



LAYERZERO
POWER SYSTEMS, LLC.

The Foundation Layer

Series 70: eSTS

250 A 120/208 V 4-Pole Static Transfer Switch



Product Brochure

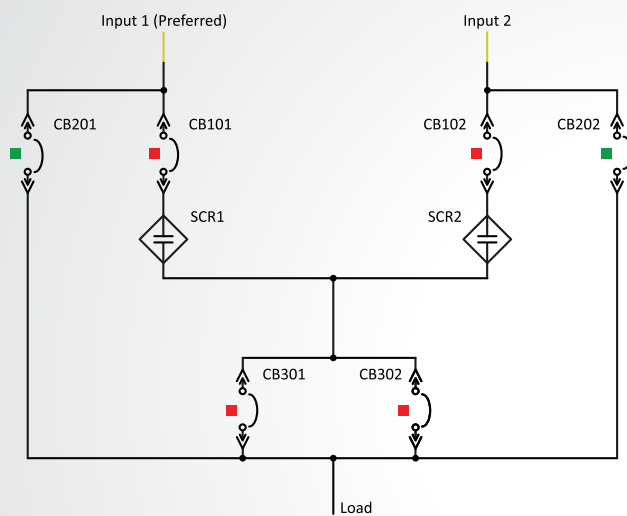
The LayerZero eSTS Static Transfer Switch Maximizes Power Reliability

eSTS Automatically Transfers Between Two or Three* Power Sources

LayerZero Power Systems designs and manufactures some of the **most reliable** static transfer switches in the world. The Series 70: eSTS is a solid-state transfer switch that provides automatic or manual transfers between two in-phase AC sources in just a quarter cycle.

The eSTS executes open-transition transfers in a way that keeps load disruption extremely low while ensuring the two power sources are never cross-connected. One source is designated as the preferred source. If that preferred source becomes unacceptable, the load transfers automatically and seamlessly to the alternate source using an open-transition static transfer. For emergency transfers between asynchronous sources, the eSTS uses dynamic phase compensation to minimize transformer saturation in 3-phase, 3-wire configurations.

*Optional



eSTS Static Transfer Switch One Line Diagram

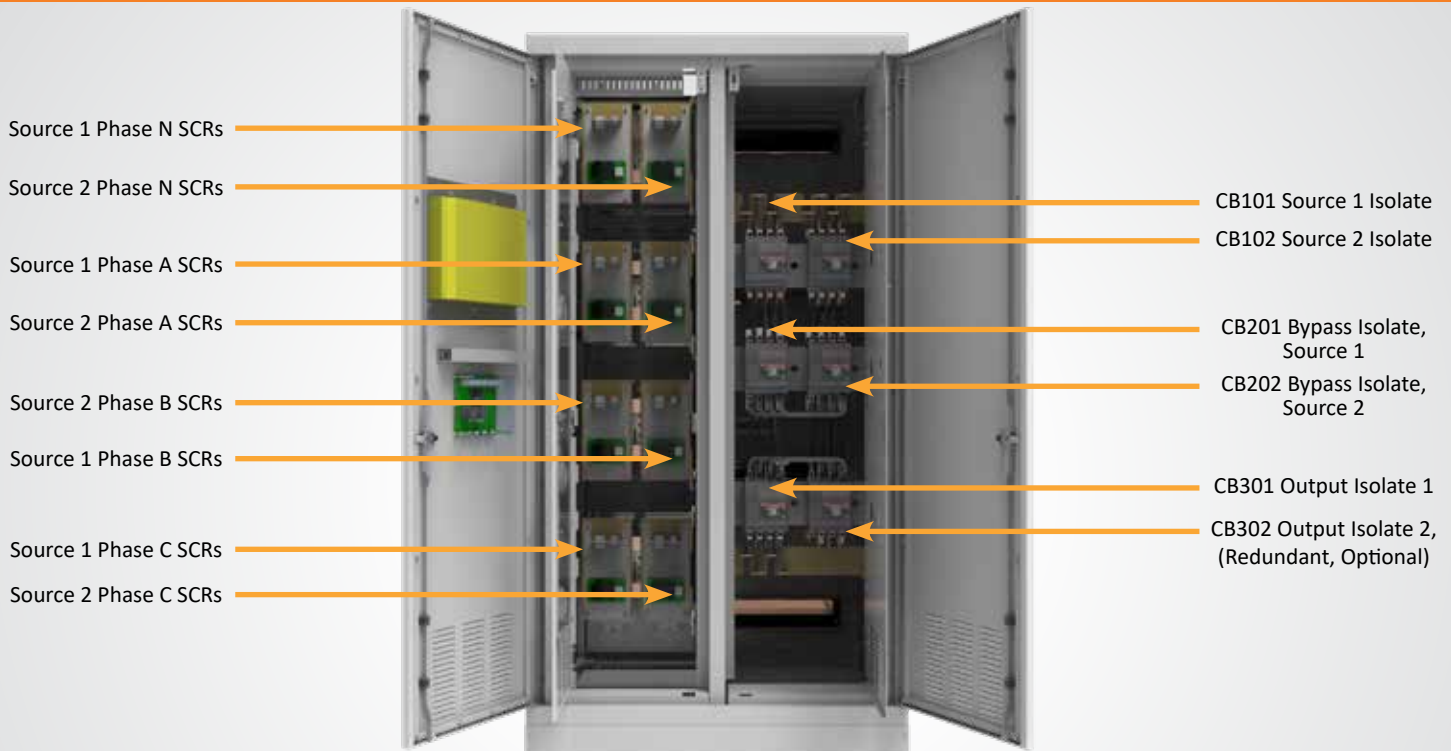
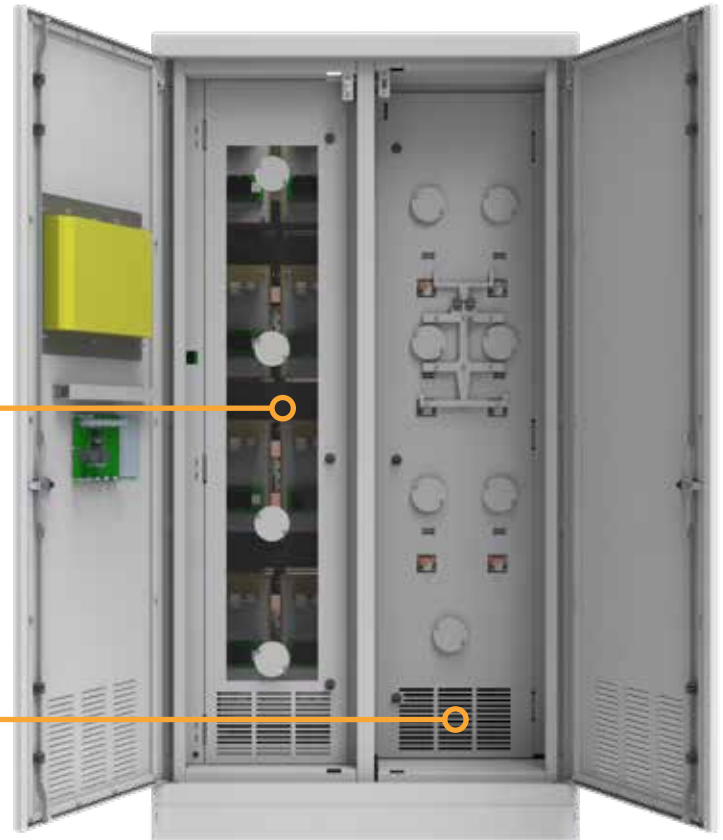


