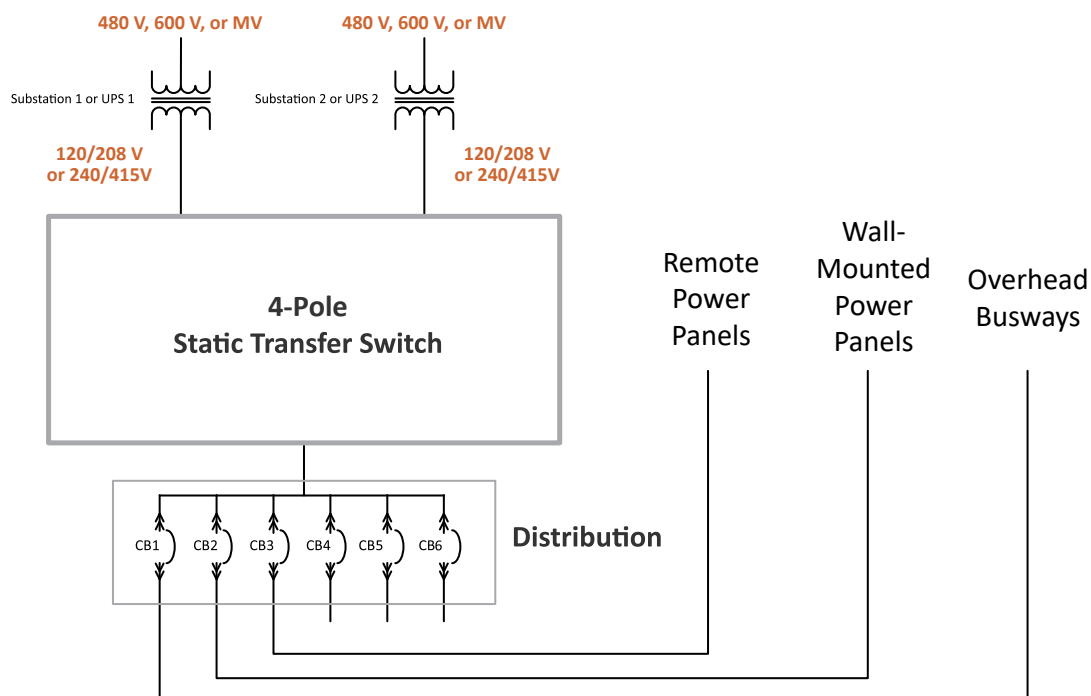


The 4-Pole eSTS Lowers Infrastructure Costs While Maintaining High Reliability

Increasingly, data center operators aspire to increase their energy efficiency; and thus reduce their operating costs and their carbon footprint. A popular technique deployed to achieve higher efficiency of critical operations is to minimize the number of AC power transformations between the building entrance to the eventual critical load. Facilities are being designed to step down voltage at the incoming sub-station to 240/415 V level; and UPS systems are being deployed with native 4-wire, 240/415 V output. Critical loads are operated at 240 V L-N. The cost of cabling in the facility is optimized at a higher voltage; and the loss of efficiency from another voltage transformation to 120/208 V is avoided.

Against this back drop and in an environment which provides two independent sources of power, if a static transfer switch is needed to increase the reliability of power to the critical load; and/or to increase the concurrent maintainability of the facility's electrical infrastructure then the static transfer switch must be a **four pole** switch. The transfer mechanism must transfer phase conductors (A, B & C) in an open transition manner; while ensuring that the transfer of the neutral between adjacent sources is completed without interruption to the neutral conductor.

LayerZero's 4-pole eSTS is the most reliable, connected and information centric product designed for this application. LayerZero uniquely uses SCR based solid-state transfers for phases A, B, C **and** Neutral. Further, for operator safety LayerZero deploys 4-pole breakers for input, output and bypass isolation.



