



Safety Automatic Transfer Switch

Installation and Operation Manual



Documented Power Supply Models

MODEL	PART NUMBER	INPUTS	OPTIONS
Safety Automatic Transfer Switch	010-505-10	120 VAC 60Hz	Mates with EDP Series Only
Safety Automatic Transfer Switch	010-505-20	120 VAC 60Hz	Universal with Line Interactive UPS'

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EMI / RFI STATEMENT

This device has been designed and manufactured to comply with the EMI / RFI emission limits and immunity characteristics as set forth in Standards EN 55022 and EN 55024. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed in accordance with this instruction manual, may cause harmful interference to radio communications.

Critical Safety Issues

Section 1: Critical Safety Issues

SAFETY ADMONISHMENTS

Three different levels of safety admonishments are used within this instruction manual; specifically **DANGER**, **WARNING**, and **CAUTION**.

Trois niveaux différents d'avertissements de sécurité sont utilisés dans ce mode d'emploi; spécifiquement DANGER, AVERTISSEMENT et ATTENTION.



DANGER

The statement following the **DANGER** heading alerts the equipment user of a potentially life or health-threatening situation unless precautions are taken against it. Admonishments of this nature usually entail the hazards of electrical shock or those encountered that may result in physical injury.

*La déclaration sous la rubrique **DANGER** avertit l'utilisateur de l'équipement d'une situation potentiellement mortelle ou mortelle, sauf si des précautions sont prises contre lui. Les admonistances de cette nature entraînent habituellement les dangers d'un choc électrique ou ceux rencontrés qui peuvent entraîner des blessures physiques.*



WARNING / AVERTISSEMENT

The statement following the **WARNING** heading alerts the equipment user of a condition or procedure that could result in interruption of service to the users or subscribers of the service receiving power from this product.

*La déclaration sous le chapitre **AVERTISSEMENT** avertit l'utilisateur de l'équipement d'une condition ou d'une procédure qui pourrait entraîner une interruption de service pour les utilisateurs ou les abonnés du service qui reçoit l'alimentation de ce produit.*



CAUTION / ATTENTION

The statement following the **CAUTION** heading alerts the equipment user of a condition that could result in damage to the subject equipment or ancillary equipment if care is not exercised during certain maintenance or operating procedures.

*La déclaration suivant la rubrique **ATTENTION** avertit l'utilisateur de l'équipement d'une condition qui pourrait endommager l'équipement concerné ou l'équipement auxiliaire si les soins ne sont pas exercés pendant certaines procédures de maintenance ou d'exploitation.*

Emergency Shutdown Procedure



Exercise extreme caution when performing the following procedure. Carry out the steps precisely in the order given to avoid the possibility of personal injury or equipment damage.

Perform the following procedure if the Safety Automatic Transfer Switch (SATS) must be shut down and disconnected on an emergency basis:

1. Open the upstream AC utility input circuit breaker servicing the cabinet.
2. If a generator is in use, disconnect the generator from its outside cabinet generator connector to complete shutdown of power to the load.
3. If using the SATS with a Multilink EDP series UPS, turn off the AC circuit breaker and disconnect the battery harness from the front of the UPS. The EDP series accepts multiple sources of power and all must be removed to safety shut down the SATS.
4. If using the SATS with a Line Interactive UPS, open both the AC circuit breaker and DC circuit breaker on the UPS.

General Safety Issues

The Safety Automatic Transfer Switch that is documented in these instructions has been designed, tested, and produced to ensure safe, trouble-free operation. Personnel installing or using this SATS should completely read and fully understand the following safety instructions. They are provided here as informational guidelines for your continued safety in the usage of this product.

Safety Issues with the Safety Automatic Transfer Switch Installation and Use

The SATS has been designed and built to power Department of Transportation and Intelligent Traffic Systems equipment. It is not intended for any other usage and provides output voltages suitable only for its intended application. Please contact Multilink if use of this product falls outside of DOT/ITS equipment.