Controls Section Contains:

- Power electronics
- SCRs (Silicon Control Rectifier) in Convection Cooled Heat Sinks
- Control Electronics
- System Control & Data Acquisition Boards
- SCR Gate Drives
- Redundant Power Supply System
- I/O system; VPN Router

CB Section Contains:

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



Standard Features

Every LayerZero Series 70: eSTS includes a comprehensive set of standard features designed to maximize reliability, enhance operator safety, and streamline daily operations. These core design elements are what make LayerZero the preferred choice for mission-critical power switching.

Reliability



Optional Triple Modular Redundancy:
Fully-independent control paths ensure no single point-of-failure.



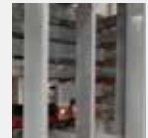
Safe Bypass Procedure:
Mechanical bypass interlock prevents human errors during bypass procedures.



Voice Guided Bypass:
Audio-video guidance offers step-by-step instructions for operators.



Convection Cooling:
Natural cooling system is maintenance-free.



Epoxy Coated Buswork:
Eliminates potential bus-to-bus faults.



Silver Plated Terminals:
Superior conductivity for enhanced electrical performance.



Maintenance-Free Joints:
Permanent brazed joints ensure longevity.



Machined Hardware:
Constant torque throughout product life.



Optical Fiber Based Controls:
Noise and interference free controls while ensuring high voltage isolation.



Serialized Critical Board Tracking:
Active database tracking for essential boards.

Safety



INSIGHT IR® Cameras:
Monitor bolted connections for temperature anomalies.



Sectionalized Components:
Allows safe de-energization for maintenance.



Polycarbonate Windows:
View critical board LEDs with closed dead-front door.



Front-Only Access:
Safe installation and maintenance without side/rear access.



Dead Front Hinged Doors:
Ensures a safe work environment with no exposed live parts.

Connectivity

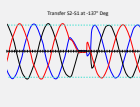
Ethernet Connectivity:
Secure VPN router for remote monitoring.

Modbus/TCP:
Connect to existing systems without proprietary restrictions.

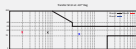
NTP Time Clock Synchronization:
Enables timeline-based event logging.

SNMP Connectivity:
Remote management via SNMP.

Power Quality Monitoring



Real-Time Waveform Capture:
Captures a picture of the power three-cycles before and after every event.



ITIC Plotting:
Analyze if equipment was affected by power quality events.



Local Touch-Screen Interface:
Secure interface for local STS operations.



Waveforms Automatically Emailed:
Send waveforms to designated individuals post-transfer.

Reliability Overview

LayerZero eSTS Reliability Overview

The LayerZero eSTS Provides Many Dimensions of Reliability:

- **Control System Reliability:**
 - **SMR (Single Module Redundancy, Standard):** Our foundational architecture delivers reliable and consistent operation under all conditions.
 - **TMR (Triple Modular Redundancy, Optional):** LayerZero's TMR system builds upon SMR by incorporating three completely independent control systems. Each operates in total isolation, independently acquiring and processing voltage and current data. Even in the event of a control path failure, the system continues operating seamlessly. This is not simply "triple-redundancy," but it is a rigorously designed architecture built for unmatched reliability.
- **Control Power Supply Reliability:** Designed to ensure consistent, uninterrupted power to control systems, minimizing the risk of unexpected shutdowns.
- **Signal Reliability:** Designed for accurate, inference-resistant signal transmission to reduce communication errors and ensure data integrity.
- **Operator Procedural Reliability:** Integrates intuitive, safety-focused features that promote error-free operation and help maintain overall system integrity.