Equipment Layout

eSTS Controls Section Contains:

Control Electronics

- System Control & Data Acquisition Boards
- SCR Gate Drives
- Redundant Power Supply System
- I/O system; VPN Router

Power electronics

- SCRs (Silicon Control Rectifier) in Convection Cooled Heat Sinks for Phases A, B, AC and Neutral Transfer

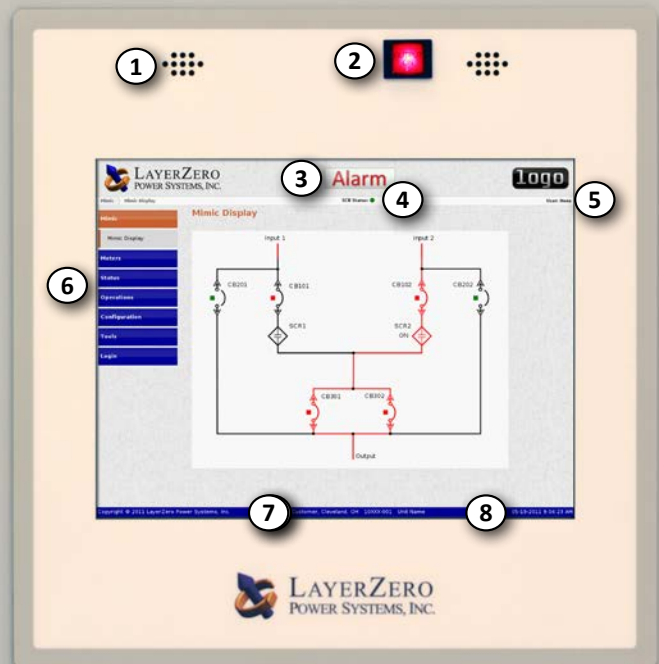
CB Section Contains:

- 4-Pole Input isolation switches
- 4-Pole Bypass isolation Switches
- 4-Pole Output isolation switches
- Source connection terminals
- Load connection terminals



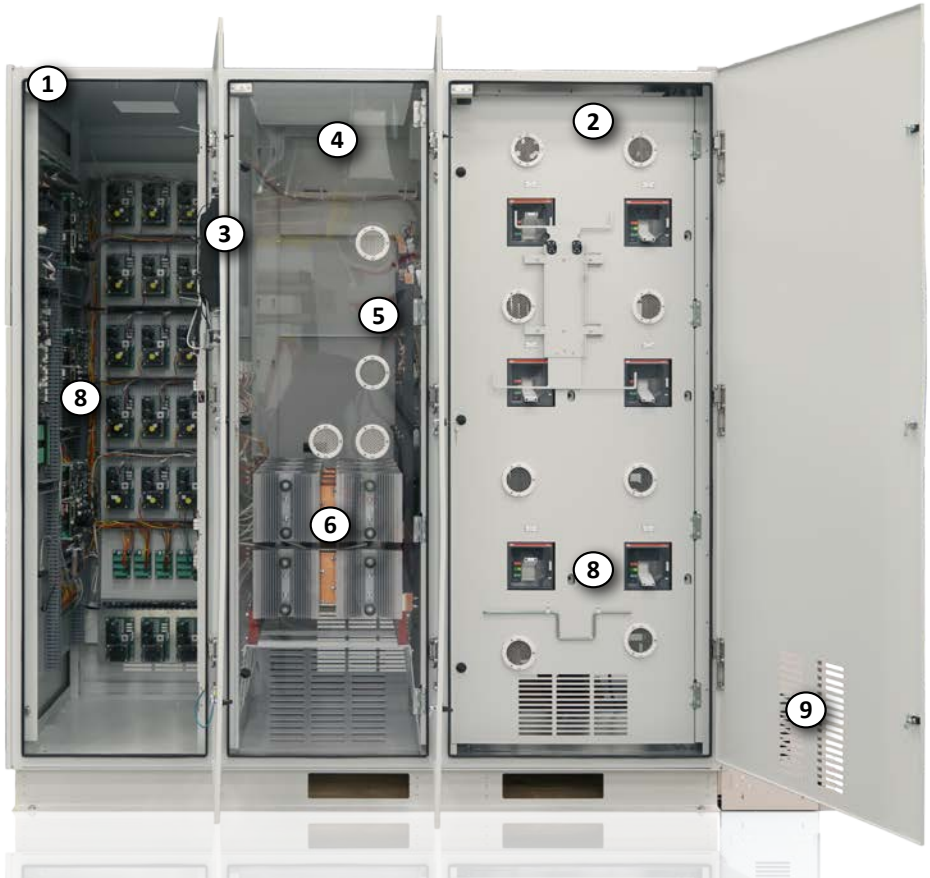
15" Color Touch Screen (Standard)

