LayerZero Power Systems, LLC.

The Foundation Layer

Series 70: eSTS

600 A 480 V 3-Pole Static Transfer Switch

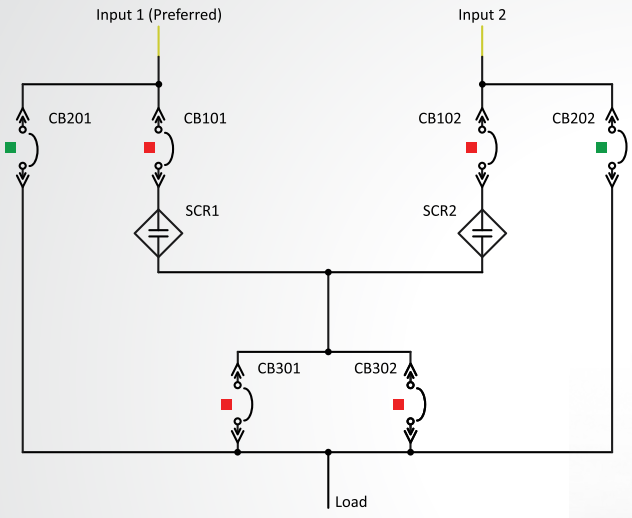
Product Brochure

The LayerZero eSTS Static Transfer Switch
Maximizes Power Reliability

eSTS Automatically Transfers Between Two or Three* Power Sources

LayerZero Power Systems designs and manufactures the world's ***most reliable*** static transfer switch. The Series 70 eSTS is a solid-state transfer switch that provides automatic or manual transfers between two in-phase AC sources within a quarter cycle. It performs open-transition transfers that minimize load disruption without ever cross-connecting power sources. One source is designated as the preferred source. If the preferred source fails, the eSTS automatically and seamlessly connects the load to the alternate source through an open-transition static transfer. For emergency transfers between asynchronous sources, dynamically phase-compensated transfers minimize downstream transformer saturation in three-phase, three-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:

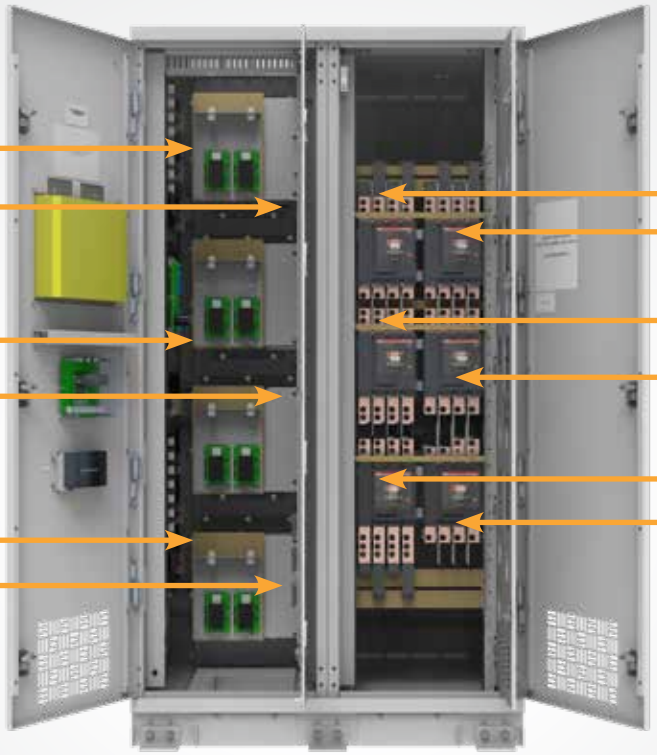
Input isolation switches

Bypass isolation Switches

Output isolation switches

Source connection terminals

Load connection terminals



Standard Features

Every LayerZero eSTS is equipped with a suite of standard features designed to maximize reliability, safety, and operational efficiency, making it the preferred choice for mission-critical environments.

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 interferance 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.

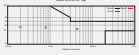
Modbus/TCP: Connect to existing systems without proprietary restrictions.

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.