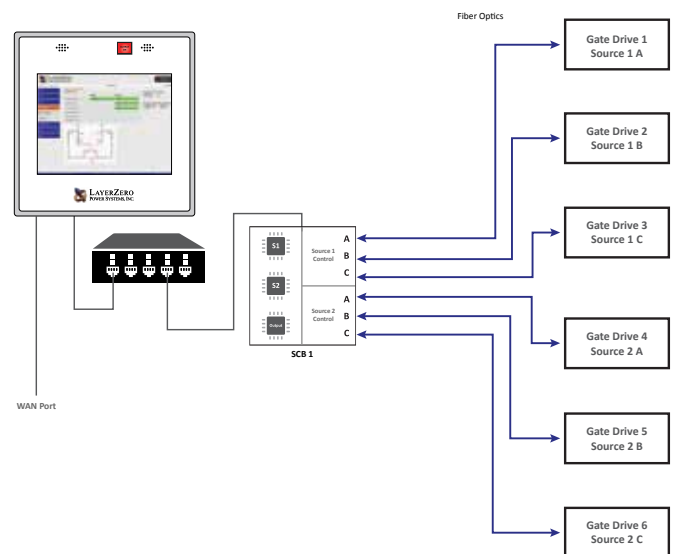


The Series 70: eSTS is designed for maximum reliability

Single Module Redundancy (SMR) Reliability (Standard)

Single Module Redundancy is a cost-effective topology that provides redundant power paths for critical loads. In an SMR system, each source has triple-redundant processors, and every phase is managed by its own individual gate drive board.

LayerZero's take on SMR is distinct: the topology is inherently fail-safe. Even if a critical board experiences a fault, the system maintains full switching capability, helping ensure uninterrupted performance.



Redundant Control Paths of LayerZero SMR Gate Drives

Reliability Features: Triple Modular Redundancy (TMR) *Optional

Triple Modular Redundancy (TMR) Reliability (Optional)

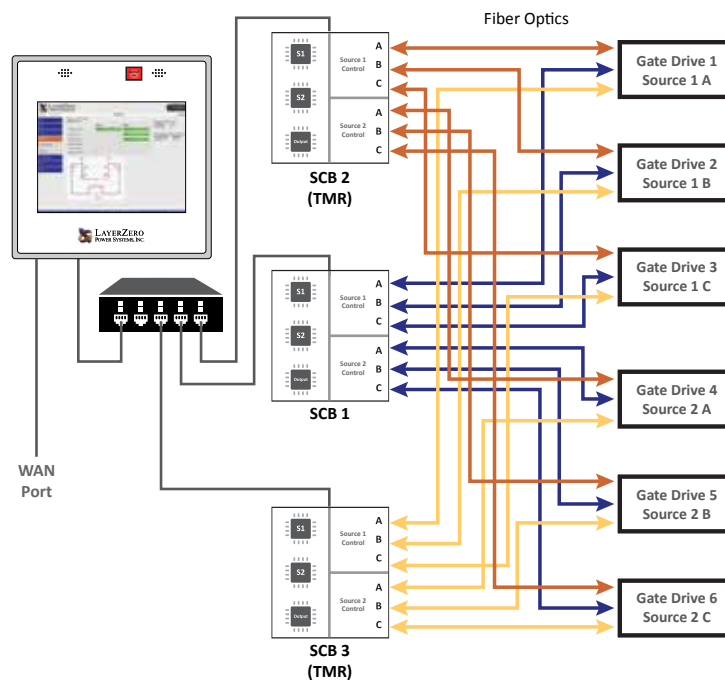
LayerZero’s TMR architecture builds upon SMR by adding another level of protection: three independent sets of analog and digital data-acquisition and control systems. These systems do not communicate with each other, nor do they share a common clock.

Each control path independently analyzes voltage and current, decides if a source is acceptable, and determines whether to transfer. Even if an entire control path fails, and the active source subsequently fails, the STS still completes its mission and transfers the load to the alternate source.

Triple Modular Redundancy is grounded in proven statistical reliability and rigorous design mathematics. Other manufacturers may use similar terminology like “tri-redundant,” but these approaches do not match the reliability delivered by LayerZero’s true TMR architecture.



Three System Control Boards (SCBs) in a TMR Configuration



Redundant Control Paths of a TMR Configuration

Reliability Features: Single Module Redundant (SMR) Redundancy

eSTS SMR Triple Redundant Power Supply Architecture

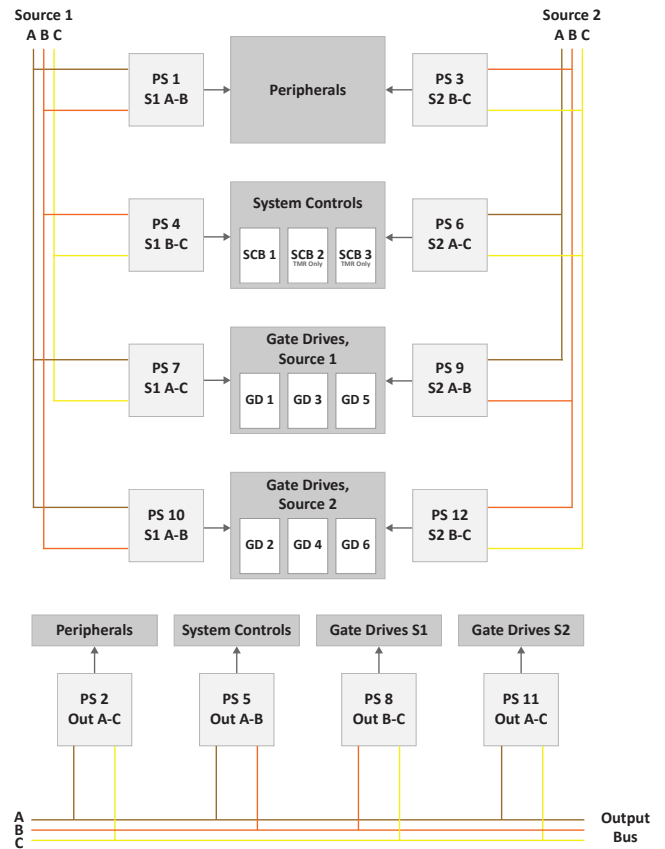
Divided into four (4) logical failure groups:

- 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.

