LayerZero Power Systems, LLC.

The Foundation Layer

Series 70: eSTS

1600 A 480 V 3-Pole Static Transfer Switch

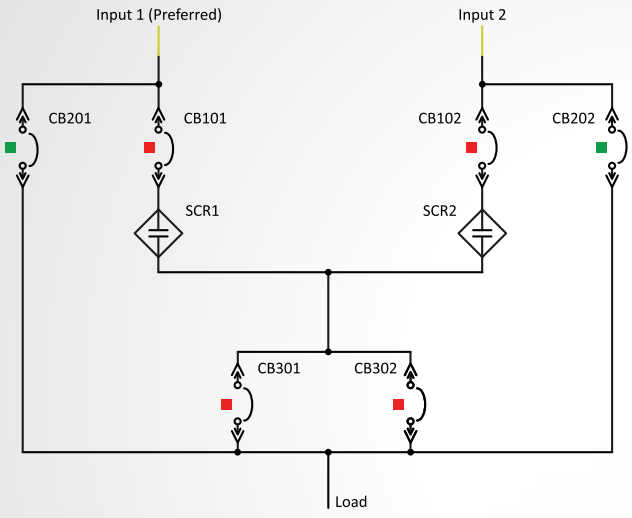
Product Brochure

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 automatically or manually provides solid-state transfers between two in-phase AC sources in just a quarter cycle. The eSTS performs open-transition transfers in a way that minimizes load disruption without cross-connecting power sources. One source is designated as the preferred source. If that source fails, the load is automatically and seamlessly connected to the alternate source through an open-transition static transfer. For emergency transfers between asynchronous sources, dynamically phase-compensated transfers are utilized to minimize downstream transformer saturation in 3-phase, 3-wire eSTS configurations.

*Optional



eSTS Static Transfer Switch One Line Diagram

Controls Section Contains:

Power electronics

- SCRs (Silicon Control Rectifier) in Forced-air 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. Explore the technologies that make LayerZero static transfer switches the industry's 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.

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.

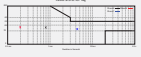
Modbus/TCP: Connect to existing systems without proprietary restrictions.

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

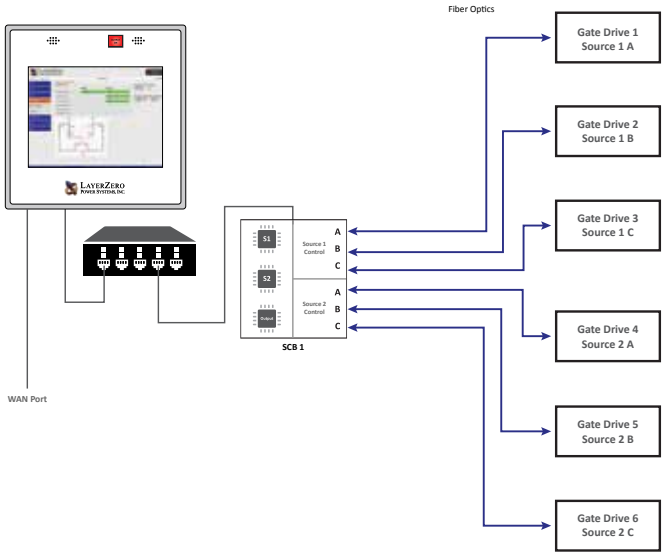
The LayerZero eSTS Provides Many Dimensions of Reliability:

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

Single Module Redundancy (SMR) Reliability (Standard)

Single Module Redundancy (SMR) is a cost-effective topology that delivers redundant power paths to mission-critical environments. In SMR systems, each source includes built-in triple redundancy of processors, and every phase is controlled by a dedicated gate drive board.

The LayerZero SMR topology is uniquely fail-safe, maintaining full switching functionality even if a critical control board were to fail.