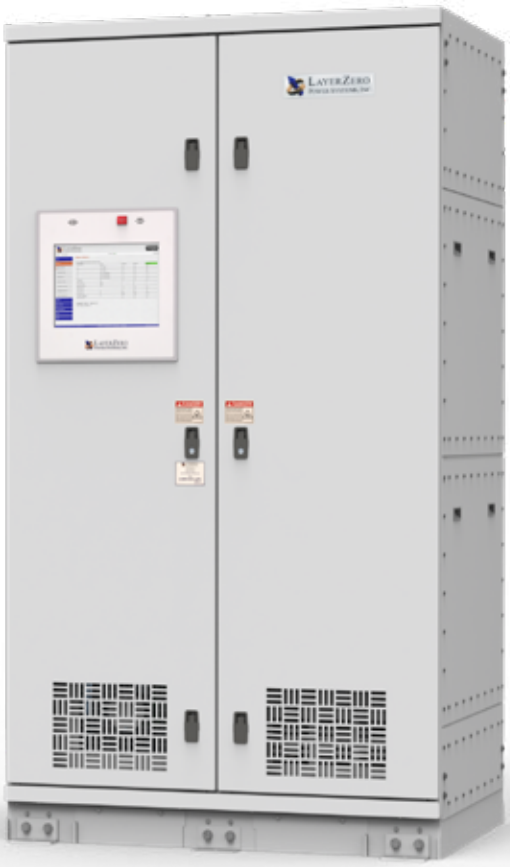
Waveforms Automatically Emailed: Send waveforms to designated individuals post-transfer.

Reliability Overview

LayerZero eSTS Reliability Overview

The LayerZero eSTS Provides Many Dimensions of Reliability:

- **Control System Reliability:**
  - **SMR (Single Module Redundancy, Standard):** The foundational architecture ensuring consistent and reliable operation.
  - **TMR (Triple Modular Redundancy, Optional):** A high-availability control system with three fully independent modules that each analyze voltage and current data. Even if one control path fails, the STS continues operation seamlessly, offering unmatched resilience.
  - **Control Power Supply Reliability:** Designed for consistent power delivery and protection from unforeseen interruptions.
  - **Signal Reliability:** Designed to ensure clear, precise, and error-free signal transmission.
  - **Operator Procedural Reliability:** Intuitive system design promotes accurate, error-free operation to maintain integrity.

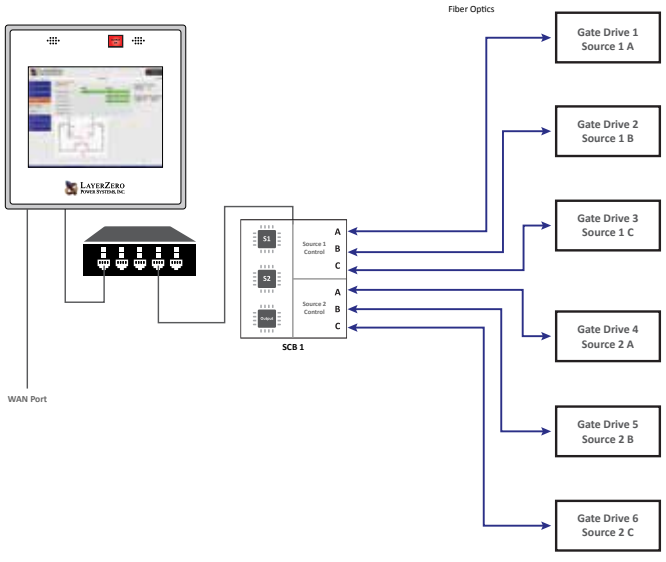


The Series 70: eSTS is designed for maximum reliability

Single Module Redundancy (SMR) Reliability (Standard)

Single Module Redundancy (SMR) is a cost-effective topology that provides redundant power paths to mission-critical equipment. Each source is managed by processors with built-in triple redundancy, and every phase is independently controlled through a dedicated gate drive board.

LayerZero's Single Module Redundancy topology is uniquely fail-safe, maintaining a full transfer functionality even if a critical board were to fail. This ensures uninterrupted reliability under all operating conditions.