This SATS operates from an AC source ranging from 55 to 155 volts. DO NOT open any covers or panels or attempt to perform any service to the SATS without first removing and disconnecting all external AC power sources. Only trained, qualified personnel should attempt service and repair work on the Safety Automatic Transfer Switch.

Multiple Power Sources

The SATS documented in this instruction manual uses more than one source of power. AC utility line, UPS output power, and AC Generator power may all be connected and provide power to the SATS at any given moment.

Enclosure Safety Issues

The enclosure and the SATS must be installed by qualified technicians or installers only, using appropriate mounting hardware in accordance with local codes and construction practices. The SATS must be installed within a grounded NEMA rated metal enclosure suitable for accommodating DOT/ITS SATS. Additionally, the enclosure must afford adequate ventilation for the SATS such that a minimum free air space of 52 mm (2 inches) remains around all sides and the top of the SATS. Temperature of the air flowing around the SATS may be rated up to 74° C (165° F). Air intake and exhaust openings within the enclosure must not be less than what is required to maintain this temperature requirement. If these temperature limits are routinely exceeded or ventilation requirements cannot be attained, a suitable forced-air cooling system may be required within the enclosure.



Fig. 1-1 Typical DOT/ITS SATS Enclosure

Introduction

Section 2: Introduction

Overview of Operation

The Safety Automatic Transfer Switch (SATS) is an integral part of an Uninterruptible Power Supply (UPS) or Battery Backup system. Its intended usage is to provide multiple sources of AC power in order to operate traffic signals, conflict monitors, camera equipment, lighting, and additional applications used in Departments of Transportation and Intelligent Traffic Systems (DOT/ITS). With utility line voltage applied and an UPS activated, the SATS will automatically begin to power the load with the UPS' regulated output voltage. It also allows the technician to perform utility line, UPS, or generator maintenance without disrupting power to the traffic equipment. By utilizing AC utility power, UPS power, and AC Generator power, the SATS will automatically determine which power source to use to continuously power the load. In the event the AC utility line voltage is missing, and UPS battery backup power has been depleted, an AC generator may be used to automatically power the load. Normal operation will delay the use of generator power for 30 seconds after AC utility line and UPS power loss to allow for AC generator initialization and startup. This allows the output voltage of the generator to stabilize before use. The SATS comes in two models, one which mates specifically to Multilink's EDP Double Conversion UPS', and another universal model which mates to Line Interactive UPS'.

Safety Automatic Transfer Switch features:

- 120VAC/60Hz output.
- Duplex Outlet with 120V/60Hz/6Amp max to allow for additional equipment to be attached.
- Dry Contact relays to allow for monitoring of Utility line voltage and Generator power.
- UL/CSA and EMI/RFI Compliant.

All Safety Automatic Transfer Switches include:

- 1 SATS, ready for installation in cabinet
- 1 Power harness (four-wire for EDP series, six-wire for universal/Line Interactive)
- 1 7-position dry contact relay connector
- 1 User manual and instruction guide

Unpacking and Inspection

Before installing this equipment, inspect the SATS for shipping damage or missing components. If the SATS or other items were damaged in shipment, file a damage claim with the shipping company and contact your Multilink representative immediately. Be sure to retain the original shipping carton and all packing material for the SATS until you are certain that warranty return will not be required.



Missing or Damaged Items

If items are found to be damaged or missing, contact the shipping company and your Multilink representative immediately. All damage claims must be filed with the shipping company conveying your equipment. Your Multilink representative will be able to assist with immediate equipment needs if necessary.

Original Shipping Container

When returning a unit for service, use its original shipping container and all original packing materials. Items damaged as a result of improper packaging will not be covered under provisions of warranty service.

SAVE THESE INSTRUCTIONS

This manual contains important instructions that should be followed during installation and maintenance of the Safety Automatic Transfer Switch.

Front Panel Control and Connections

Section 3: Front Panel Control and Connections

The front panel of each Safety Automatic Transfer Switch contains various connections. These items are described as follows. See figure 3-1, 4-1, and 4-2 for connector locations. Further details regarding use of control and operation may be found in the **Startup and Operation** section of this manual.