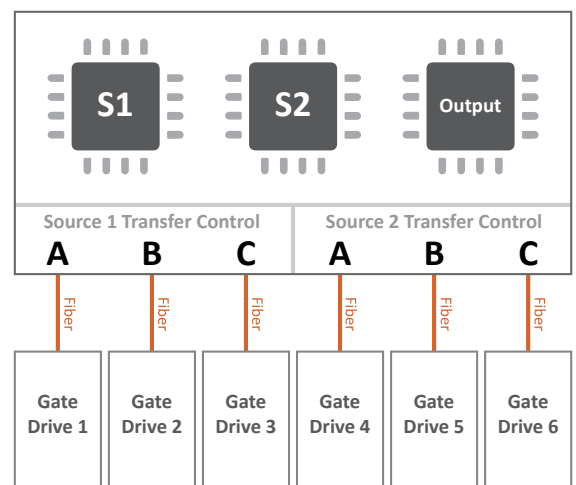
LayerZero’s STS design incorporates twelve (12) power supplies (3 power sources x 4 failure groups.) The resultant control power topology utilizes all possible power paths to the four logical STS failure groups; and is the most comprehensive and redundant power supply system in existence.



eSTS SMR Triple Redundant Processors

LayerZero’s Single Module Redundancy (SMR) architecture incorporates triple-redundant processors to enhance power quality analysis and system reliability. Each processor operates independently to monitor and manage power flow from its designated source.

- Independent processors are dedicated to Source 1, Source 2, and the Output, providing real-time, isolated power quality analysis.
- If the processor for Source 1 malfunctions, the system can still be commanded to transfer to Source 2 and vice versa.
- In the event of a complete failure of the main control system, the static transfer switch continues to conduct power from the current source to the load. While transfers between sources are temporarily unavailable, power delivery remains uninterrupted until the control system is restored.
- For added reliability, each phase of each source is managed by an independent gate drive circuit board, providing isolated phase control and enhanced system fault tolerance.

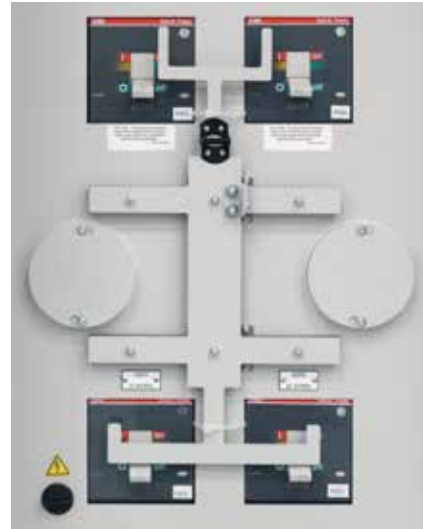


Reliability Features

Mechanical Bypass Interlock

To minimize the risk of operator error during bypass operations, LayerZero's eSTS features a comprehensive mechanical interlock system designed with multiple layers of protection:

1. **Interlocked breakers** to prevent unsafe switching actions.
2. **Source verification mechanisms** ensure that a source cannot be bypassed unless the STS is actively sourcing from it.
3. **Protective safeguards** that prevent the inadvertent cross-connection of power sources.
4. **Voice-guided bypass procedures** that audibly walk the operator through each required step.
5. **Step-by-step pictorial and video guidance** are displayed on the unit's touchscreen interface during the bypass process.



Mechanical Bypass Interlock "Goalpost" Design

Voice Guided Bypass

Operator error during maintenance bypass is a well-known threat to system reliability. To address this risk, every LayerZero eSTS is equipped with a voice-guided bypass interface. The system walks the operator through the bypass sequence one step at a time, with each action presented on a dedicated screen. Both audio and visual cues are provided to guide proper execution, significantly reducing the risk of procedural mistakes.



The Voice Guided Bypass Screen in the LZA GUI

No Fans, No Filters, No Fuses

The Series 70 eSTS utilizes a natural convection cooling system, eliminating the need for fans, fan sensors, dust filters, or fan fuses - all common points of failure in traditional designs.

This convection-based approach not only reduces maintenance requirements but also maximizes uptime. The heat sink layout is strategically staggered between sources and phases to minimize thermal gradients during source transitions, further enhancing thermal reliability and operational stability.



Convection-Cooled Design in an eSTS, showing perforated vents on the cabinet bottom

Reliability Features

Epoxy-Coated Buswork and Maintenance-Free Joints

LayerZero's use of epoxy-coated buswork enhances both system safety and reliability by eliminating the risk of bus-to-bus faults. All bus joints are permanently brazed, resulting in maintenance-free connections that reduce the need for ongoing service and minimize potential points of failure.

Silver Plating for High Performance

All bus joints and terminals are silver-plated to ensure the highest level of electrical performance. Silver's superior conductivity and low resistance make it the ideal material for creating clean, efficient, and dependable electrical contacts.



Silver-Plated, Epoxy Coated Customer Inputs for Source 1 and Source 2

Precision-Machined Hardware

LayerZero employs precision-machined cap screws and engineered disc springs in all bolted connections. This pairing provides a consistent pressure-versus-deflection profile, ensuring that each connection maintains constant torque over the product's lifetime. These components have been extensively tested across wide temperature ranges to guarantee long-term mechanical stability. Once tightened, connections remain secure.