Redundant Control Paths of LayerZero SMR Gate Drives

Reliability Features: Triple Modular Redundancy (TMR) *Optional

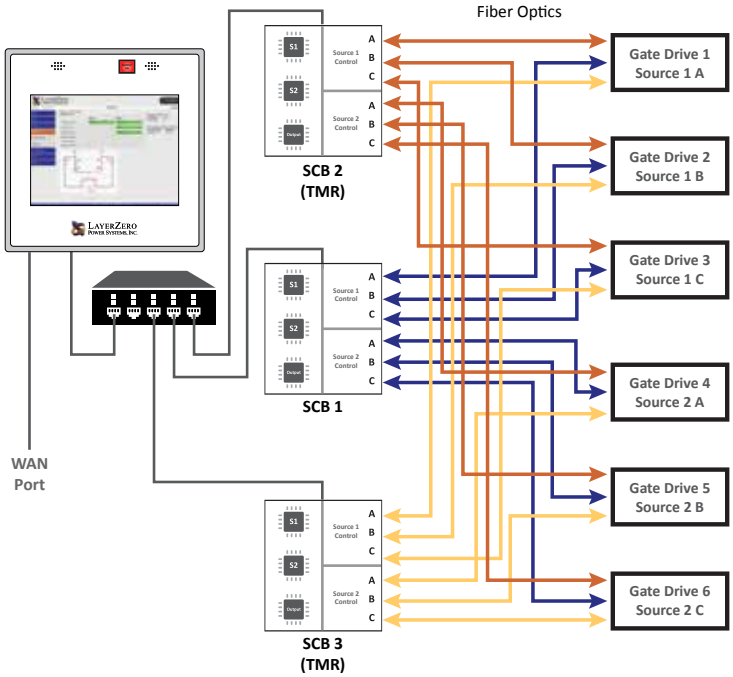
Triple Modular Redundancy (TMR) Reliability (Optional)

LayerZero's Triple Modular Redundancy (TMR) architecture builds upon the foundation of Single Module Redundancy (SMR) by incorporating three fully independent analog and digital data acquisition and control systems. Each operates autonomously. There is no direct communication or shared system clock between them.

Every control system independently measures voltage and current, evaluates source quality, and determines transfer conditions. Even in the unlikely event of a complete control path failure followed by a power source fault, the eSTS remains capable of completing its mission by transferring to the alternate source.

TMR reliability is grounded in rigorous statistical analysis and mathematical modeling. While other manufacturers may use similar-sounding terms like "tri-redundant," LayerZero's true Triple Modular Redundancy delivers a higher, proven level of reliability unmatched in the industry.

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

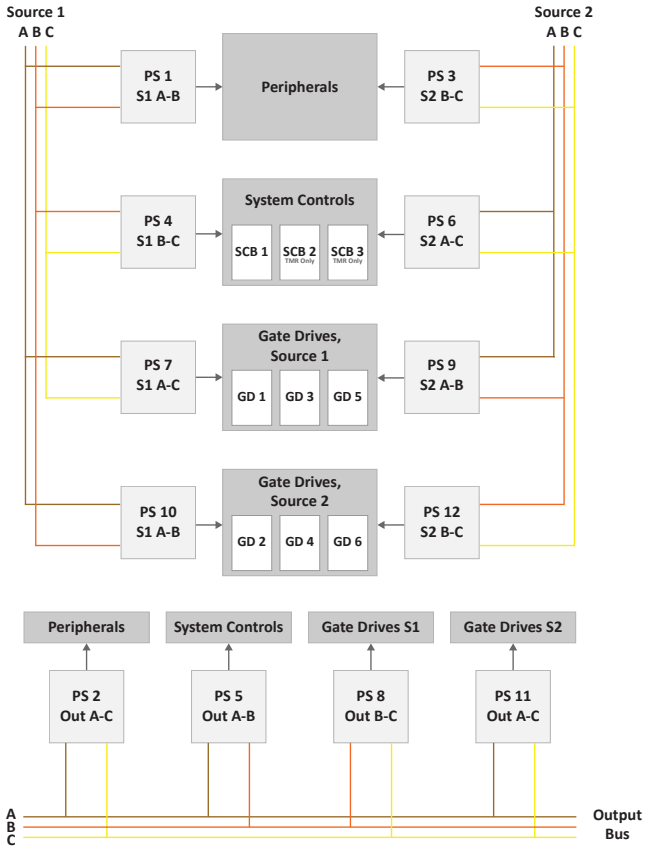
Divided into four (4) logical failure groups:

- 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:

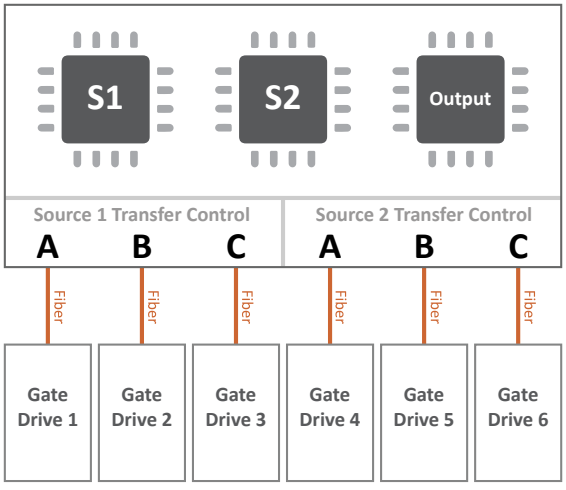
- Source 1
- Source 2
- STS Output.