1. Stereo Speakers for Guided Bypass Prompts
2. Output On Light (Remains Lit in Bypass Isolate Mode)
3. Alarm & Bypass Indicator
4. SCB Status Indicator
5. Logged In User
6. Navigation Menu
7. Customer & Project Information
8. Date & Time



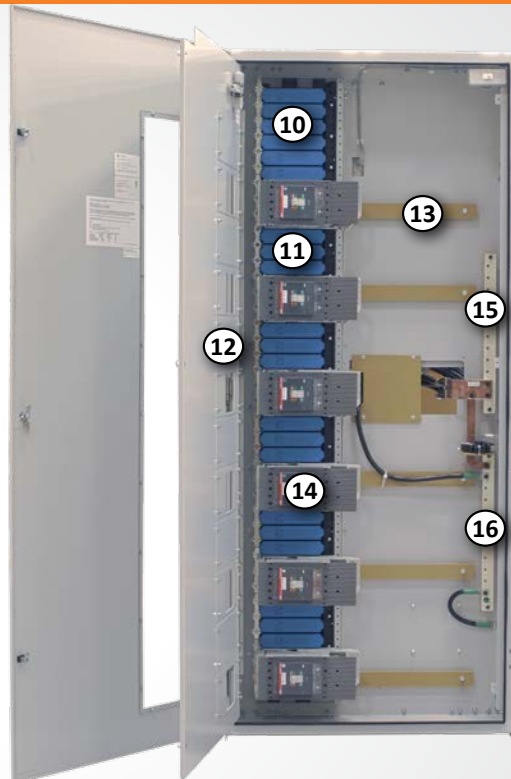
Equipment Construction Detail

1. Alarmed Doors
2. Hinged Dead Front Doors
3. 15" (38.1 cm) Color Touch Screen GUI
4. Polycarbonate Window
5. InSight™ IR Portholes
6. Convection Cooled Heat Sinks
7. Isolation Molded Case Switches
8. Redundant Power Supplies
9. Convection Cooled Intake



10. SafePanel™ with Finger Safe Construction
11. SafePanel™ Shrouds
12. Universal Dead Front Door
13. Load Cable Supports
14. Up to 12 Subfeed Circuit Breakers (400 AF or 250 AF)
15. Load Neutral Terminals
16. Load Ground Terminals

- Mounted on the right side of 4-Pole eSTS
- Adds 12" Width; Right Side Access Required



Reliability Overview

LayerZero eSTS Reliability Overview

The LayerZero eSTS 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



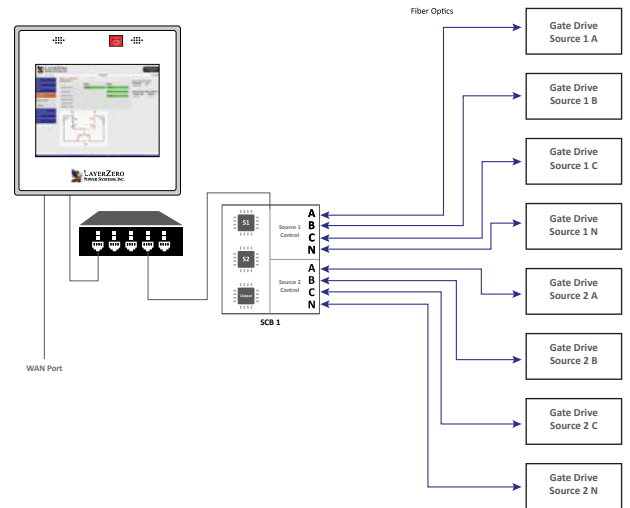
Reliability Features: Control System Reliability

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.

