

## APC Smart-UPS

### GUIDE SPECIFICATIONS FOR 1000VA & 2000VA Smart-UPS 230VAC Uninterruptible Power Supply

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This specification describes the operation and functionality of a continuous duty, single-phase, solid-state, static Uninterruptible Power System (UPS) hereafter referred to as the UPS.
- B. The UPS utilizes double conversion online topology designed to protect electronic equipment by supplying reliable, network-grade power featuring extremely tight voltage and frequency regulation. The UPS also features internal bypass and input power factor correction.
- C. The primary sections of the UPS are: input disconnect and filter stage, input PFC power stage, energy storage stage (DC bus capacitor bank), output power stage (inverter), DC/DC converter and a battery charger. The control of power module and fault detection logic is microcontroller based. Input disconnect and filter stage contains input backfeed relay, input filter, transient suppression. Input PFC power stage contains non-isolated power factor correcting AC/DC converters. This converter is capable of full power operation in very wide input voltage range. The energy storage stage is a split DC bus capacitor handling seamless transitions from battery to line and vice versa as well as the low and high frequency power stages ripple. The DC/DC converter stage transfers the nominal DC battery voltage up to DC bus voltage for supplying energy to inverter stage when AC input has an outage. The inverter stage operates directly from the DC bus and produces an AC output voltage of 220/230/240VAC output. The output of UPS is either connected through a bypass relay to the inverter or to the input filtered line. UPS contains a battery charger, which operates from the AC input section directly.
- D. The UPS batteries are internal, not hot-swappable, not user-replaceable.
- E. The UPS and associated equipment shall operate in conjunction with a primary power supply and an output distribution system to provide quality uninterrupted power for mission critical, electronic equipment load.
- F. All programming and miscellaneous components for a fully operational system as described in this specification shall be available as part of the UPS.

H. Configuration Specifics:

The UPS is available in one of the following configurations:

MODEL	SKU #
<b>TOWER - MOUNT – 1000VA</b>	
APC Smart-UPS 1000VA 230V	SRC1KI
APC Smart-UPS 1000VA 230V Argentina	SRC1KI-AR
<b>TOWER – MOUNT – 2000VA</b>	
APC Smart-UPS 2000VA 230V	SEC2KI
APC Smart-UPS 2000VA 230V Argentina	SRC2KI-AR

1.2 STANDARDS

- A. Designed to EN62040-2
- B. Designed to IEC 61000-2-2, 2-3, 4-2, 4-3, 4-4, 4-6, 4-8, 4-11, EN 61000-4-5: 2005
- C. Designed to IEC 60068-2-27, 2-32, 2-64
- D. Designed to IEC62040-3
- E. Designed to IEC 60950
- F. ISO 9001
- G. ISO 14001

1.3 MODES OF OPERATION

- A. Online: The input PFC power stage and the output power stage (inverter) shall operate in an on-line manner to continuously regulate power to the critical load. The input PFC stage provides regulated power to the load for all line and load conditions within the range of the UPS specifications. The inner battery charger shall be capable of full battery recharge.
- B. On Battery: Upon failure of the AC input source, the critical load shall continue being supplied by the output power stage (inverter), which shall derive its power from the battery system. There shall be no interruption in power to the critical load during both transfers to battery operation and retransfers from battery to online operation.
- C. Bypass: The bypass mode shall be used to provide transfer of critical load from the inverter output to the primary power source. This transfer, along with its retransfer, shall take place with minimum power interruption, 4 ms, to the critical load. In the event of an emergency, this transfer shall be an automatic function.

- D. Green mode/High efficiency mode: Enabling this mode shall transfer the load to utility input power through bypass relay as long as input voltage is within the range of  $\pm 24V$  of configured output voltage and input frequency is within the range of  $\pm 3$  Hz of output frequency. If the utility power goes out of range, inverter is turned on and load is transferred back to inverter (online or on battery). Power to the connected load may be interrupted up to 4 ms during transfer and retransfer. Power to the connected load may be interrupted up to 10 ms during retransfer to battery mode.
- E. Maintenance or service of the UPS: Please turn off and remove UPS from the AC input connection or wiring.

1.4 SUBMITTALS

- A. Proposal Submittals:
  - 1. As bid system bill of materials.
  - 2. Product catalog sheets or equipment brochures.
  - 3. Product guide specifications.
  - 4. System single-line operation diagram.
  - 5. Installation information, including weights and dimensions.
  - 6. Information about terminal locations for power and control connections.
- B. Delivery Submittals:
  - 1. User manual, which includes installation and operating instructions.