This configuration results in 12 total power supplies (3 source X 4 failure groups), utilizing every possible power path to maintain continuous operation. The result is the most comprehensive and redundant control power topology in existence, ensuring uninterrupted functionality even under multiple fault conditions.



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.

Mechanical Bypass Interlock “Goalpost” Design

Voice Guided Bypass

Operator error during maintenance bypass has historically been one of the greatest risks to system reliability. To address this, LayerZero’s Series 70 eSTS incorporates a voice-guided bypass system that walks the operator through the procedure step-by-step, one operation per screen. Each instruction is reinforced through visual and audio cues, ensuring clarity and preventing out-of-sequence actions. This design dramatically reduces the likelihood of human error while improving operational confidence and safety.

The Voice Guided Bypass Screen in the LZA GUI

No Fans, Dust Filters, or Fan Fuses

For maximum uptime and reduced maintenance, the Series 70 eSTS utilizes a natural convection-cooled heat dissipation system.

Because it contains no fans, dust filters, or fan fuses, the system eliminates common failure points associated with forced-air cooling.

The heat sink arrangement is strategically staggered between sources and phases to minimize the formation of extreme thermal gradients when conducting on either source. The result is a cooler, quieter, and more reliable static transfer switch built for continuous mission-critical performance.

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

Reliability Features

Epoxy Coated Buswork/Maintenance Free Joints

LayerZero utilizes epoxy-coated buswork to enhance safety and improve long-term reliability by eliminating the potential for bus-to-bus faults. All bus joints are permanently brazed, creating maintenance-free connections that maintain integrity over the product's lifetime.

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

Silver Plating

To achieve maximum electrical performance, LayerZero applies silver plating to all bus joints and terminals. Silver's high conductivity and low resistance provide superior electrical contact characteristics, minimizing power loss and ensuring consistent, reliable performance in mission-critical environments.

Machined Hardware

LayerZero's bolted connections are designed for longevity and reliability using machined cap screws and precision disc springs. This combination delivers a flat pressure-versus-deflection profile, ensuring that each bolted connection maintains constant torque throughout the product's life.

These connection technologies have been tested across a wide range of environmental conditions, confirming that once tightened, connections remain secure and stable under varying temperatures and loads.

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

Fiber Optic Controls Increase System Reliability

LayerZero's fiber optic-based control system eliminates electrical noise and interference while isolating sensitive components from high voltage. In the Series 70 eSTS design, gate drives operating at power circuit voltage receive control signals through optical fibers, ensuring clean, reliable communication and enhanced system immunity to transient disturbances. This approach improves reliability, safety, and long-term system performance in demanding power environments.

Fiber Optic Connections (highlighted) in a Gate Drive

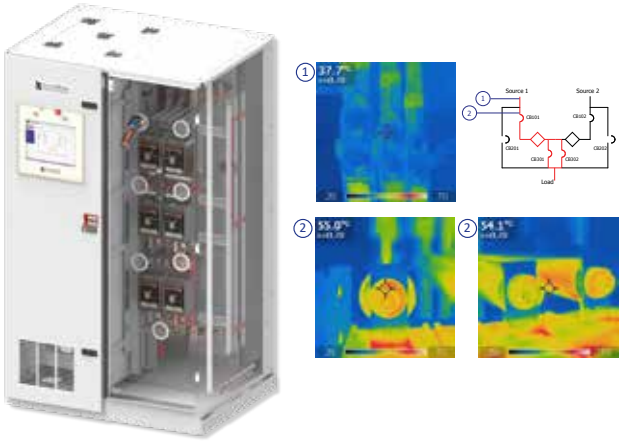
Safety - Ease of Maintenance

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

LayerZero's INSIGHT IR® portholes are strategically positioned to allow safe thermal scanning of all bolted connections while the dead-front doors remain closed. This design ensures the operator is never exposed to power circuit voltage during inspection.