Reliability Features: Triple Modular Redundancy (TMR) *Optional

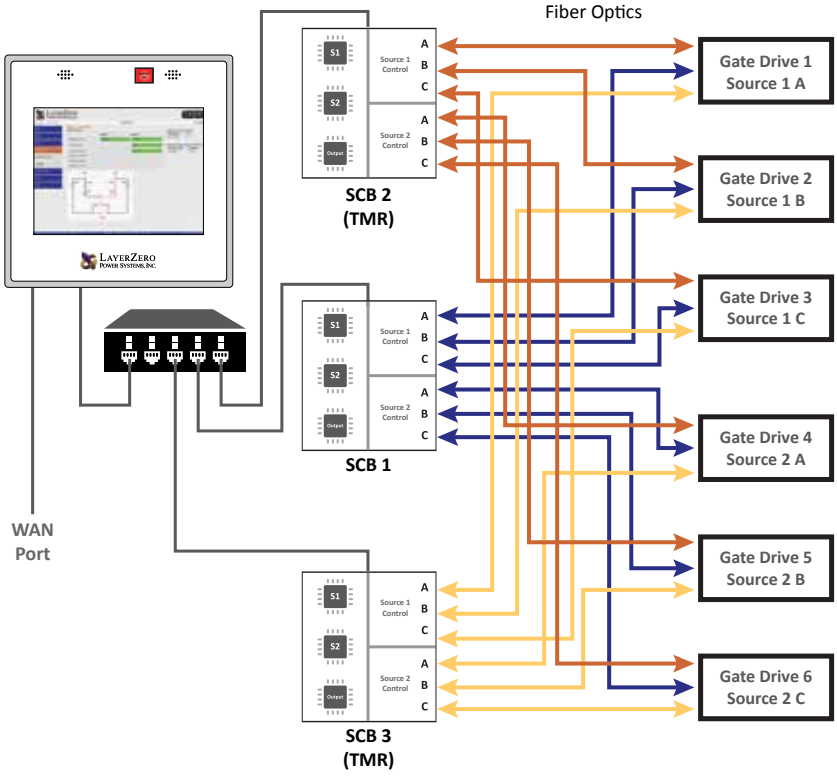
Triple Modular Redundancy (TMR) Reliability (Optional)

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

If an entire control path or its component were to fail, and then if the active power source were to fail, the eSTS transfers to the alternate source.

Triple Modular Redundancy, a proper noun, is based on proven statistics and stringent mathematics.



Reliability Features: Single Module Redundant (SMR) Redundancy

eSTS SMR Triple Redundant Power Supply Architecture

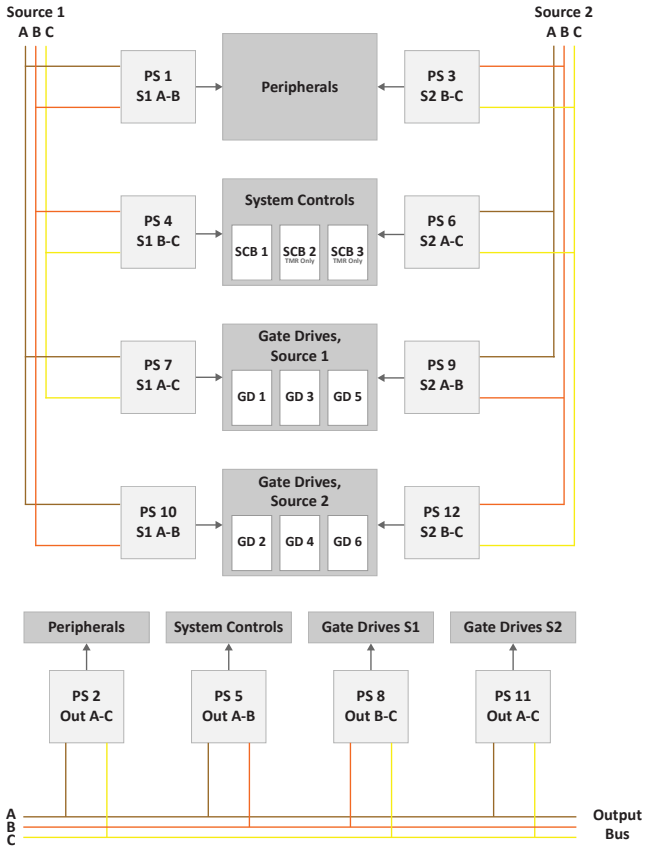
Divided into four (4) logical failure groups:

- 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:

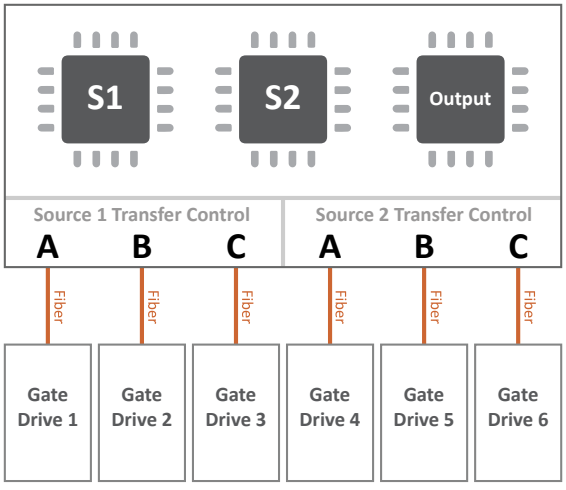
- Source 1
- Source 2
- STS Output.

This results in a total of 12 power supplies (3 power sources across 4 failure groups), creating the most comprehensive and redundant control power system. LayerZero's topology ensures that all possible power paths to the control system are available, enhancing uptime and resilience even in the most demanding environments.



eSTS SMR Triple Redundant Processors

- Independent processors monitor and analyze Source 1, Source 2, and Output power quality individually.
- If the Source 1 processor malfunctions, the system can still be commanded to transfer to Source 2, and vice versa.
- In the unlikely event of a main control system failure, the STS continues to receive power from the existing source. This helps to maintain load integrity, though transfers are temporarily unavailable.
- Each phase of each source is governed by a dedicated gate drive circuit board, ensuring precise, phase-by-phase control and protection.



Reliability Features

Mechanical Bypass Interlock

To minimize the possibility of operator error during equipment bypass operations, every LayerZero eSTS includes multiple safety mechanisms:

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 is a well-known reliability risk. To address this, LayerZero eSTS features an interactive voice-guided bypass system that leads operators through the process one step at a time. Each operation appears on its own screen, accompanied by visual and audio prompts that make it virtually impossible to perform steps out of sequence, dramatically reducing human error and improving operational safety.

Forced Air Heat Dissipation System

The 1600 A Series 70 eSTS utilizes a forced air-cooled heat dissipation system, a proven and highly effective method for thermal management.

By maintaining consistent airflow across critical components, this system efficiently removes heat, extending equipment lifespan and ensuring optimal performance under continuous, high-load operation.

Reliability Features

Epoxy Coated Buswork/Maintenance Free Joints

LayerZero's use of epoxy-coated buswork enhances both operator safety and system reliability by eliminating the potential for bus-to-bus faults. Each bus joint is permanently brazed and maintenance-free, ensuring long-term stability without the need for periodic tightening or service.

Silver Plating

To ensure the highest level of electrical performance, all bus joints and terminals are silver-plated. Silver's exceptional conductivity and low resistance deliver superior contact, minimizing losses and optimizing efficiency across all power paths.

Machined Hardware

LayerZero employs precision-machined cap screws paired with engineered disc springs for every bolted connection. This combination provides a flat pressure-versus-deflection profile, maintaining constant torque and contact pressure throughout the product's life.

Tested in environments with wide temperature variations, this design ensures that once connections are tightened, they stay that way.

Fiber Optic Controls Increase System Reliability

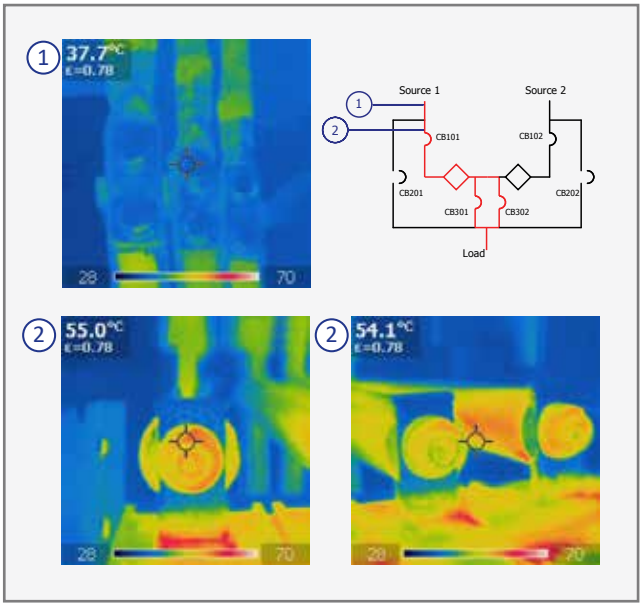
LayerZero's fiber optic-based control system eliminates electrical noise and interference while electrically isolating low-voltage controls from high-voltage circuits. In the eSTS design, gate drives operating at power circuit voltage receive control signals through optical fibers, ensuring secure communication, electrical isolation, and enhanced system reliability.