Control

AUTO/BYPASS SWITCH: This switch allows the SATS to either automatically select the AC power source when necessary or to Bypass the UPS and generator power sources and utilizes the AC utility voltage to power the traffic equipment during UPS and generator maintenance. LED indicator illuminates in “Bypass” mode.

UPS INPUT CIRCUIT BREAKER: 20A magnetic circuit breaker for UPS input voltage. This circuit breaker is used to open or close input power to the UPS and allow for UPS maintenance and removal without disconnecting power to the load.

Connections

POWER HARNESS: The SATS contains a UPS power harness to connect either the EDP double conversion UPS or a Line Interactive UPS to the SATS. This harness is model dependent, with the EDP series containing four, labeled wires, and the Line Interactive model containing six, labeled wires.

MAINS/LOAD/GEN: 3, WECO 324-HDS screw type terminals provide the attachments of “MAINS” AC utility line voltage, the “LOAD” of the cabinet traffic equipment, and the “GEN” generator attachment to the outside cabinet generator connector. Max torque of 7.0 lbs-in.

RELAY CONNECTOR: OnShore Tech OSTTJ® 7 pin terminal blocks allow for external alarm reporting to a conflict monitor for both the MAINS and GEN AC power through dedicated dry contacts relays. Each relay has a set of 2 pins. **NOTE:** The first set of pins is marked “AUX” and are place holders for UPS’ utilizing a 48VDC control wires. Max torque of 5.0 lbs-in.

DUPLEX OUTLET: Provides 120VAC/60Hz power up to **6.0 Amps** for additional equipment to be attached.

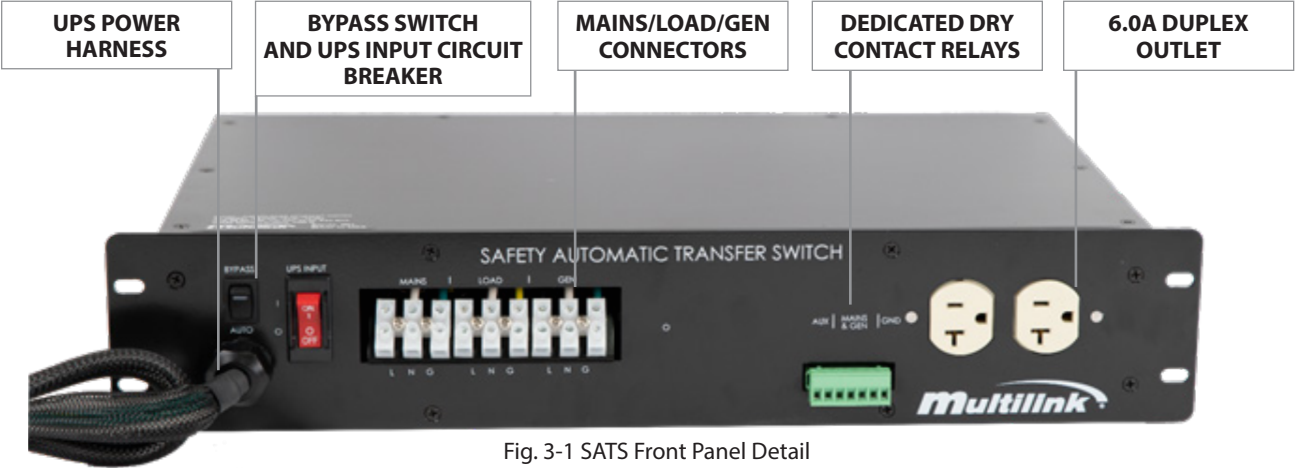


Fig. 3-1 SATS Front Panel Detail

Installation and Setup

Section 4: Installation and Setup

Installing and wiring the Safety Automatic Transfer Switch into an enclosure may be accomplished by connecting the utility AC input wires and cabinet load wires to the appropriate connectors of the SATS. If in use, the generator wires from the outside generator cabinet connector may also be wired to the appropriate connector. The UPS power harness shall be used to connect the SATS to the UPS according to the wiring diagram. The 7-position dry contact relay connector may be wired to sense the presence of power and report this to a conflict monitor when MAINS or GEN power is currently active or inactive.