Each IR window swivels upward and unlocks with keyhole access, revealing a protective mesh that allows operators to safely point and shoot thermal cameras to obtain accurate readings.

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 continuous thermal monitoring system designed to detect abnormal heat conditions before they escalate into critical failures. The system captures data from a network of fixed infrared cameras, displaying a real-time thermal image of each monitored connection.

INSIGHT IR® also enables phase-by-phase temperature visualization, helping operators quickly identify developing issues. By detecting problematic areas early, maintenance teams can perform proactive repairs, preventing downtime and improving overall system reliability.

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 ensures operators are protected from exposed live components. Normal operator sections, such as breakers and switches, are physically separated from the power electronics and control electronics compartments, allowing maintenance to be performed safely on one section without exposure to energized parts. If service is required, power can be bypassed to an alternate section, enabling safe and uninterrupted maintenance options.

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

The Series 70 eSTS product line was developed with NFPA-70E principles in mind, helping data centers significantly reduce energy distribution risks.

Operators can view diagnostic status LEDs and SafePanel circuit breaker positions without opening the dead-front doors, minimizing exposure to energized components and enhancing operational safety.

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: A eSTS is designed to be installed, operated, diagnosed and maintained only from the front. The dead-front panels are hinged, and side or rear covers never have to be removed.

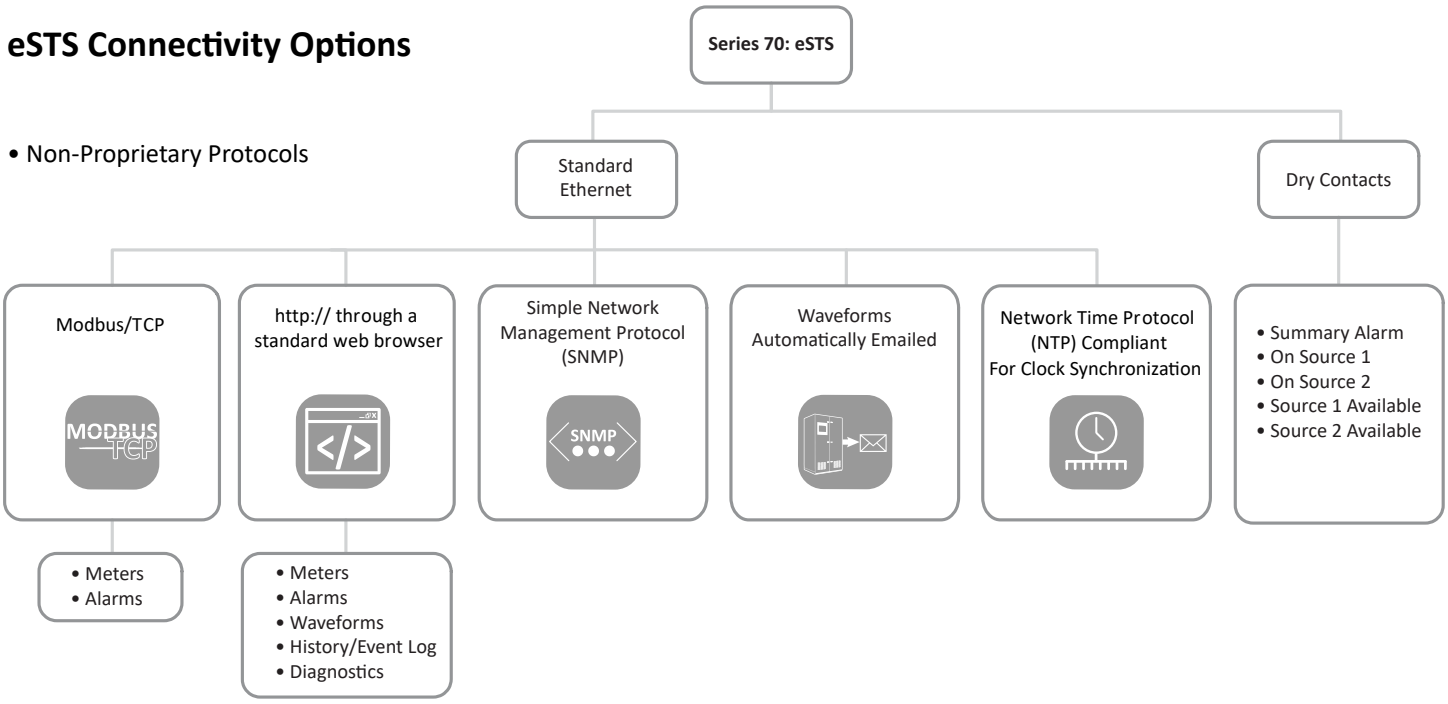
Unhinged covers can be bulky and unwieldy, and operator error during removal and replacement of covers has been known to cause mishaps and compromise load reliability. A safe, non-invasive operation and maintenance regime results in a higher reliability of the critical load.

