

Model ESV Uninterruptible Power System

1.5 KVA/KW - 14.0 KVA/KW

Single Phase

General Specification

1.0 General

This specification describes the features and design of an on-line, dual conversion, uninterruptible power supply (UPS) system. The Model ESV UPS is designed to assure maximum reliability, serviceability and performance. The system incorporates a microprocessor-based, DSP controlled, input power factor corrected, high-frequency IGBT PWM rectifier/charger, together with an IGBT PWM inverter and high speed fail-safe SCR automatic bypass transfer circuit. These components and battery backup work to provide immunity from all line disturbances and power interruptions, with no loss or break in AC output power. The Model ESV has a vertical space-saving front access enclosure design to provide extended battery runtime, facilitate centralized UPS installation, and accommodate vertical overhead cable landings for server racks and other critical equipment. A self-diagnostic monitoring alarm system with optional network remote communications continuously advises of system status and battery condition. The UPS includes a manual bypass switch for maintenance and periodic battery replacement.

2.0 Inverter Ratings

<u>Model</u>	<u>Rating</u>
ESV1500	1.5KVA / KW
ESV2200	2.2 KVA / KW
ESV3000	3.0 KVA / KW
ESV3500	3.5 KVA / KW
ESV4200	4.2 KVA / KW
ESV5000	5.0 KVA / KW
ESV6000	6.0 KVA / KW
ESV7000	7.0 KVA / KW
ESV7500	7.5 KVA / KW
ESV8500	8.5 KVA / KW
ESV10000	10.0 KVA / KW
ESV12500	12.5 KVA / KW
ESV13500	13.5 KVA / KW
ESV14000	14.0 KVA / KW

3.0 Standards

The systems are designed in accordance with applicable portions of the following standards:

- 3.1 American National Standards Institute (ANSI C57.110).
- 3.2 Institute of Electrical and Electronic Engineers (IEEE 519-2014) (C62.41-2002).
- 3.3 National Electrical Manufacturers Association (NEMA PE-1).
- 3.4 National Electric Code (NEC 2005, Article 700).
- 3.5 Underwriters Laboratories (UL) (C-UL to CSA Standards).
- 3.6 Federal Communications Commission (FCC Part 15, Sec. J, Class A).
- 3.7 Federal Aviation Administration (FAA-G 201e).
- 3.8 Listed UL Standards UL 1778 Uninterruptible Power Systems, C-UL listed to CSA C22.2, No. 107.1-M01.

4.0 Input Specifications

4.1 Input Voltage:

120 or 277 VAC - on models 1.5 KVA and 2.2 KVA
120, 208/120, 240/120, or 277 VAC - on models 3.0 KVA and 3.5 KVA
120, 208/120, 220, 240/120, 277, 347, 480, or 600 VAC - on models 4.2 KVA and 5.0 KVA
208/120, 220, 240/120, 277, 347, 480, or 600 VAC - on models 6.0 KVA through 14.0 KVA

4.2 Operating Range: +12% to -15% without battery usage.

4.3 The unit incorporates the use of variable range logic in conjunction with the load percentage to extend the input range to +12% to -30% without battery usage while maintaining a regulated, usable output voltage.

4.4 Frequency Range: 57.5 Hz. to 62.5 Hz.

4.5 Power Factor: Self-correcting to >0.97 (approaching unity).

5.0 Output Specifications

5.1 Output Voltage:

120 VAC - on models 1.5 KVA and 2.2 KVA
120, 208/120, or 240/120 VAC - on models 3.0 KVA and 3.5 KVA
120, 208/120, 220/127, or 240/120 VAC - on models 4.2 KVA through 14.0 KVA

5.2 Sine Wave Voltage Output: Maximum 3% THD under linear load.

5.3 Output frequency: 60Hz, plus or minus 0.5 % under full range load while in the battery operation mode.

5.4 Harmonic Attenuation: Reflected load generated harmonics are attenuated at the input.

5.5 Overload Rating:

105% continuous, 125% for 10 seconds, and 1000% for 3 cycles when fed from AC power source – on models 1.5 KVA/KW through 3.5 KVA/KW.

125% for 2 minutes, 150% for 30 seconds and 200% for 15 cycles when fed from AC power source – on models 4.2 KVA/KW through 14.0 KVA/KW.