Machined Cap Screws and Engineered Disc Springs Utilized in LayerZero Power Systems Products

Fiber Optic Controls Increase System Reliability

LayerZero's eSTS architecture leverages fiber optic-based controls to enhance system performance and reliability. By eliminating electrical noise and signal interference, optical fiber ensures clean, accurate communication across the system, even in electrically noisy environments.

Fiber optics also provides critical electrical isolation, protecting sensitive control components from high-voltage areas. In the eSTS design, gate drives located at power circuit voltage receive their control signals exclusively via optical fibers, enabling safe and reliable operation.

This architecture not only supports robust system communication. It also improves serviceability, allowing tools to interface with the system securely and safely, without introducing electrical risk.



Fiber Optic Connections (highlighted) in a Gate Drive

Safety - Ease of Maintenance

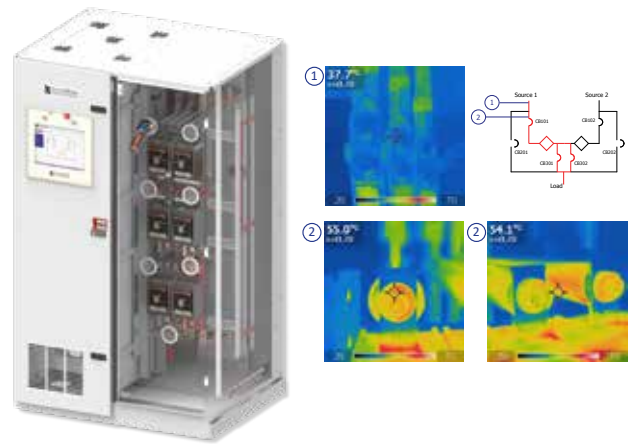
INSIGHT IR® Portholes Permit Scanning of Bolted Connections with Dead-Front Doors Closed

LayerZero’s strategically positioned IR-scan portholes allow operators to safely perform thermal scans of all bolted connections without opening the dead-front door or being exposed to power circuit voltage. Scanning can be performed entirely from the front, minimizing risk during routine maintenance.

Each IR window swivels upward and unlocks via a keyhole access mechanism, revealing a protective mesh screen. This design allows operators to simply point and shoot thermal cameras to capture accurate temperature readings of internal components.



INSIGHT IR® Porthole mounted on a polycarbonate window.



An IR Camera Scanning an INSIGHT IR Porthole for Source 1 Input (Door and side panel hidden for visibility)

INSIGHT IR® Cameras Provide Early Detection

INSIGHT IR® is a thermal monitoring system that is designed to continuously monitor the temperatures of critical components. INSIGHT IR® captures data from a network of fixed infrared cameras, and displays a live image of the temperature of each connection. INSIGHT IR® has the capability to view temperatures by-phase. If a problematic area is detected early, repairs can be made on equipment before the problem leads to downtime.



INSIGHT IR® live images can be viewed on a local or remote display.



INSIGHT IR® Camera Housing



INSIGHT IR® Cameras are installed near bolted connections and critical components, and generates a hybrid heat map over a visible image

Safety

Sectionalization Maximizes Operator Safety

LayerZero's sectionalized design provides enhanced operator protection by physically separating user-accessible sections, such as breakers and switches, from the power electronics and control electronics. This architecture allows maintenance activities to be performed safely and efficiently, as power can be bypassed around the section requiring service, reducing exposure to energized components and minimizing arc flash risks.



eSTS with the Outer Doors Open, showing physical separation between the power electronics and control sections

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

Inspired by NFPA 70E safety principles, the Series 70 eSTS is designed to help data centers significantly reduce exposure risks during normal operation and routine inspection.

Operators can easily view diagnostic status LEDs and SafePanel circuit breaker positions, all with the dead-front doors closed, eliminating the need to access live compartments. This feature supports safer, faster inspections while enhancing overall system reliability and uptime.



Polycarbonate Window on the Power Electronics Section, allowing visibility of status LEDs.

Ease of Maintenance/Connectivity Options

Front Only Access Saves Space

The Series 70 eSTS is designed for installation, operation, diagnostics, and maintenance entirely from the front, eliminating the need to remove side or rear covers. All dead-front panels are hinged, providing streamlined access while enhancing safety and convenience.