The Series 70: eSTS utilizes dead-front hinged doors. An alarm notifies when an outer door has been opened.

Front of the eSTS Static Transfer Switch

eSTS Connectivity Options

- Non-Proprietary Protocols



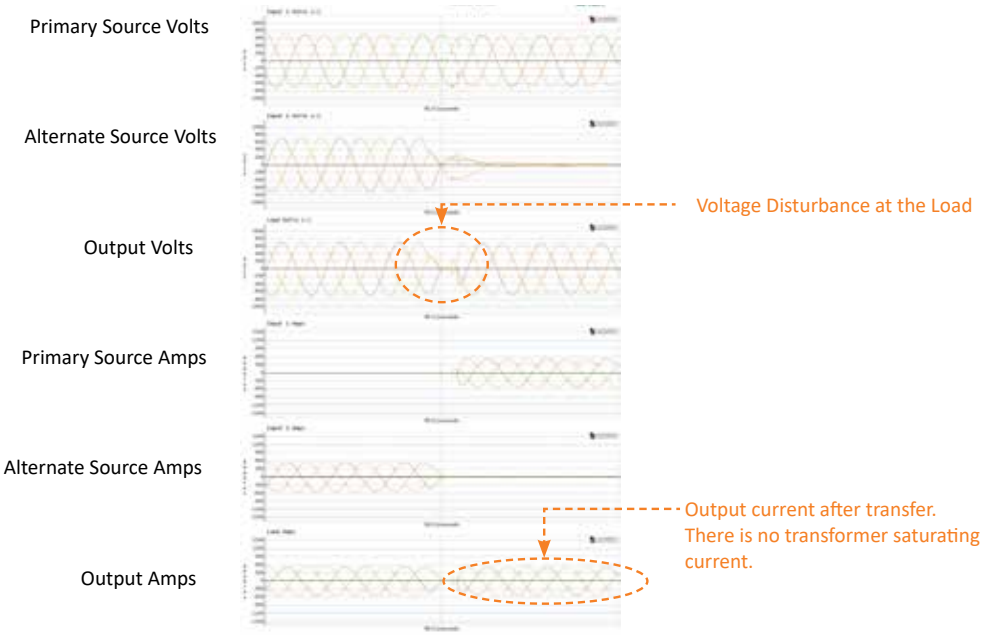
Generate Easy-To-Understand Power Quality Reports with ITIC Plotting

All LayerZero Power Systems products are equipped with on-board power quality analyzers that continuously sample and analyze input sources. If the power quality of a source goes out of specification, the eSTS automatically transfers to the alternate source while simultaneously generating waveform captures and VDAT-produced ITIC curves of the event. This data can be remotely accessed through a standard web browser for in-depth review.

VDAT (Voltage Disturbance Analysis Tool) represents a major advancement in interpreting complex power system data. Using advanced algorithms and processing techniques, VDAT converts intricate waveform data into clear, actionable insights aligned with Information Technology Industry Council (ITIC) standards. This intuitive approach allows professionals to quickly assess system performance and identify issues without needing expert-level waveform interpretation.

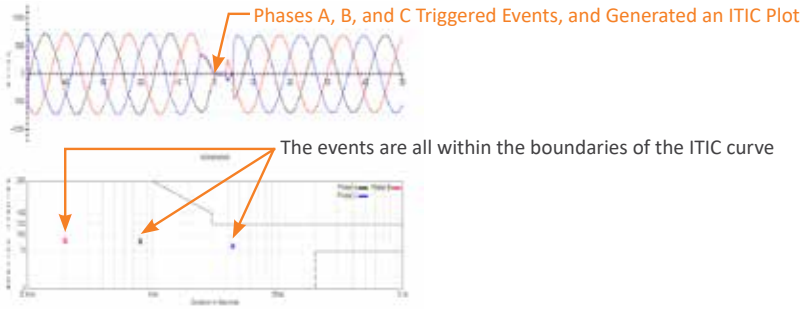
In the test example below, the STS was connected to two sources 150° out of phase. When the Source 2 breaker opened, the STS performed an automatic transfer to the primary source, generating ITIC plots for Phases A, B, and C. Unlike raw waveform captures, ITIC plots are easy to read and immediately communicate power event severity and duration.