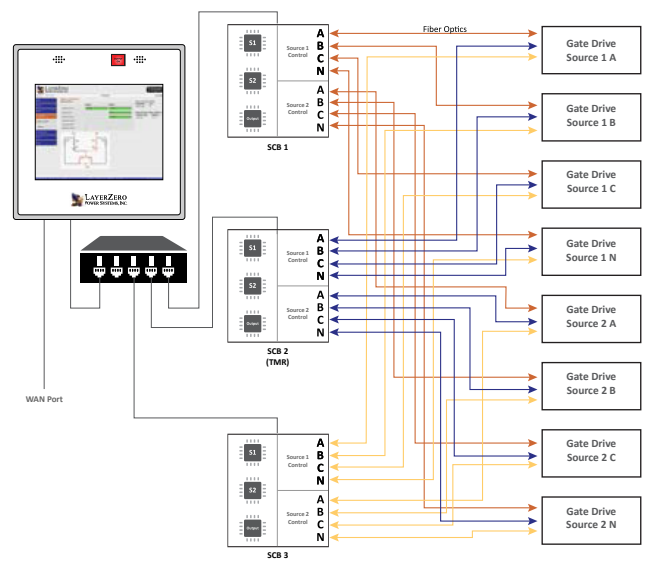


Triple Modular Redundancy (TMR) Reliability (Optional)

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: Control Power Supply Reliability/Signal Reliability

Control Power Supply Reliability

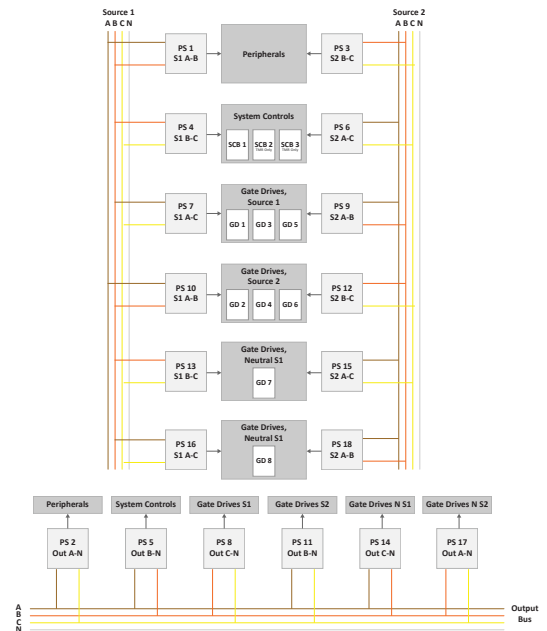
Divided into five (5) logical failure groups:

- System controls
- Source 1 gate drives
- Source 2 gate drives
- Neutral 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 eighteen (18) power supplies. The resultant control power topology utilizes all possible power paths to the four logical STS failure groups; and is the most comprehensive and redundant STS power supply system in existence.

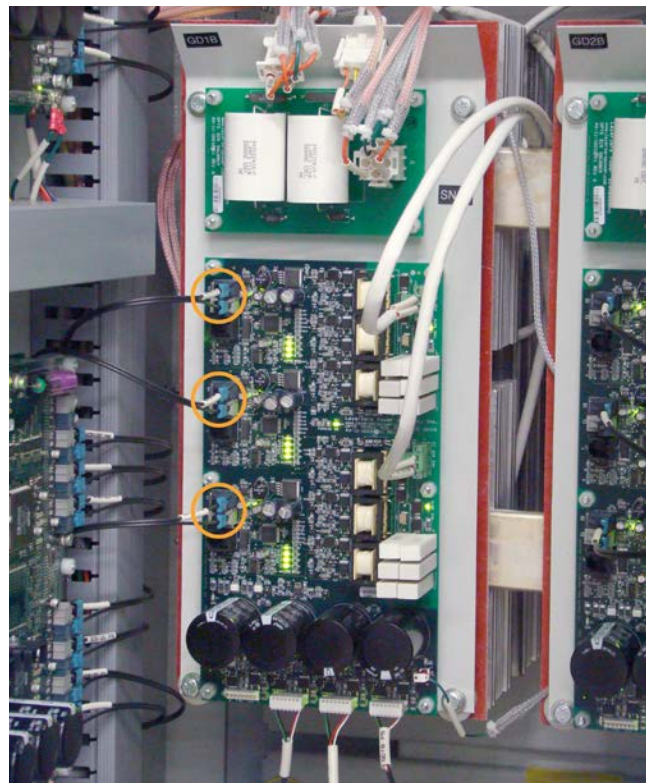


Signal Reliability

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 eSTS design, the gate drives (at Power Circuit Voltage) receive control signals via optical fibers.