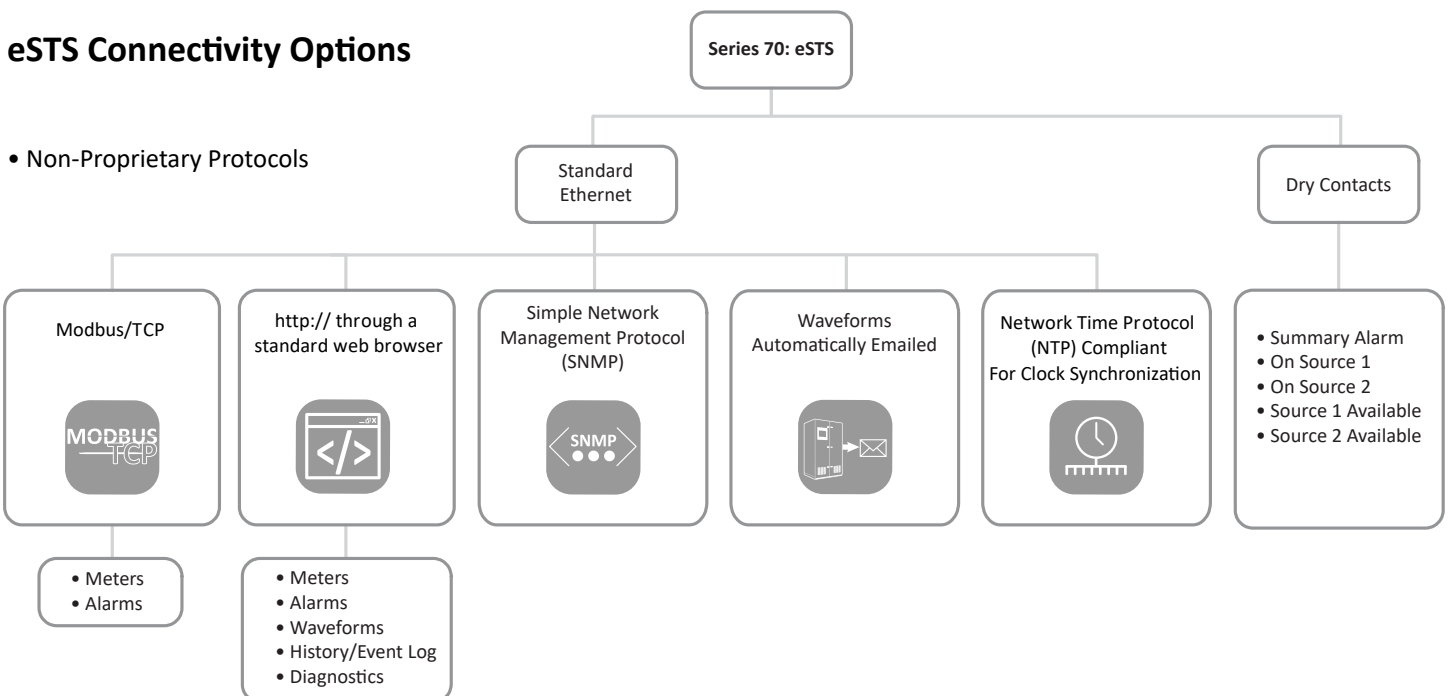
Traditional unhinged covers can be cumbersome and difficult to handle, and operator errors during their removal or reattachment have been known to compromise load reliability. By enabling safe, non-invasive access from the front only, the Series 70 supports a more reliable and space-efficient maintenance process, minimizing disruption to critical operations.

Additionally, the system’s dead-front hinged doors are equipped with integrated alarms that notify operators whenever an outer door is opened, reinforcing operational awareness and safety.



Front of the eSTS Static Transfer Switch

eSTS Connectivity Options



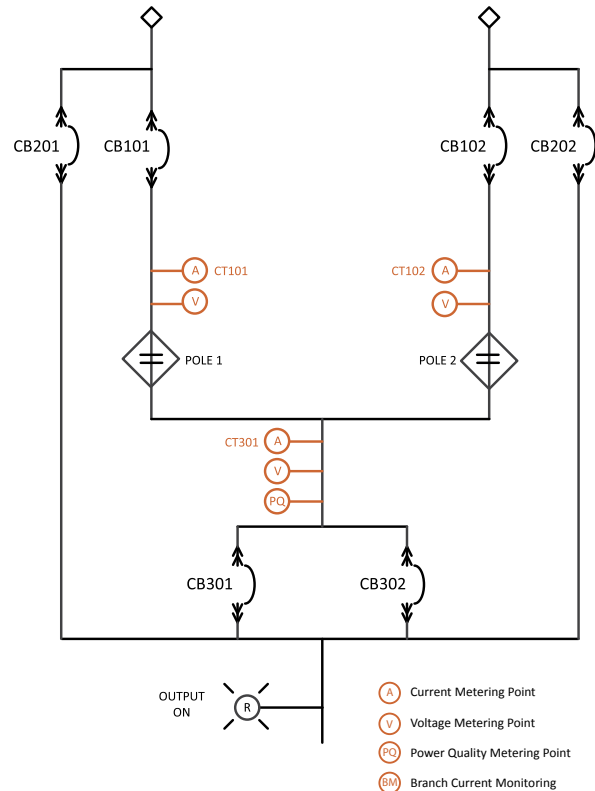
Features/Power Quality Monitoring

LayerZero Power Quality Monitoring

LayerZero PQM (Power Quality Monitoring) provides comprehensive insight into the activity within your critical power distribution systems. This all-encompassing platform offers both local and remote communication capabilities, ranging from basic status and alarm reporting to advanced power quality analytics, empowering you to maintain the highest levels of system reliability.

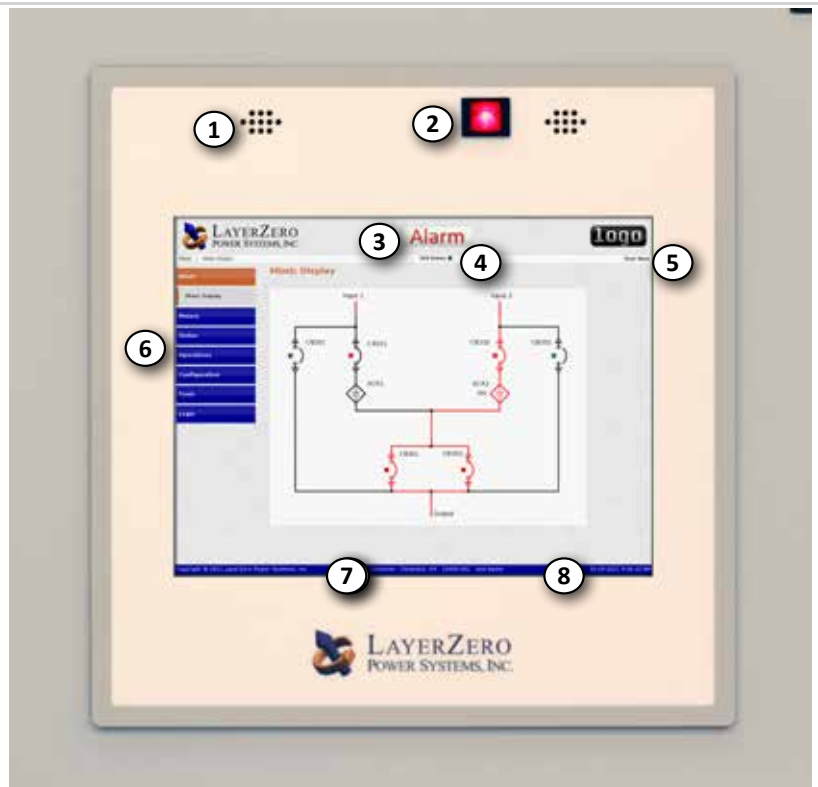
LayerZero PQM delivers a vendor-neutral “bird’s eye” view of your entire power infrastructure, allowing you to proactively monitor for power quality issues, UPS output anomalies, or active alarms across your network.