In all installations, the following conditions apply and must be observed:

- A service disconnect switch containing over-current protection devices such as circuit breakers or fuses with appropriate AIC (amperes – interrupting capacity) rating should be placed between the AC utility source and the service entrance device for the SATS. Where used, the disconnect switch must be installed in compliance with all national, state and local codes as required.
- For outdoor installations, the AC utility conductors connected to the cabinet service entrance device shall be physically protected through an appropriate restraining device and conduit, consistent with local codes and practices.
- Permission to mount the SATS enclosure at any site shall be made in accordance with all legal requirements and local practices of the area.

This SATS is designed for use in both existing and new ground-mount enclosures. Observe the following procedures during installation of any SATS.

Preparation

The Safety Automatic Transfer Switch has been factory assembled, tested and prepared as a complete product ready for installation within an enclosure. The installer must verify that the correct type of AC power receptacle is installed in the enclosure for the input service and SATS selected for use at any given site. SATS ratings may be verified from the nameplate on the top of the SATS near the duplex outlet.

Grounding

Safety ground and earth ground connections must be in place for the SATS and enclosure for both personal safety and operational considerations. During SATS and/or enclosure installation, the following grounding connections must be provided or verified.



Failure to provide and connect adequate safety and earth grounds at each installation site may result in improper SATS operation or permanent damage to the SATS itself. Grounding facilities and connections must conform to appropriate national codes and/or local practices.

1. The AC utility conductors installed in the service entrance box must contain a safety ground conductor. The SATS installer should verify that this grounding conductor is in place, having been installed along with the AC utility input.
2. A separate enclosure ground wire must be connected between the enclosure ground lug and an earth ground connection provided by a ground rod installed at the SATS site. In most cases, one copper or copper-clad steel ground rod of 2.5 meter (8 feet) length driven into the earth will be sufficient to provide the ground connection required. In some instances, a more elaborate grounding method (such as a ring ground) may be required; however, this may be dictated by state or local codes and depends on conductivity of the soil within the installation area.
3. The dead metal of the service entrance box **must** be bonded to the metal enclosure that houses the SATS. Additionally, the ground bar within the service entrance box should be bonded to the metal enclosures; however, this requirement may be subject to local codes and practices.
4. The grounding wire connected between the SATS enclosure and the earth ground rod should be no smaller in area than 13 mm² (6 AWG) copper. Both ends of the ground wire should be sealed with an appropriate anti-oxidation compound.
5. An optional ground bonding connection exists on the 7-position dry contact connector.

Placement in the Enclosure

This SATS has been designed primarily for use within a cabinet or enclosure offering protection from outdoor weather, entry of excessive dust, dirt or moisture, and from unauthorized contact by untrained personnel. If used in a controlled environment, the SATS may be located within an indoor equipment cabinet or may be mounted on a rack shelf. Place the SATS within 36 inches of the line and load terminal block buses inside the cabinet.

The SATS should be mounted on a ventilated shelf or rack that allows free air circulation, especially through the right and left side panels of the SATS cabinet. Clearance of at least 1RU or 1.75 inches must be maintained around all surfaces of this SATS for unobstructed airflow. Temperature of the air entering the SATS should not exceed 74°C (165° F). System de-rating will occur at 55°C. See Specifications.

Wiring

Connect the MAINS, LOAD, GEN, and monitor wiring to the SATS according to the following procedure. Refer to Figs. 4-1 and 4-2 for control and connector positions.