**PART 2 - PRODUCT**

2.1 MECHANICAL DESIGN

- A. The UPS is contained in a rugged steel cabinet with plastic front bezel;
- B. The UPS dimensions are;

Dimensions without packaging	SRC1KI / SRC1KI-AR	SRC2KI / SRC2KI-AR
(W x H x D)	145 mm (5.7in) x 220 mm (8.66 in) x 400 mm (15.75 in)	145 mm (5.7in) x 220 mm (8.66 in) x 504 mm (19.8 in)

- C. The UPS cabinet shall be Tower- Mount;

## 2.2 SYSTEM CHARACTERISTICS

### A. System Capacity:

1. The system is rated to be capable of supporting:
  - a. 1000VA or 800W whichever limit is reached first (for the 1000VA model).
  - b. 2000VA or 1600W whichever limit is reached first (for the 2000VA model).

### B. The UPS efficiency shall be 88% Max., without degradation of output regulation as specified.

### C. Input:

1. AC input nominal voltage: 220/230/240VAC, single phase, 3 wire (L + N + G), connected via IEC-320 C14 connector.
2. AC input voltage window:
  - a. 190 – 295VAC ( $\pm 5\%$ ) (L-N) at full load, while providing nominal charging power to the battery system, Ambient @ 40°C
  - b. 175-295VAC ( $\pm 5\%$ ) (L-N) at full load, Charger derated linearly < 190V, Ambient < 35°C
  - c. 140–295VAC ( $\pm 5\%$ ) (L-N) at 60% load, Charger derated linearly < 190V, Ambient @ 40°C
  - d. 125 – 295VAC ( $\pm 5\%$ ) (L-N) at 60% load, Charger derated linearly < 190V, Ambient < 35°C
3. Input frequency range: 40-70Hz;
4. Input Power Factor:  $\geq 0.93$  typical.
5. Input Current Distortion: Meets the requirements of IEC61000-3-2 /3-3
6. Crest factor: 3:1.

### D. UPS Output:

1. AC Output Nominal Output: 230VAC Single Phase, 3 wire (Phase + N + G);
2. Output connectors: 3 x IEC 320 C13 connectors (SRC1KI Model), 4 x IEC 320 C13 connectors (SRC2KI Model), 3 x ARGENTINA SOCKETS (SRC1KI-AR/SRC2KI-AR);
3. Output frequency: 50/60Hz +/- 3Hz tracking (Auto detection);
4. AC output voltage distortion: < 3% @ 100% linear load; < 6% @ 100% non-linear Load, < 15% during last 60 seconds of back up time with full load only.
5. AC output static voltage regulation: +/-1%;

6. AC output dynamic voltage regulation: +/- 6% during 20% to 100% R load take on and 100% to 20% R load take off in On-line mode. +/- 9% during 20% to 100% R load take on and 100% to 20% R load take off in On-battery mode. Recovery time < 200 ms;
7. Overload Rating:
  - a. Online (Ambient < 35°C): <105% - infinite; 125% - 1 minute; 150% - 30 seconds; 150% to < 210% 3 seconds; > 210% Transfer to bypass immediately;
  - b. Online (Ambient > 35°C): <105% - infinite; 125% - 30 seconds; 150% - 15 seconds; 150% to < 210% 1.5 seconds; > 210% Transfer to bypass immediately;
  - c. Onbattery (Ambient < 35°C): <105% - infinite; 130% - 1 minute; 130% to <210% 3 seconds, > 210% shuts down immediately;
  - d. Onbattery (Ambient > 35°C): <105% - infinite; 130% - 30 seconds; 130% to < 210% 1.5 seconds, > 210% shuts down immediately;
  - e. Bypass/ECO Mode: 110% -120% - 30 minute: 120% - 130% - 10 minute: 130% - 150%- 1 minute
  - f. Overload is protected by the input circuit breaker. (7 A Thermal circuit breaker is fitted at the input of the 1000VA models, a 13A Thermal circuit breaker is fitted at the input of the 2000VA models.);
8. Output Power Factor Rating: 0.8 lagging to 0.8 leading.

### 2.3 ENVIRONMENTAL

1. Short term storage, Ambient Temperature: -20°C to 50°C
2. Operating Ambient Temperature: 0°C to 50°C. 80% output derating when 40°C < Ambient < 50°C
3. Relative Humidity: 0 to 95% non-condensing
4. Storage altitude: 50,000 feet (15000m) above sea level
5. Operating altitude: < 10,000 feet (3000m) above sea level.
6. Audible noise: 50dBA max. (Battery fully charged, without buzzer)

### 2.4 INPUT PFC POWER STAGE

- A. The input PFC power stage of the UPS constantly rectifies the power imported from the mains input of the system, converting input mains AC power to DC power for precise regulation of

the DC bus voltage and output power stage (inverter) regulated output power.