More than just real-time monitoring, LayerZero PQM also provides historical playback functionality, enabling users to retrace and analyze the exact sequence of past events. This powerful capability delivers unmatched.



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

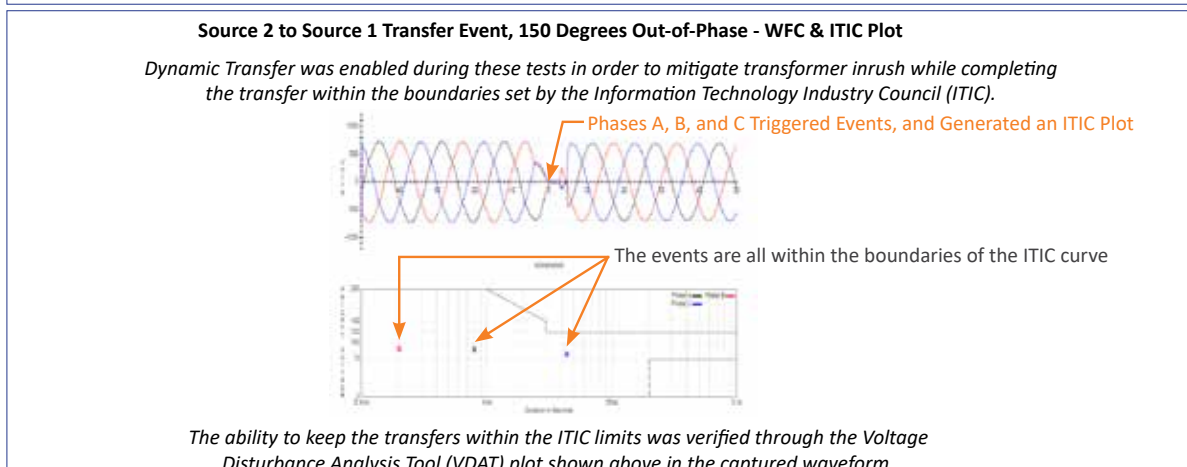
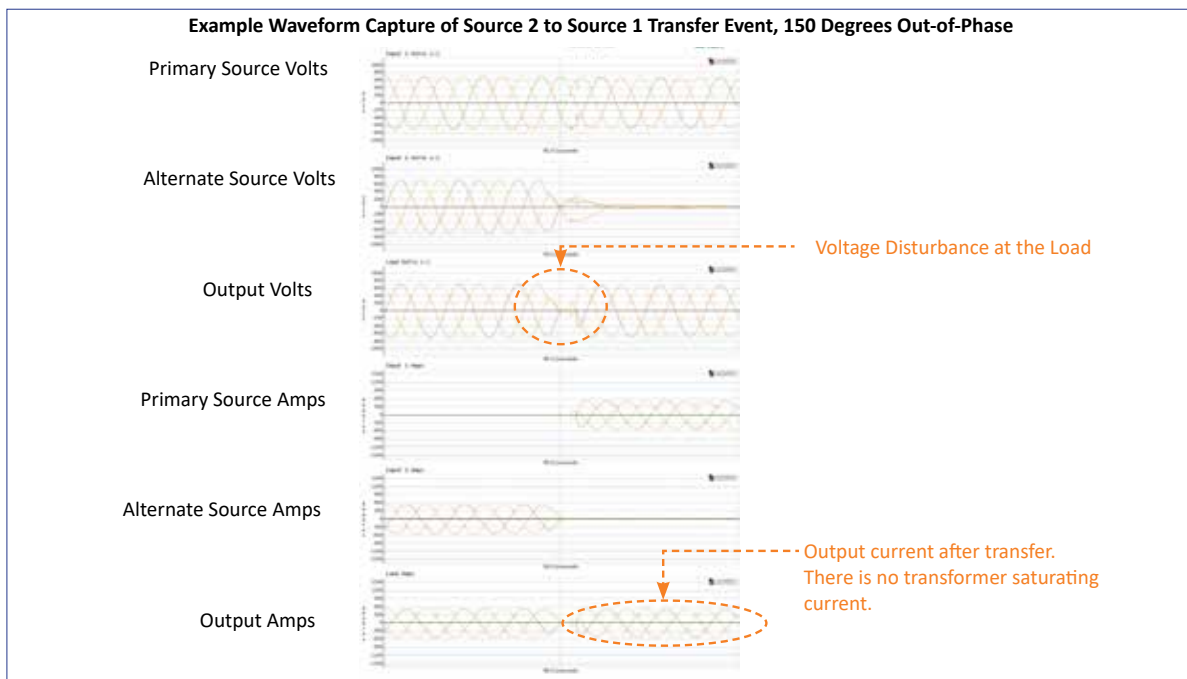


Generate Easy-To-Understand Power Quality Reports with ITIC Plotting

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 VDAT-generated ITIC curves of the event. This data is remotely accessible by connecting to the unit via web browser.