To reduce the risk of fire, connect only to a circuit provided with 20A maximum branch circuit over-current protection in accordance with the National Electrical code, ANSI/NFPA 70 and the Canadian Electrical Code, Part 1, C22.1

1. Operate the AC line circuit breaker in the service entrance box to the OFF position. If the SATS is located at a head end or other customer premise site, ensure that the branch circuit breaker chosen to protect the AC receptacle for the SATS is operated to the OFF position.
2. Operate the UPS Input circuit breaker on the SATS to the OFF position.
3. Wire the SATS as shown in Fig 4-1. Recommended wire strip length of 7mm. Secure the screw terminal contacts with a max torque of 7.0Lbf-in.

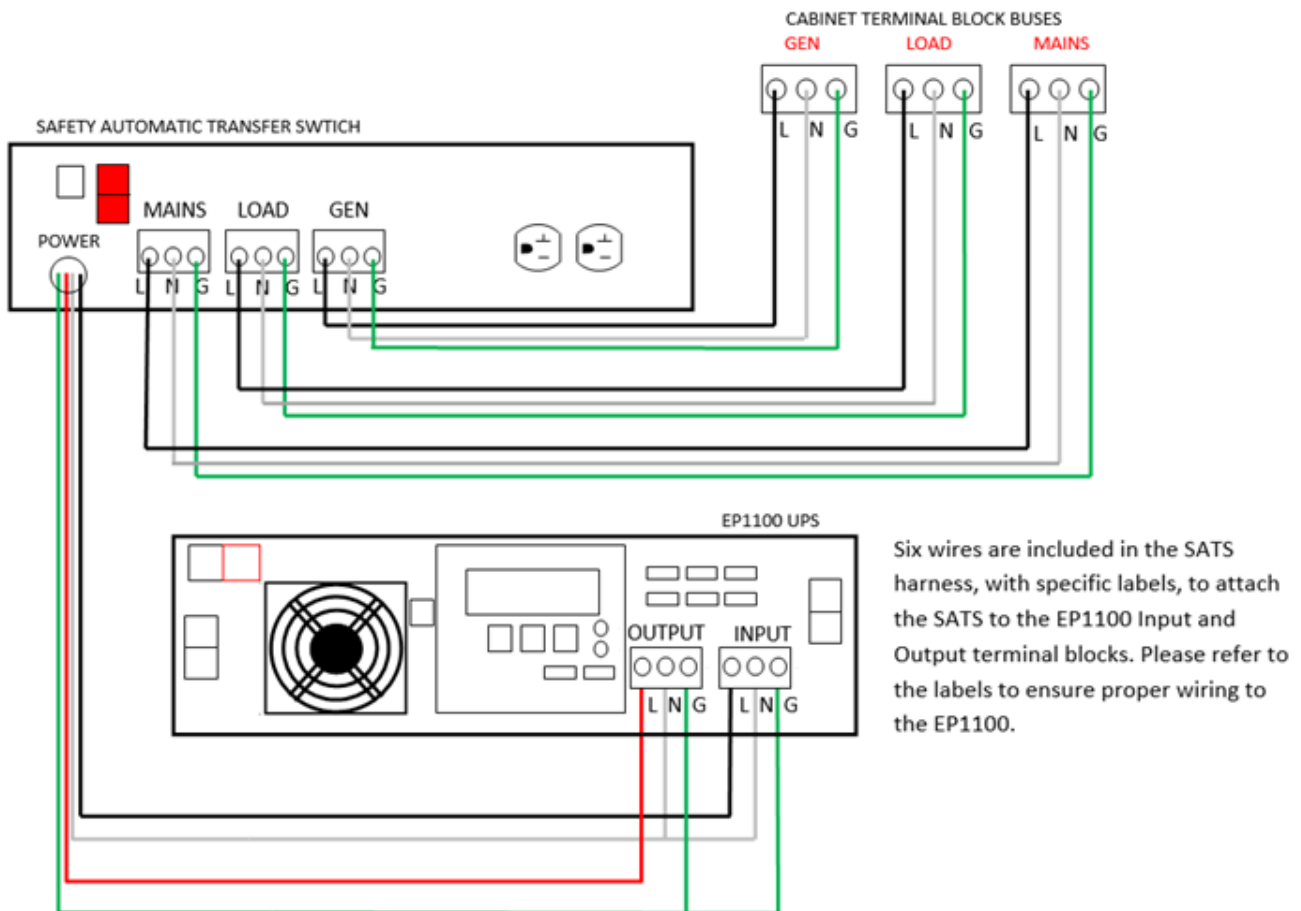


Fig. 4-1 SATS and EP1100 (Line Interactive) wiring example

4. Connect the power harness to the input/output connectors on the UPS.
5. If desired, wire the 7-position dry relay connector. Recommended wire strip length is 7mm, with a max torque of 5Lb-in. as shown in Fig 4-2 for reporting to the traffic controller.

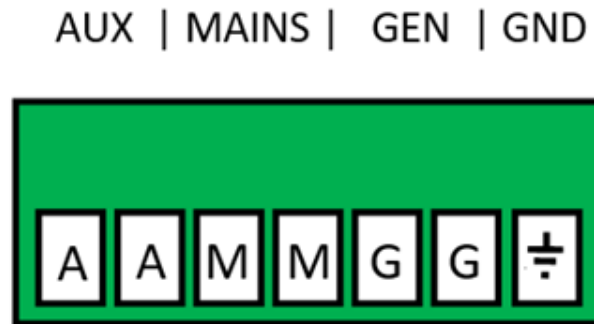


Fig. 4-2 7-position connector wiring example

When using the 7-position MAINS/GEN sense relay connector, please note operation as follows:

1. The first 2 positions on the left of the connector labeled "AUX" are intended for use with UPS systems that have external control wires to operate that system's respective transfer switch. These two positions are to be used to safely secure those wires. The control wires will not be used by the SATS.
2. Positions 3 and 4 are used to report the presence of AC utility line power. When AC utility line voltage is present, the dry relay contacts of these 2 positions will close. When AC utility line voltage is absent, the dry relay contacts will open.
3. Positions 5 and 6 are used to report the presence of AC Generator power. When AC Generator voltage is present, the dry relay contacts of these 2 positions will close. When AC Generator voltage is absent, the dry relay contacts will open.