Reliability Features: Operator Procedural Reliability

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.

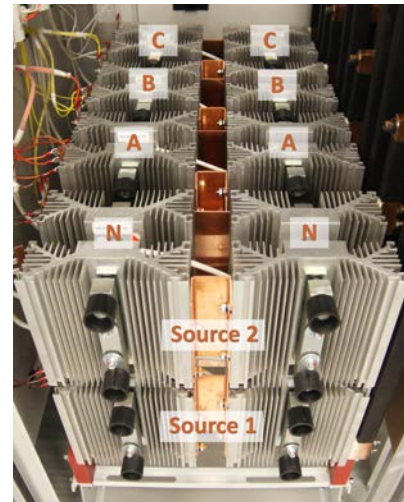


Reliability Features: Heat Dissipation, Serialized Components

No Fans, Dust Filters, or Fan Fuses

The Series 70: eSTS Static Transfer Switch utilizes a natural convection-cooled heat dissipation system. Fans and fan sensors can be some of the most common components to fail.

For maximum uptime, LayerZero's eSTS systems do not contain any fans, dust filters to change, or fan fuses to replace.



Machined Hardware

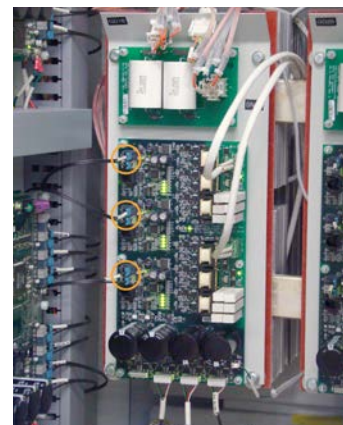
Our bolted connections utilize machined cap screws and engineered disc springs. The result is a flat pressure vs deflection profile to ensure that all bolted connections maintain constant torque through the life of the product.

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 eSTS design, the gate drives (at Power Circuit Voltage) receive control signals via optical fibers.



Reliability/Safety Features

Serialized circuit boards

We serialize and track all critical circuit boards and memory cards through our eBOSS portal, which allows customers to reference which components their machines are made from, who tested the components, as well as the ability to view notes generated from testing.

Serialized components offer the ability to drill-down on prospective component failure utilizing predictive modeling techniques, so if part fails, the instance can be cross-referenced with similar parts. This preventative maintenance helps ensure maximum uptime.



View Critical Board LEDs with Dead Front Doors Closed

The Series 70: ePODs: 4-Pole eSTS is equipped with a polycarbonate window located on the inner door of the power control section.



4-Pole Isolation Molded Case Switches

The 4-Pole eSTS utilizes four pole molded case switches (MCS) for source, load, and bypass isolation.

Solid-state switches transfer three phases (A-B-C) and the Neutral (N).

By utilizing 4-pole MCS, the neutral can be completely isolated from feeder circuits during maintenance.

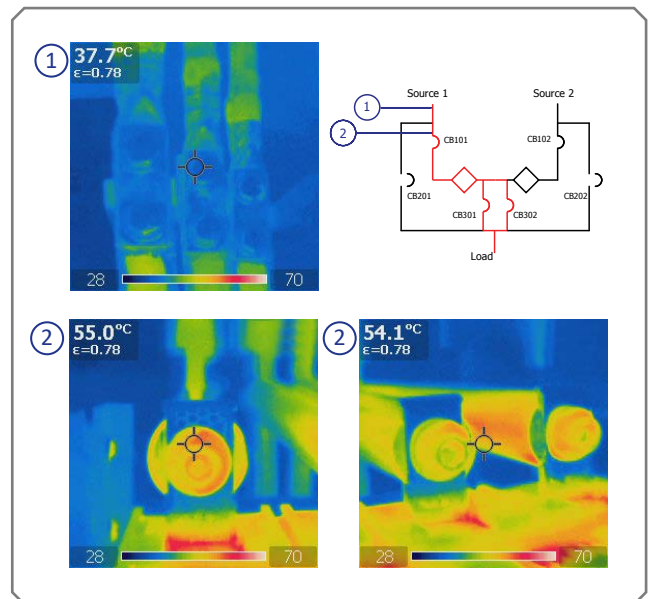


Safety Features/Ease of Maintenance

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.