5.6 On Battery Overload Rating: 125% for 30 cycles, 150% for 3 cycles.

5.7 Voltage Regulation: $\pm 2\%$.

6.0 Battery Specifications

6.1 Battery Time: Runtime is at full rated kilowatt output, and determined by the battery option selected.

6.2 Battery Type: Valve regulated, sealed lead calcium, maintenance free batteries.

6.3 Charger: Four stage, temperature compensated, 1% ripple filtered. 700 watts on models 1.5 KVA/KW through 5.0 KVA/KW, or 1400 watts on models 6.0 KVA/KW through 14.0 KVA/KW

6.4 DC Bus voltage: 120 VDC.

7.0 Performance

- 7.1 Normal Operation: The load is supplied with regulated power derived from the normal AC power input terminals through the rectifier charger and inverter. The rectifier charger is fully rated to charge the batteries and supply sufficient DC energy for the inverter when under full load. The battery is connected in parallel with the rectifier charger output.
- 7.2 Uninterrupted Emergency Operation: Upon the failure or unacceptable deviation of commercial AC power, energy will be supplied by the battery through the inverter and continue to supply power to the load without switching loss or disturbance. When power is restored at the AC input terminals of the system, the rectifier charger continues to supply power to the load through the inverter and simultaneously recharges the batteries.
- 7.3 Automatic Bypass Operation: The system includes a high speed automatic static bypass for fault clearing, instantaneous overload conditions and/or to connect the load to the normal utility source in the event of a system rectifier charger or inverter failure.
- 7.4 Secure Internal Maintenance Bypass / Isolation Switch: The system includes an integral, make-before-break maintenance bypass switch accessible via the front of the UPS enclosure through a hinged, key lockable door. The switch incorporates a push-to-turn function. Pushing the maintenance switch will invoke the static bypass prior to completing the switch transition to bypass. When in the bypass position, the maintenance bypass switch will provide complete isolation of the UPS output from external circuits. When the load is supplied from the normal AC input power source through the maintenance bypass switch, the AC input supply terminals will remain energized to permit UPS operational checking. A maintenance circuit breaker is provided as means of disconnecting the AC input source from the rectifier charger and inverter, allowing complete maintenance and replacement of circuit cards or components without disrupting power to the load. The maintenance circuit breaker provides the ability to turn the AC input power source off and on again to the rectifier charger and inverter to facilitate on-site trouble shooting while the UPS output remains isolated from the load. With the rectifier charger and inverter energized, the UPS system may be returned to normal mode operation by placing the secure maintenance bypass switch in its normal position via the push to turn function, without disrupting power to the load. This internal method of bypass maintains the UPS's input – output voltage configuration.
- 7.5 Optional Break-Before-Make External Maintenance Bypass: On UPS systems where the nominal input and output voltages are the same and output distribution breakers are external from the UPS enclosure, an external, wall mounted, push to turn, break before make, wrap around maintenance bypass switch is available for field installation. When in bypass mode, the switch will bypass the UPS system and feed the load power directly from the AC input power source. The UPS system's main input breaker may then be opened, allowing the UPS to be fully serviced, including the complete maintenance and replacement of circuit cards or components. The bypass switch includes an auxiliary contact to indicate the position of the switch (normal or bypass) for remote monitoring purposes. The bypass switch is provided with a padlock attachment for lockout purposes during maintenance.
- 7.6 Optional Make-Before-Break External Maintenance Bypass: On UPS systems where the nominal input and output voltages are the same and output distribution breakers are external from the UPS enclosure, an external, wall mounted, push to turn, make before break, wrap around maintenance bypass switch is available for field installation. When in bypass mode, the switch will bypass the UPS system and feed the load power directly from the AC input power source. The UPS system's main input breaker may then be opened, allowing the UPS to be fully serviced, including the complete maintenance and replacement of circuit cards or components. The bypass switch includes an auxiliary contact to indicate the position of the switch (normal or bypass) for remote monitoring purposes. A second auxiliary contact must be wired to the UPS and will invoke the system's static bypass before the switch is turned to the bypass position. The bypass switch is provided with a padlock attachment for lockout purposes during maintenance.