Safety - Ease of Maintenance

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

Strategically positioned INSIGHT IR® portholes allow operators to perform thermal scans of bolted connections with the dead-front doors closed, maintaining complete operator safety.

The swiveling IR window opens upward with keyhole access, revealing a protective mesh that enables point-and-shoot thermal imaging without any exposure to energized power circuits. This design allows full infrared inspection from the front of the unit, with no door removal or exposure required.



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

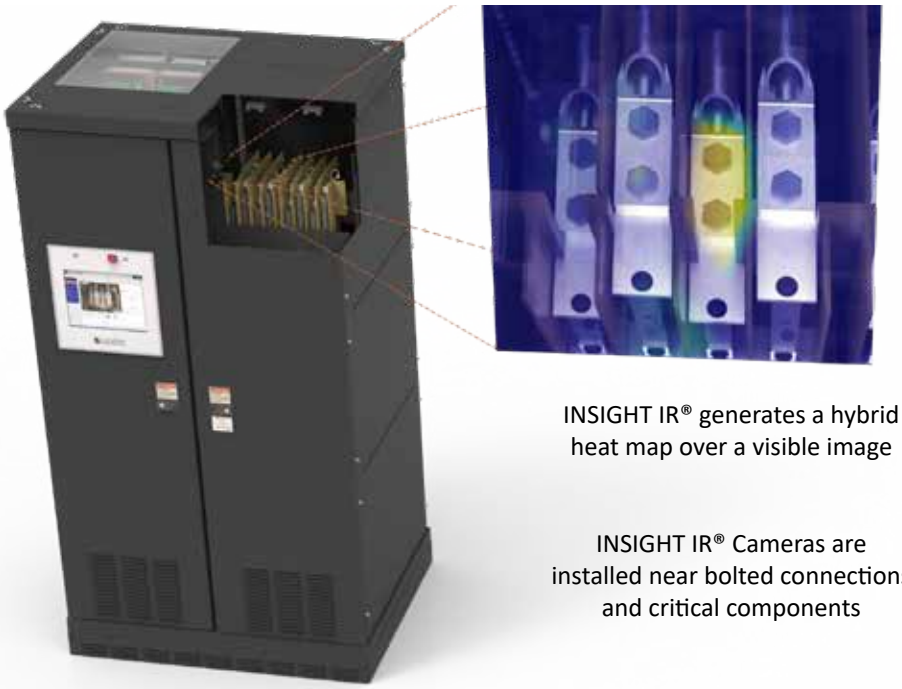
Safety - Ease of Maintenance

INSIGHT IR® Provides Early Detection of Thermal Issues

INSIGHT IR® is an advanced continuous thermal monitoring system that tracks the temperature of critical components in real time. A network of fixed infrared cameras captures and displays live thermal images of each bolted connection, with the ability to view temperature data by phase. By identifying thermal anomalies early, INSIGHT IR® empowers maintenance teams to perform proactive repairs before minor issues escalate into costly downtime.

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

INSIGHT IR® Camera Housing



INSIGHT IR® generates a hybrid heat map over a visible image

INSIGHT IR® Cameras are installed near bolted connections and critical components

Safety

Sectionalization Maximizes Operator Safety

The LayerZero eSTS is designed with a sectionalized architecture to maximize operator safety. Normal operator sections, such as breakers and switch compartments, are physically separated from the power electronics and control electronics sections. This separation allows maintenance to be performed on one section while power is safely bypassed to another, ensuring continuous operation and safety during service.