IR Portholes in eSTS
(Door and side panel hidden for visibility)

Safety Features

The LayerZero SafePanel™

The Series 70 eSTS + Distribution 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.



SafePanel™ Distribution 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.

Power Quality Monitoring/Connectivity Options

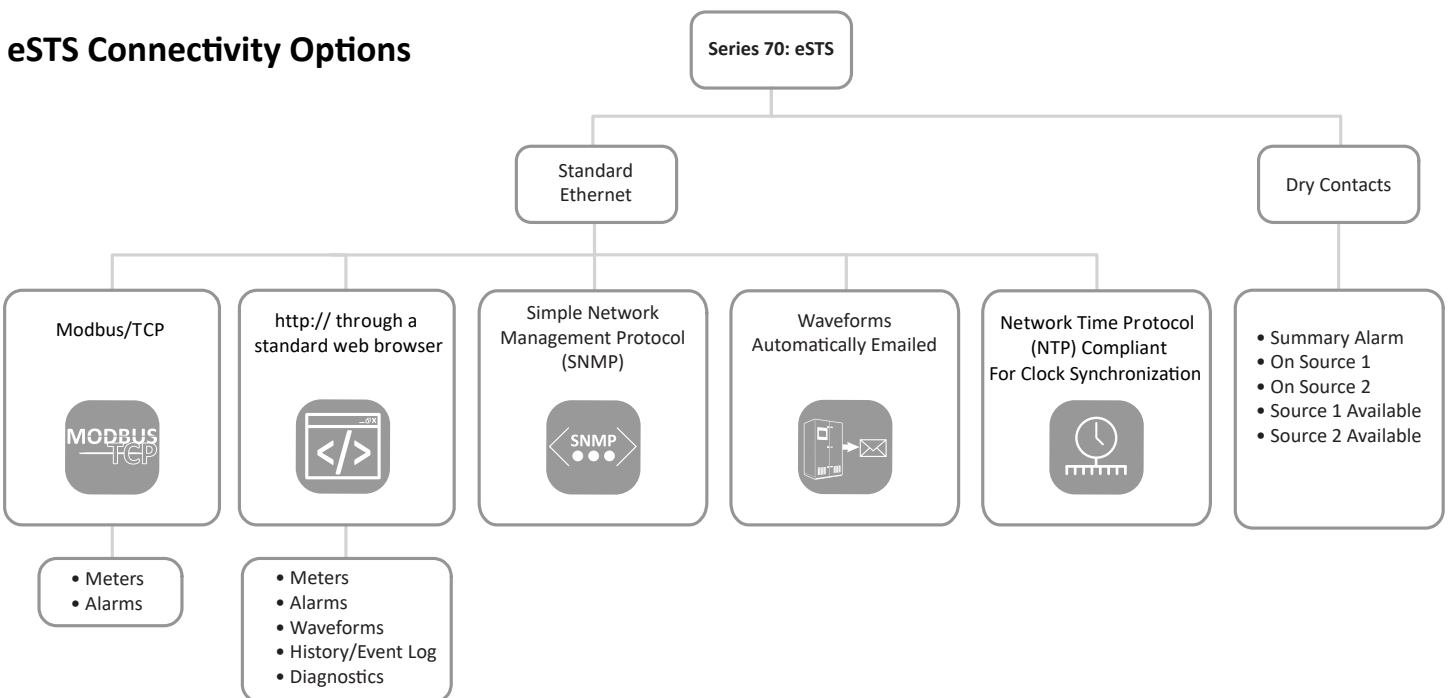
zen SSQM

The Series 70: eSTS is equipped with Zen SSQM (Static Switch Quality Monitoring), an all encompassing monitoring system with local and remote communications options.