8.0 Environmental Specifications

- 8.1 Operating Temperature: 0°C (32°F) to 40°C (104°F).
- 8.2 Storage Temperature: -20°C to 50°C.
- 8.3 Relative Humidity: 95% non-condensing.
- 8.4 Elevation: 5,000 feet, 1,500 meters without de-rating.
- 8.5 Audible Noise Level: Not greater than 50 dba at 1 meter.

9.0 Enclosure Specifications

- 9.1 Description: Floor-mounted, NEMA 1 vertical front access cabinet with top-side conductor cable landings to facilitate centralized installation for server racks and/or other critical equipment.
- 9.2 Construction: The top and all sides of the enclosure are constructed from 14 gauge steel, and the base is constructed from 12 gauge steel. The enclosure steel is pre-treated and finished with a powder-coat paint to resist corrosion, marring or scratching.
- 9.3 Access: A hinged, key lockable front door is provided for access to all components and batteries. Side and back access are not required for system installation, operation, or service.
- 9.4 Breakers Location: A hinged, key lockable breaker panel door is provided for access to input and output circuit breakers.
- 9.5 Color: Graphite

10.0 Standard Display Monitor and Diagnostics

- 10.1 Display Panel – System includes a local, front mounted, LED display panel to indicate system status and battery condition. Display automatically monitors input voltage normal, input voltage high, input voltage low, on bypass, % load, battery in use, battery full, battery low and check battery.
- 10.2 Automatic Self-Testing – System provides a 30 second automatic battery test programmable for every 7, 30, or 90 days.
- 10.3 Manual Battery Testing – System provides a push to test feature in the event that a manual battery test is required.
- 10.4 Audible Alarm – The display panel includes an audible alarm with alarm silence for system on battery, low battery, check battery, over temperature warning, system fault, and inverter overloaded.
- 10.5 Control Functions – The display panel includes a push button for UPS on, fail safe dual push buttons for UPS off, alarm silence push button, and push button for system battery testing.
- 10.6 Electrical Measurements (RS232) – Electrical measurements include: Input voltage, output voltage, output current, output watts, output volt amperes, % load, battery voltage and DC charging current, and output frequency.

- 10.7 System Set Points (RS232) – Systems include a provision to program the following via computer interface: The percentage point at which the display panel indicates the low battery alarm, sag point at which battery usage is to occur, surge point at which battery usage is to occur, and points at which automatic battery tests are to be performed (7 day intervals, 30 day intervals, or 90 day intervals).
- 10.8 System Log (RS232) – Systems also include provisions to log power outages with date and time and system overloads with date and time.

11.0 Remote Communications

- 11.1 Communications Port (RS232) – A communications port for remote monitoring access to electrical measurements, system set point programming and the system’s log is furnished for computer interface. The communications port features Status / Alarm relay interface normally open contacts rated at 30VDC 2A. Contacts are provided for optional remote annunciator panel, automatic message dialer or TCP/IP adapter. Available contacts are: On Battery, Low Battery, Battery Test Activated, and General Alarm.
- 11.2 Relay Contact Terminal Strip – Systems include a terminal strip with potential free, 500mA, 120 volt rated, relay contacts for system alarm monitoring.
 - 11.2.1 The following normally open relay contact alarms are available via the terminal strip: On Battery, Low Battery, and General Alarm.
 - 11.2.2 The following normally closed relay contact alarm is available via the terminal strip: Battery Test Active.

12.0 Optional Intellistat Monitor

- 12.1 Intellistat Monitor Panel – Systems include a local, front mounted, sealed, touch screen, LCD display monitor panel with battery back-up memory. The Intellistat displays electrical parameters, system status and alarm conditions.
 - 12.1.1 The monitor displays the following electrical parameters:
 - Input Voltage
 - Output Voltage
 - Output Current
 - Output Volt-Amperes
 - Output Watts
 - Output Power Factor
 - Output Percent Load
 - Output Frequency
 - Battery Voltage
 - Battery Charge Current
 - 12.1.2 The monitor displays the following system status / alarm conditions:
 - Input Voltage High/Low
 - Output Voltage High/Low
 - Output Volt-Amperes High - Overloaded
 - Output Volt-Amperes Low
 - Output Frequency High/Low
 - Battery Voltage High/Low
 - Battery Charger Current High
 - General Alarm