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

Inspired by NFPA-70E standards, the Series 70 eSTS enables operators to monitor system diagnostics without exposure to live power circuits. Status LEDs can be viewed safely through the dead-front door and SafePanel® circuit breaker positions are visible without opening any covers.

This design drastically reduces electrical exposure risk and simplifies system monitoring, delivering LayerZero's signature combination of safety, reliability, and ease of operation.

Ease of Maintenance/Connectivity Options

Front Only Access Saves Space

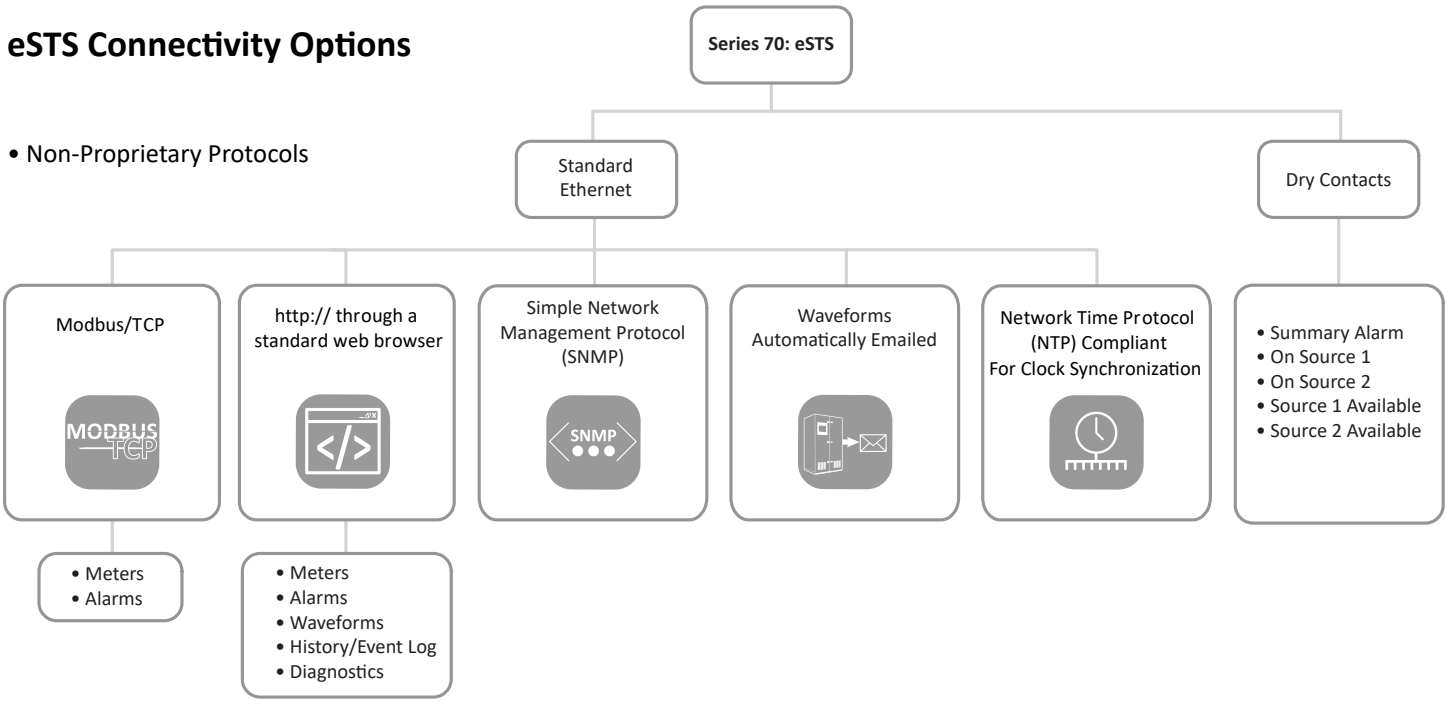
The Series 70: A eSTS is designed to be installed, operated, diagnosed and maintained only from the front. The dead-front panels are hinged, and side or rear covers never have to be removed.