From basic monitoring & alarm reporting, to advanced power quality monitoring functionality, Zen SSQM provides a wide-range of options to help you be aware, be vigilant, be proactive in your quest to create a safe, stable and reliable operation.



eSTS Connectivity Options



Zen SSQM Technical Specifications



Zen SSQM Parameters		Mains
Voltage Inputs and Output	Voltage (Volts)	✓
	Voltage Average of Phases (Volts)	✓
	Frequency (Hertz)	✓
	Total Harmonic Distortion (Percent VTHD)	✓
	Phase Rotation	✓
Current Inputs	Current (Amps)	✓
	Current Average of Phases (Amps)	✓
	Current Imbalance (Percent)	✓
	Real Power (kilowatts)	✓
	Apparent Power (kilovolt-amperes)	✓
	Reactive Power (kilovolt-amperes reactive)	✓
	Power Factor	✓
	Crest Factor	✓
	Crest Factor Average of Phases	✓
	Phase Difference Between Sources	✓
	Phase Difference Between Sources and Output	✓
	Alarms	Summary Alarm
On Source (1/2)		✓
Source Fail (1/2)		✓
Source Preferred (1/2)		✓
Source 1st Alternate (1/2)		✓
Source Over/Under Voltage (1/2)		✓
Source Over/Under Frequency (1/2)		✓
Source Not Available (1/2)		✓
Output Failure		✓
Source Overcurrent (1/2)		✓
Source Exceeds Manual Limit (1/2)		✓
Source Exceeds Automatic Limit (1/2)		✓
Bypassed to Source (1/2)	✓	

All product specifications are subject to change without notice.

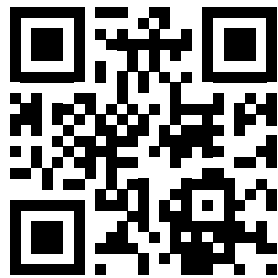
Technical Specifications: 4-Pole Static Transfer Switch

4-Pole eSTS Models with Withstand Ratings					
eSTS Rating (100%)	Voltage	Withstand	Dimensions	Weight	Heat Dissipation
250 A *	120/208 V 220/380 V 230/400 V 240/415 V 277/480 V	65 kA	48" W x 36" D x 90" H (1219.2 mm x 914.4 mm x 2286 mm)	1,800 lbs. (816 kg)	6,000 BTU/Hr.
400 A *				2,000 lbs. (907 kg)	8,000 BTU/Hr.
800 A			84" W x 40" D x 86" H (2133.6 mm x 1016 mm x 2184.4 mm)	2,950 lbs. (1338 kg)	8,000 BTU/Hr
Mechanical Characteristics					
Access	Front Only				
Cable Entry	Top (Connection Box Required)/Bottom				
Cable Exit	Top (Connection Box Required)/Bottom				
Frame Construction	Welded Frame				
Electrical Connections	Silver-Plated Solid Busbar				
Color	Textured Powder Coat White (RAL 7035), Blue (RAL 5017), Black, Custom				
Floor Stands	Optional				
Seismic floor stands	Optional				
Junction Boxes	Optional				
Sectionalization	Engineered Composite Insulation, Dead Front Doors				
Electrical Characteristics					
Number of Inputs	2				
Number of Output MCS	1, 2				
Frequency	50 Hz, 60 Hz				
Poles	4-pole				
Phases	3 Phase, 4 Wire + Ground				
Neutral Rating	100%				
Transfer Time	Nominal 1/4- cycle for in-phase sources				
Redundancy	Single Module Redundancy, Triple Modular Redundancy (Optional)				
Circuit Breaker Type	Molded Case Switch (Standard), Electronic Trip (Optional)				
Circuit Breaker Mounting Type	Plug-In 250 A, 400 A; Draw-Out 800 A				
SPD	Type 2				
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				
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				
Power Path Indicator	On Live Mimic				
Distribution Section					
Dimensions	Add 12" (30.48 cm) to Width				
Access	Front & Right Side				

Technical Specifications

Operational Characteristics	
Transfer Modes	Automatic; Manual (via Preferred Source Selection)
Cooling	Convection Cooling
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" (38.1 cm) 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 (4 Failure Groups. Triple Redundant Supplies.)
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; Local Display; Modbus/TCP; Web Browser
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

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Learn more at www.LayerZero.com



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