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.

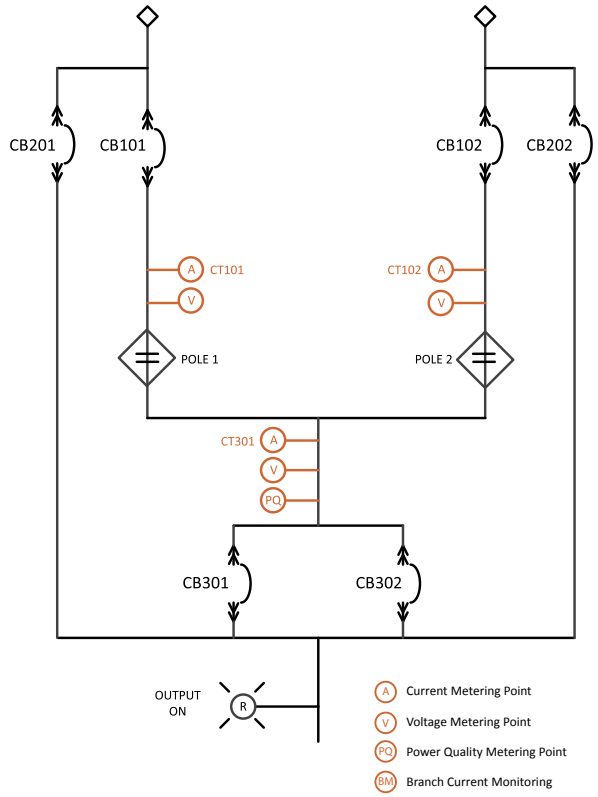
Features/Power Quality Monitoring

LayerZero Power Quality Monitoring

LayerZero PQM (Power Quality Monitoring) provides complete visibility into your critical power distribution systems. Designed as a comprehensive monitoring solution with both local and remote communication capabilities, LayerZero PQM supports everything from basic monitoring and alarms to advanced power quality analysis.

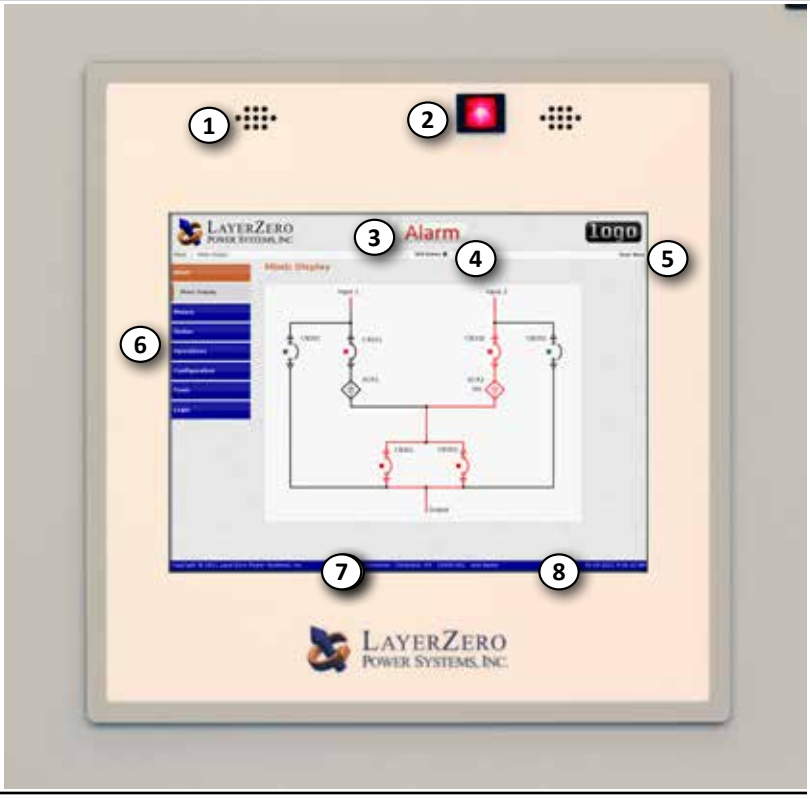
The system offers a vendor-neutral “bird’s-eye” view of your entire power infrastructure, ensuring continuous awareness of system health. LayerZero PQM helps identify power quality issues such as poor source quality, UPS output irregularities, or other critical alarms that could impact reliability.