4. Position 7 is an additional grounding point.

Startup and Operation

Section 5: Startup and Operation

The SATS is ready to be placed into operation after it has been installed in its enclosure and all input and output connections have been made. Ensure that AC utility line power is available to the SATS and then perform the following steps in sequence.



The following steps in these startup and operating procedures **MUST** be performed exactly as presented; otherwise, permanent damage to the SATS may result.

For Normal Operation, perform the following procedure:

1. Verify that all connections and initial wiring is complete, as previously outlined and described.
2. Operate the AUTO/Bypass switch to the "AUTO" position.
3. Operate the upstream AC utility line circuit breaker serving the SATS to the ON position.
4. The SATS is now operating in its normal mode, assuming application of appropriate AC line power. The load is now being powered from AC utility line voltage. **NOTE:** This voltage is not regulated.
5. If an UPS is in use, operate the UPS Input circuit breaker on the SATS to the ON position and then operate the UPS' respective input circuit breaker in the ON position. After its initial startup, the UPS will automatically begin to power the load with regulated voltage.

For Maintenance or Bypass mode, perform the following procedure:

1. Verify AC utility line voltage is present, and the upstream AC utility line circuit breaker is in the ON position.
2. Place the AUTO/Bypass switch in the "Bypass" mode. The LED shall illuminate when in Bypass mode. This will disconnect the load from the UPS and power the load directly from utility power.
3. Verify the SATS is maintaining the load with AC utility line voltage. **NOTE:** This voltage is not regulated.
4. Remove the battery harness from the UPS or operate the DC circuit breaker to the OFF position.
5. Place the AC circuit breaker on the UPS to the OFF position.
6. Place the UPS Input circuit breaker on the UPS to the OFF position.
7. The UPS and battery string may now be maintained by a qualified technician.