- B. **Input Current Total Harmonic Distortion:** The input current  $THD_I$  shall meet IEC61000-3-2 requirements at full system, while providing conditioned power to the critical load bus, and charging the batteries under steady-state operating conditions. This shall be accomplished with no additional filters, magnetic devices, or other components.
- C. **Input Current Limit:**
  - 1. Input current draw from utility is limited by input converter internal fuse in online mode, 8A fuse for 1 KVA and 15A fuse 2 KVA. In bypass mode UPS operation is limited to 30 minutes for 110%-120% rated output current, 10 minutes for 120%-130% rated output current and 1 minutes for 130%-150% rated output current.
  - 2. In cases where the source voltage to the UPS is nominal and the applied UPS load is equal to or less than 100% of UPS capacity, input current shall not exceed 130% of UPS output current, while providing full battery recharge power and importing necessary power for system losses.

## 2.5 OUTPUT POWER STAGE (INVERTER)

- A. The UPS output power stage (inverter) constantly recreates the UPS output voltage waveform by converting the DC bus voltage to AC voltage through a set of IGBT switches. In both online operation and battery operation, the output power stage (inverter) creates an output voltage waveform independent of the mains input voltage waveform. Input voltage anomalies such as brown-outs, spikes, surges, sags, and outages do not affect the amplitude or sinusoidal nature of the recreated output voltage sine wave of the output power stage (inverter).
- B. **Overload Capability:** The output power stage (inverter) is capable of withstanding >150% overload for 1.5 seconds or 150% overload for 15 seconds or 125% overload for 30 seconds or < 105% overload for indefinite length of time in online operation at 40°C ambient; The output power stage (inverter) is capable of withstanding > 130% overload for 1.5 seconds or 130% over load for 30 seconds or < 105% overload for indefinite length of time in battery operation at 40°C ambient;
- C. **Output Contactor:** The output power stage (inverter) is equipped with an output relay to provide physical isolation of the inverter from the critical bus. With this feature a failed inverter shall be removed from the critical bus.
- D. **Battery Protection:** The inverter is provided with monitoring and control circuits to limit the level of discharge on the battery system.

## 2.6 AUTOMATIC BYPASS

- A. As part of the UPS, a system automatic bypass switch is provided. The system automatic bypass shall provide a transfer of the critical load from the Inverter output to the automatic bypass input source during times when the inverter cannot support the load. Such times may be due to

prolonged or severe overloads, or UPS failure. The UPS constantly monitors the output current, as well as the bypass source voltage, and inhibits potentially unsuccessful transfers to automatic bypass from taking place.

- B. The design of the automatic bypass switch power path consists of a heavy-duty electromechanical relay.
- C. Automatic Transfers: An automatic transfer of load to bypass takes place whenever the load on the critical bus exceeds the overload rating of the UPS. Automatic transfers of the critical load from bypass back to normal operation takes place when the overload condition is removed from the critical bus output of the system. Automatic transfers of load to bypass also take place if for any reason the UPS cannot support the critical bus
- D. Manual Transfers: Manually initiated transfers to and from bypass may be initiated through the UPS front panel LCD display or UPS computer interface.

## 2.7 BATTERY

- A. The UPS battery system is internal to the UPS. Battery system is not user replaceable, and not hot swappable.
- B. The battery used are of the Valve Regulated Lead Acid (VRLA) type.
- C. The UPS incorporates the Intelligent Battery Management system to continuously monitor the health of battery. This system shall notify the user in the event that a failed or weak battery is found.
- D. Charging:
  - 1. The intelligent battery management system contains a temperature monitoring circuit and compensation algorithm that regulates the battery charging current & voltage so as to optimize battery life.
  - 2. The battery charging circuit remains active when in bypass and online states.
- E. Additional battery modules cannot be added to increase runtime.
- F. The UPS is shipped with battery pre-installed but disconnected. Battery connect feature is provided on the back panel.