In addition to real-time visibility, LayerZero PQM allows users to review and trace historical power events, providing a unique ability to analyze sequences leading up to any issue. This powerful feature makes LayerZero PQM a trusted tool in the mission-critical industry for maintaining safe, stable, and reliable operations.



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



Power Quality Monitoring

Static Switch Power Quality Monitoring

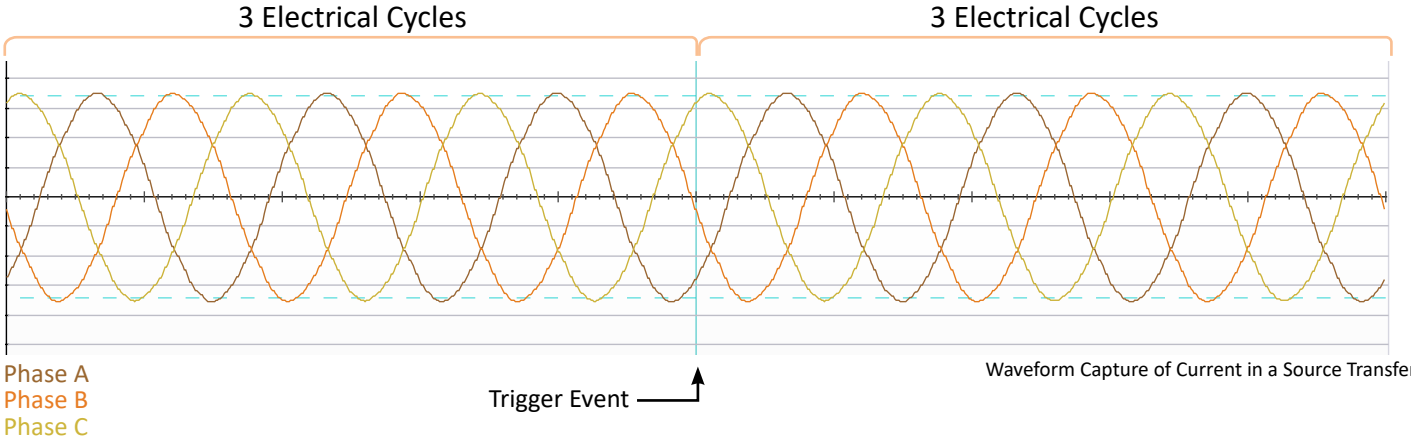
The Series 70 eSTS includes LayerZero SSQM (Static Switch Quality Monitoring), a comprehensive monitoring platform designed with the same advanced communication and analysis capabilities as PQM.

LayerZero SSQM delivers a full range of monitoring options, from alarm reporting and basic event notifications to high-level power quality diagnostics. These tools enable operators to remain aware, vigilant, and proactive in ensuring system reliability and operational safety.

eSTS Touch Screen GUI showing Real Time Waveform Capture

LayerZero's SSQM Provides Answers

LayerZero SSQM captures timestamped waveforms both before and after power events, giving operators the data needed to pinpoint and resolve the root causes of electrical disturbances. Power quality information is continuously gathered at the Static Transfer Switch (STS), Power Distribution Unit (PDU), and Remote Power Panel (RPP), supporting comprehensive post-event analysis and data-driven decision-making.



Waveform Capture of Current in a Source Transfer

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: 3-Pole Static Transfer Switch

Mechanical Characteristics *	
Current/Voltage/Number of Poles	600 A 480 V 3-Pole
Heat Dissipation	4,800 BTU/Hr
Weight	1,350 lbs (620 kg)
Dimensions	36”W x 36”D x 80”H (1219 mm x 914 mm x 2032 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	3-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 PQM (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

*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.

All product specifications are subject to change without notice.

Learn more at www.LayerZero.com

LayerZero Power Systems, LLC.
1500 Danner Drive
Aurora, OH 44202 U.S.A.

Rev. 4/26 #14