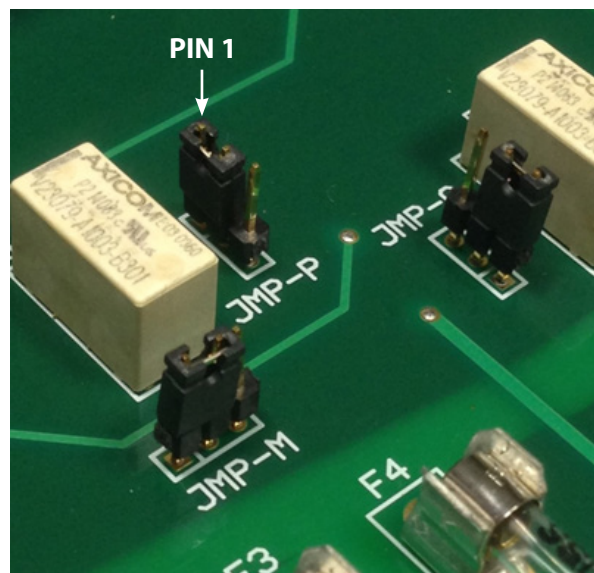
Alternative Mode

An alternative operating mode is available to perform authorized AC utility voltage shutdown, with the use of an AC generator, without interrupting the load. This mode must be configured before the SATS is in operation and shall not be performed when in use. To use this mode, the SATS internal jumper on JMP-P must be placed on pins 1 and 2.



The following steps in this alternative mode procedure **MUST** be performed exactly as presented; otherwise, injury or death and damage to the SATS may result. Please note that with the SATS removed, AC power will not be available for the traffic equipment.

1. If the SATS is currently in operation, the SATS must be removed prior to selecting this alternative mode. Do not attempt this procedure if the SATS is currently in use. If the SATS is not yet in use, jump to step 4.
2. Operate the UPS' DC circuit breaker to the OFF position or disconnect the battery harness from the UPS.
3. Operate the AC circuit breaker on the UPS to the OFF position.
4. Operate the UPS Input circuit breaker on the SATS to the OFF position.
5. Operate the upstream AC utility line circuit breaker to the OFF position.
6. Remove all wiring attached to the SATS and disconnect power harness from the UPS.
7. With the SATS removed, remove the top 8 screws from the top cover and the 2 top screws on the face plate.
8. Place the jumper on JMP-P to pins 1 and 2 for Alternative Mode.
9. Replace the top cover of the SATS and reinstall the SATS into the cabinet as shown in Section 4.
10. Perform the startup procedure in Section 5.



Safety Automatic Transfer Switch Shutdown

Section 6: Safety Automatic Transfer Switch Shutdown

If SATS shutdown becomes necessary at any time, observe the following procedure:

1. Operate the upstream AC utility input circuit breaker servicing the enclosure to the OFF position.
2. Operate the UPS' DC and AC breakers to the OFF position and disconnect the battery harness.
3. Operate the UPS Input circuit breaker on the SATS to the OFF position.
4. If a generator is in use, disconnect the generator from the outside cabinet generator connector.

Replacement Parts

Section 7: Replacement Parts

If parts become damaged or lost during operation, replacement parts are available from Multilink.

535-037-10: 7-position terminal block plug.

540-020-10: 2-position jumper .025sq post for JMP-P, JMP-G, and JMP-M.

870-242-20: Power harness for EDP series UPS.

870-252-20: Power harness for Universal/Line Interactive UPS.

Fuses: F1: 1/2 Amp, Fast-Blow, Cartridge Style, 5mm x 20mm.

F2, F3, F4: 2 Amp, Fast-Blow, Cartridge Style, 5mm x 20mm.

F5, F6, F7: 1 Amp, Slow-Blow, Cartridge Style, 5mm x 20mm.

F8: 6 Amp, Fast-Blow Cartridge Style, 5mm x 20mm.

Troubleshooting

Section 8: Troubleshooting

This troubleshooting guide has been designed to help you quickly locate and resolve common powering problems. The table assumes normal operation and configuration of the SATS at any given time. If you still cannot solve the problem, replace the SATS with a known, functional unit.