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.

eSTS Connectivity Options

- Non-Proprietary Protocols



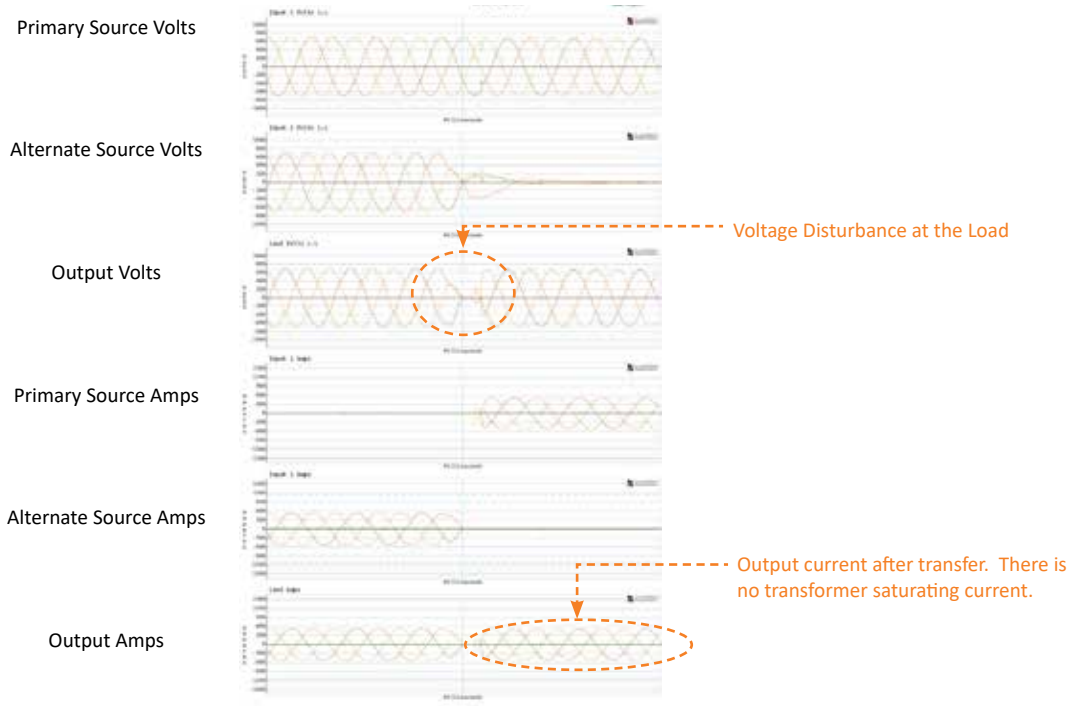
Generate Easy-To-Understand Power Quality Reports with ITIC Plotting

All LayerZero Power Systems products feature integrated power quality analyzers that continuously sample and evaluate source quality. When a source drifts out of specification, the eSTS automatically transfers to the alternate source, simultaneously generating waveform captures and VDAT-generated ITIC curves of the event. This data is remotely accessible through a standard web browser, allowing operators to monitor, review, and diagnose power performance with ease, with no proprietary software required.

VDAT (Voltage Disruption Analysis Tool) represents a quantum leap in power systems data interpretation. By harnessing advanced algorithms and processing techniques, VDAT effortlessly translates complex power data into clear, actionable insights. Traditional waveform captures can be intricate and time-consuming to interpret. VDAT simplifies this process through intuitive plots based on ITIC (Information Technology Industry Council) standards, helping users make faster, more informed decisions about power quality and reliability.

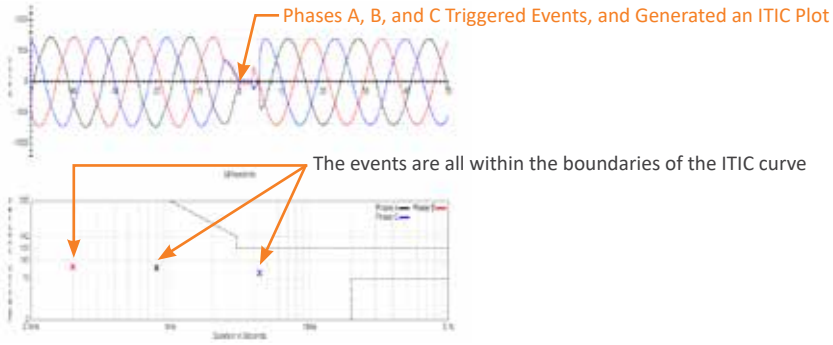
In the test shown below, the STS was connected to two sources 150° out of phase. When Source 2's breaker opened, the STS performed an automatic transfer to the primary source, generating delayed transfer events on Phases A, B, and C. VDAT automatically produced easy-to-read ITIC plots of each event, providing instant clarity without requiring expert analysis.