- System on Battery
- Low Battery Warning
- Low Battery Shutdown
- DC Charger Failure / DC Open
- Inverter Over-temperature Warning
- Output Circuit Breaker Open
- REPO Shutdown
- System in Manual Bypass
- System in Static Bypass
- Battery Test Pass
- Battery Test Fail

12.1.3 The monitor displays the following operational conditions:

- System Normal
- Percent Battery Time Remaining
- Battery Test In Process

12.2 The monitor incorporates into its design, user programmable set points for the following:

- Status and Alarm Conditions – User Programmable for all High/Low thresholds alarm set points.
- Automatic Testing – User Programmable frequency of occurrence.

12.3 The monitor maintains a log that records all system alarms, events and battery system test results. The logs are made available through the LCD display of the monitor. The system log capacity is:

- Event and Alarm Log: 25 Alarms
- Battery System Test Log: 25 Battery Tests

12.4 The monitor features a manual, proprietary, password protected “Push to Test” feature.

12.5 The monitor features automatic battery testing that records test data:

- 12.5.1 It features a 30 second automatic battery test programmable for every 7, 30, or 90 days.
- 12.5.2 It reports the Time, Date, and a Pass/Fail indication via the local monitor panel and/or via E-mail, SNMP, MODBUS, BACnet, or Ethernet TCP/IP with an optional network communications. This information is also available via fax, voice messaging and/or web page generation via an optional multifunction communications modem.

12.6 The monitoring system includes a 9 pin status / alarm port and a terminal strip with potential free, 500mA, 120 volt rated contacts.

12.6.1 Alarms monitored from the Intellistat status/alarm port:

- On Battery
- Low Battery
- General Alarm
- System On Bypass

12.6.2 Status / Alarm port contact ratings: 24 VAC and/or 24 VDC, 500 mA.

12.6.3 The following alarms are monitored from the Intellistat terminal strip:

- On Battery
- Low Battery
- General Alarm
- System On Bypass
- Battery Test Pass
- Battery Test Fail

13.0 Reliability

13.1 MTBF Electronic / Electrical System: 100,000 hours.

13.2 MTTR: One hour.

14.0 Standard Equipment

14.1 Terminals for hard wired input and output.

14.2 Normally on, uninterrupted A.C. output bus.

14.3 Single control module design.

14.4 Static bypass switch.

14.5 Make before break secure bypass switch.

14.6 Front mounted diagnostic monitor panel.

14.7 Batteries.

14.8 Thermal magnetic A.C. input circuit breaker.

14.9 D.C. battery fuse and Anderson connector with interconnect cable.

14.10 Output distribution circuit breaker panel.

14.11 Copper conductor construction.

14.12 Functional steel cabinet enclosure with hinged, removable, lockable front door.

14.13 Graphite color powder coat finish.

15.0 Optional Equipment

15.1 Pre-installed, 20 amp output circuit breakers (Maximum of 20 pole positions.)

15.2 System output circuit breaker open or tripped alarm contacts. (Adds ½ pole position to each breaker at 120 VAC; therefore, a maximum of 13 pole positions. Adds 1 pole position to each breaker at 208 VAC or 240 VAC.)

15.3 Automatic message dialer.

15.4 Remote annunciator panel.

- 15.5 Fax/Voice/Web multifunction communications modem.
- 15.6 Network communications via SNMP / Ethernet TCP/IP / MODBUS TCP.
- 15.7 Network communications via MODBUS RS485.
- 15.8 Network communications via BACnet/IP or BACnet MS/TP.

16.0 Warranty

- 16.1 All power components and system electronics are guaranteed to be free from defects in material and workmanship for a period of 2 years following shipment from the factory.
- 16.2 Batteries are warranted with a 2-year full replacement warranty, and an optional 3-year pro-rate with applicable maintenance contract. On site labor for warranty repair in the United States and Canada is covered for 90 days following shipment from the factory.
- 16.3 Extended warranty and maintenance contracts are available.

17.0 Serviceability

Each UPS contains one front-accessible electronics module subassembly. Batteries are positioned and wired to facilitate rapid replacement.