There are various fuses inside the SATS to protect against over current conditions. These items are not field-serviceable. The enclosure cover shall not be removed while in operation. Repair must be done by certified technicians. Additionally, when replacing the SATS when in use at a live intersection, use of law enforcement may be required to direct traffic during maintenance.

Operating Conditions	Corrective Actions
No output voltage to load	<ul style="list-style-type: none"> • Verify wiring is correct to all SATS terminal strips. Tighten contacts. • Verify the upstream AC utility line circuit breaker to CLOSED. • Verify the UPS Input circuit breaker is closed, and voltage is available at the input of the UPS. • Verify the UPS is operating in Line mode, otherwise, inspect UPS for output alarms or faults. • Verify AC utility line voltage is present. • If no audible relay closure is heard when applying AC utility line voltage, replace SATS.
Bypass Mode not operational	<ul style="list-style-type: none"> • Verify AC utility line voltage is present. • Verify the LED illuminates when the switch is placed in Bypass Mode. • If LED does not illuminate, replace SATS.
No output voltage at duplex outlet	<ul style="list-style-type: none"> • Verify the AC utility line circuit breaker to CLOSED. • Verify AC utility line voltage is present. • F8, 6Amp fuse failure. Replace fuse with 6Amp fuse.
No output voltage with Generator	<ul style="list-style-type: none"> • Verify wiring to the SATS GEN terminal strip is correct. Tighten contacts. • Verify switch is in AUTO Mode. • Verify generator AC output voltage is present.
MAINS/GEN Sense relays not reporting	<ul style="list-style-type: none"> • F2, F3 open. Replace fuses.

SATS Specifications

Section 9: SATS Specifications

Specifications for the Safety Automatic Transfer Switch are listed below.

Parameter		Specifications	Notes
Output Capacity		2kW	Continuous Load
Cooling System		Convection	
Operating Temperature		-37°C - + 74°C	Output capacity de-rated to 1.6kW between 55-74°C
Mechanical (W x H x D)		19" x 3.5" x 10"	2-RU Rack Mount
AC Input			
Connection		Terminal Blocks	7.0 Lbf-in mas
Phase		Single Phase 3-wire	
Voltage		120VAC Nominal	55V to 155V < 1.0VAC Back-feed voltage
Frequency		60Hz	±5%
Input Power Factor		0.98-1.0	Load dependent
Power Consumption		3W	Power source dependent
AC Output			
Output Power Connection		Terminal Block	7.0 Lbf-in max
Phases		Single phase 3-wire	
Voltage		120VAC Nominal	When UPS is activated
Voltage Regulation		Rated Voltage ±5%	±15% with Generator
Current Capacity		16.67A @ 120VAC	
Rated Frequency		60Hz	
Voltage Waveform		Sine Wave	Regulated by UPS, when used.
Transient Voltage Variation	Rapid Load Change	Rated Voltage ±5%	0% ↔ 100% at transient or output switch
	Power Outage Recovery		At rated output
	Rapid Input Voltage Charge		±15% variation
Transfer Time		5 Cycles or less	Typically, 5-10ms when using Bypass switch in either mode. Approx. 55ms with abrupt power disruption between generator and utility power.
Load Power Factor		0.7-1.0	Variation range 0.7 to 1.0 dependent on AC source
Over Current Protection		20A UPS Input Circuit Breaker and Internal Fuses	High impedance magnetic breaker. Fuses are replaceable
Overload Capability		150%	0.05 seconds or rated circuit breaker release time or UPS overload conditions handling.
Transfer Relays			
Output Transfer Relay		30A/277VAC	
MAINS/GEN Power Relay		30A/277VAC	Open frame
Dry Contact Sense Relays			
Switching Power		60W	Minimum contact rating: 10mVdc, 10µA. 5.0 Lbf-in max
Switching Voltage		12VDC	
Max Switching Current		5A	
Carrying Current		2A	



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