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).



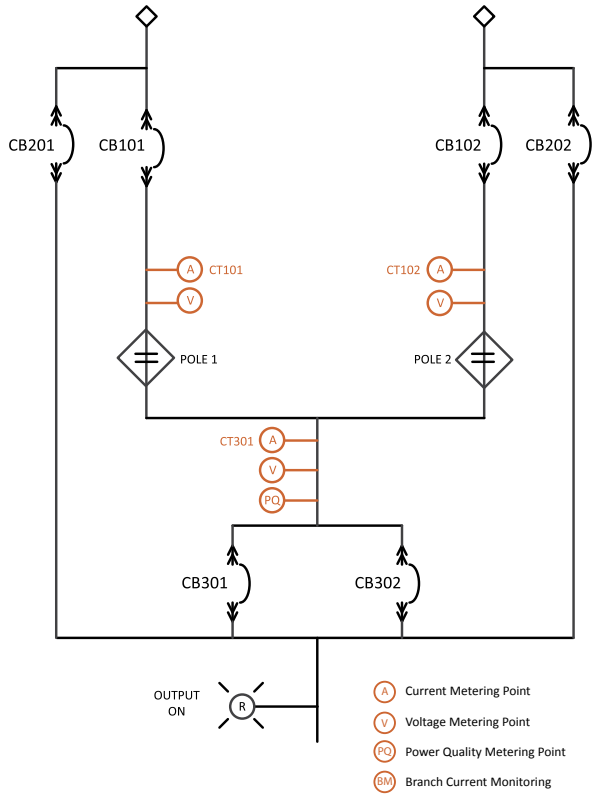
The ability to keep the transfers within the ITIC limits was verified through the Voltage Disturbance Analysis Tool (VDAT) plot shown above in the captured waveform.

Features/Power Quality Monitoring

LayerZero Power Quality Monitoring

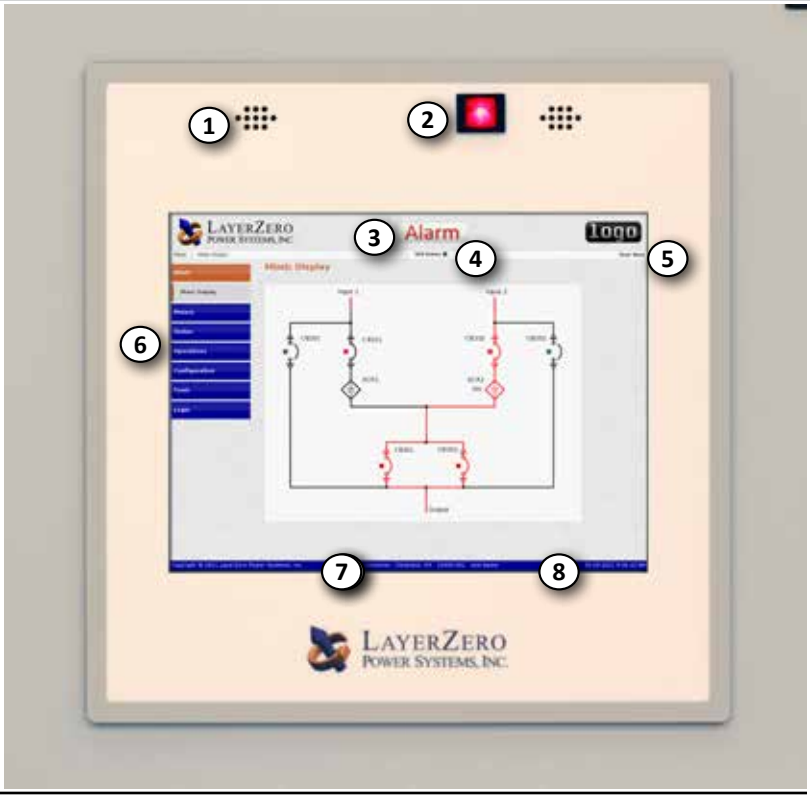
LayerZero PQM (Power Quality Monitoring) provides complete visibility into every aspect of your critical power distribution systems. It is an all-encompassing monitoring solution that includes both local and remote communication options. From standard monitoring and alarms to advanced power quality analysis, LayerZero PQM offers a broad range of capabilities designed to maintain the highest levels of reliability.