V DAT (Voltage Disruption Analysis Tool) is a quantum leap in the field of power systems data interpretation. By harnessing state-of-the-art algorithms and processing techniques, V DAT effortlessly translates complex power data into discernible, actionable insights. V DAT tackles a major industry challenge: while traditional waveform captures are often intricate and challenging to interpret, V DAT brings clarity with its intuitively designed plots based on Information Technology Industry Council (ITIC) standards, empowering professionals to make quick and informed decisions.

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.



Power Quality Monitoring

Static Switch Power Quality Monitoring

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

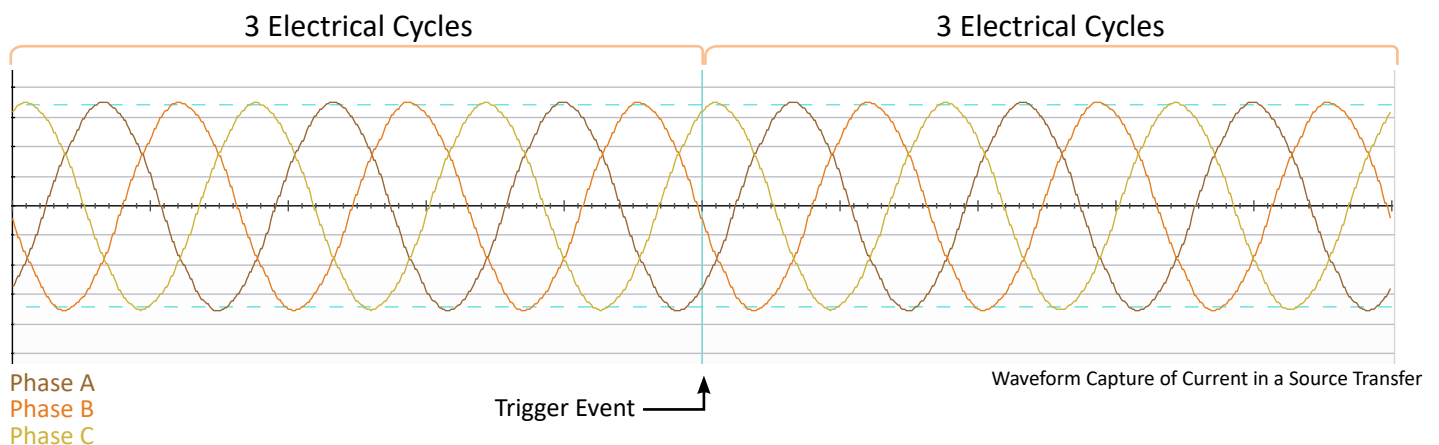
From basic monitoring & alarm reporting, to advanced power quality monitoring functionality, LayerZero’s SSQM provides a wide-range of options to help you be aware, be vigilant, be proactive in your quest to create a safe, stable and reliable operation.



eSTS Touch Screen GUI showing Real Time Waveform Capture

LayerZero’s SSQM Provides Answers

LayerZero SSQM provides timestamped pictures of waveforms before and after events, providing information that enables facilities to go back in time to methodically identify and correct the root causes of events. LayerZero actively captures power quality information at the STS, PDU, and RPP - permitting thorough post-event analysis.



LayerZero SSQM Technical Specifications

LayerZero 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 (1/2/3)	✓
	Source Fail (1/2/3)	✓
	Source Preferred (1/2/3)	✓
	Source 1st Alternate (1/2/3)	✓
	Source Over/Under Voltage (1/2/3)	✓
	Source Over/Under Frequency (1/2/3)	✓
	Source Not Available (1/2/3)	✓
	Output Failure	✓
	Source Overcurrent (1/2/3)	✓
	Source Exceeds Manual Limit (1/2/3)	✓
	Source Exceeds Automatic Limit (1/2/3)	✓
	Bypassed to Source (1/2/3)	✓

Technical Specifications: 4-Pole Static Transfer Switch

Mechanical Characteristics *	
Current/Voltage/Number of Poles	250 A 120/208 V 4-Pole
Heat Dissipation	4,800 BTU/Hr
Weight	1,350 lbs (620 kg)
Dimensions	48"W x 36"D x 90"H (1210 mm x 914 mm x 2300 mm)
Clearances	Front: 36" (914 mm) Rear: 0" Sides: 0" Top: 18" (457 mm)
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, 3 (3 optional)
Number of Output CBs	1, 2
Frequency	50 Hz, 60 Hz
Poles	4-pole
Phases	3 Phase, 3 Wire, 4 Wire + Ground
Neutral Rating	100%, 150%, 200%
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 up through 600 A; Draw-out 800 A, 1200 A
TVSS	Standard
Power Quality Monitoring	
Power Quality Monitoring Technology	LayerZero Power 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

*Dimensional & weight data is only valid for 2-source.

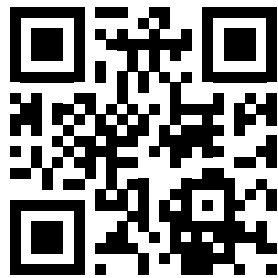
All product specifications are subject to change without notice.

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 (4 Failure Groups. Triple Redundant Supplies. 12 Power Supplies Provided.)
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	
CSA	ETL Listed to C22.22 No 107.
UL	ETL Listed to UL 1008S

All data tables above are for 3-pole only. Contact LayerZero for custom sizes and designs.

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Learn more at www.LayerZero.com



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