LayerZero PQM delivers a vendor-neutral “Bird’s Eye” view of the entire critical power distribution infrastructure. It maximizes reliability by alerting users to issues such as poor source quality, degraded UPS outputs, or active alarms. Beyond real-time analysis, LayerZero PQM enables users to revisit the exact sequence of historical events, empowering facilities to retrace system activity with unmatched precision.



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

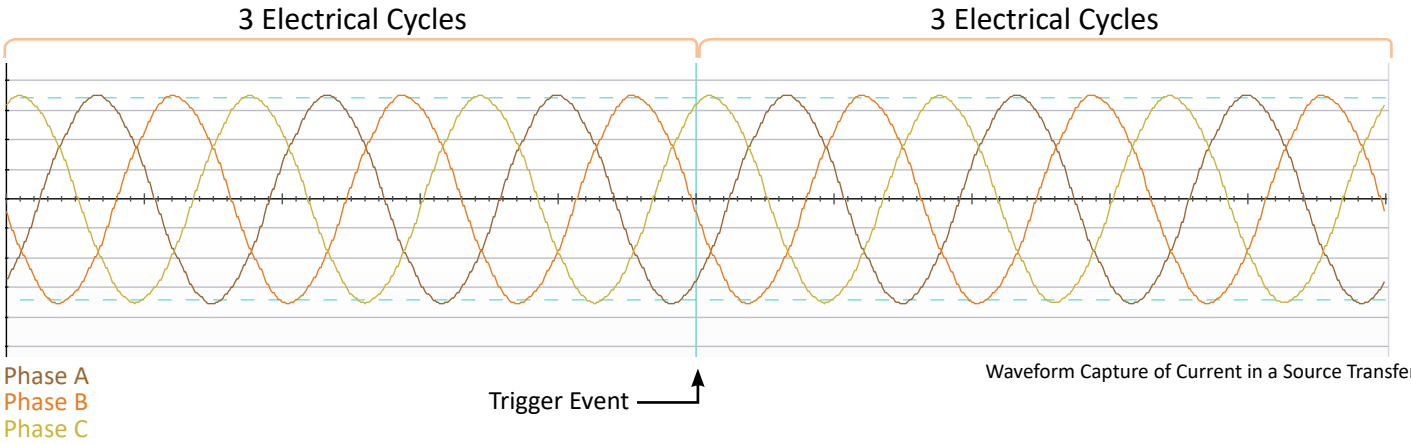
Static Switch Power Quality Monitoring

The Series 70 eSTS is equipped with LayerZero Static Switch Quality Monitoring (SSQM), a comprehensive system with both local and remote communications capabilities.

From alarm reporting and basic system status checks to advanced power quality diagnostics, SSQM enables users to remain aware, vigilant, and proactive in their pursuit of a safe, stable, and reliable operation.

LayerZero's SSQM Provides Answers

LayerZero SSQM delivers timestamped waveform captures recorded both before and after power events. This provides the detailed information necessary to identify and correct the root causes of power disturbances. SSQM continuously captures and archives power quality data at the Static Transfer Switch (STS), Power Distribution Unit (PDU), and Remote Power Panel (RPP), ensuring comprehensive post-event analysis.



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	1600 A 480 V 3-Pole
Heat Dissipation	26,000 BTU/Hr
Weight	4,800 lbs [2177kg]
Dimensions	96” x 90” x 42” (2438 mm x 2277 mm x 1069 mm)
Clearances	Front: 42” (1067 mm) Rear: 4” (102 mm) 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	Forced Air 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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