## 2.8 DISPLAY AND CONTROLS

- A. Control Logic: The UPS is controlled by an embedded microcontroller which performs functions:
  - 1. Monitoring quality of output voltage;
  - 2. Monitoring vital parameters of the UPS;

3. Executing the state machine;
  4. Intelligent battery management;
  5. Remaining runtime calculation;
  6. Self-diagnostics, self-test and proactive fault detection;
  7. Communication to the host server via serial port;
  8. Communication to the Network Interface Card or another SmartSlot accessory card if equipped.
- B. Display/Control Unit: A display/control comprised of LCD, LED and 5 pushbutton switches is located on the front side of the UPS.
- C. The pushbutton switches located at the Display/Control Unit: The following controls functions can be accomplished by use of the pushbutton switches located at the Display/Control Unit:
1. Turn the UPS on;
  2. Turn the UPS off;
  3. Initiate self-test in order to test battery condition;
  4. Silence audible alarm;
  5. Cold start.
  6. Enable /disable bypass mode and ECO mode
  7. Configure output voltage and bypass input voltage range
  8. Display Input voltage & frequency, output voltage & frequency, Battery Voltage, battery capacity remaining, Ambient temperature, Load % and fault log.
- D. EPO switch: The UPS is equipped with Emergency Power Off (EPO) terminal which can be wired so as to provide means to instantaneously de-energize the UPS and its load from a remote location in case of emergency.
- E. Data displayed on the Display/Control Unit: The following indicators are available on the Display/Control Unit:
1. The UPS load bar;
  2. The UPS is online;
  3. The UPS is on battery;

4. The UPS battery capacity bar;
  5. The UPS is in bypass;
  6. The UPS is in ECO mode;
  7. The UPS is overloaded;
  8. The UPS is in fault state;
  9. The battery is bad or disconnected;
  10. UPS Output Voltage;
- F. Audible Alarms: Using audio signal, the UPS will notify the user about important events. The following is the list of distinct audio alarms:
1. The UPS is on battery;
  2. The UPS is on battery and the remaining battery capacity is low;
  3. The UPS has shut down due to low battery capacity;
  4. The battery is disconnected; The battery is bad;
  5. The UPS is overloaded;
  6. The UPS is in fault state;

### **PART 3 - PART 3 – ACCESSORIES**

#### **3.1 SOFTWARE AND CONNECTIVITY**

- A. Network Adaptor: APC SmartSlot Network Management Card shall allow one or more network management systems (NMS) to monitor and manage the UPS in TCP/IP network environments.
- B. Unattended Shutdown
  1. The UPS, in conjunction with a network interface card, shall be capable of gracefully shutting down one or more operating systems during when the UPS is on battery mode.
  2. The UPS is also capable of using an RS232/USB port to communicate to the host computer by means of serial communications so as to gracefully shut down one or more operating systems during an on battery situation. The PowerChute Business Edition (PCBE) software can be downloaded from website.

#### **3.2 REMOTE UPS MONITORING, CONFIGURATION AND CONTROL**

- A. The following method of remote UPS control, configuration and monitoring is available:
  - 1. **Web Monitoring:** Remote monitoring, configuration and control is available via a web browser such as Internet Explorer provided the UPS is equipped with

### 3.3 SOFTWARE COMPATIBILITY

- A. UPS is compatible with PowerChute Business Edition (PCBE) software. The software supports graceful shutdown and remote monitoring for various systems.
- B. Please visit APC web site for current listing of compatible systems.

## **PART 4 - Part 4 - EXECUTION**

### 4.1 FACTORY ASSISTED START-UP

If a factory assisted UPS start-up is requested, factory trained service personnel shall perform the following inspections, test procedures, and on-site training:

- A. **Visual Inspection:**
  - 1. Inspect equipment for signs of damage.
  - 2. Verify installation per manufacturer's instructions.
- B. **Mechanical Inspection**
  - 1. Check all UPS and external service bypass panel internal power wiring connections.
  - 2. Check all UPS and external service bypass panel terminal screws, nuts, and/or spade lugs for tightness.
- C. **Electrical Inspection:**
  - 1. Verify correct input and bypass voltage.
  - 2. Verify correct UPS control wiring and terminations.
  - 3. Verify neutral and ground conductors are properly landed.
  - 4. Inspect external service bypass panel for proper terminations.
- D. **Site Testing:**

1. Ensure proper system start-up.
  2. Verify proper firmware control functions.
  3. Verify proper firmware bypass operation.
  4. Verify proper bypass switch operation (where applicable).
  5. Verify proper inverter operation and regulation circuits.
  6. Simulate utility power failure.
  7. Verify proper charger operation.
  8. Document, sign, and date all test results.
- E. On-Site Operational Training: During the factory assisted start-up, operational training for site personnel shall include front display panel features and operation, LED indicators, start-up and shutdown procedures, maintenance bypass and AC disconnect operation, and alarm information.

#### 4.2 MANUFACTURER FIELD SERVICE

- A. Worldwide service: The UPS manufacturer has a worldwide service organization available, consisting of factory trained field service personnel to perform start-up, preventative maintenance, and service of the UPS system and power equipment. The service organization offers 24 hours a day, 7 days a week, 365 days a year service support.
- B. Replacement parts: Parts are available through the worldwide service organization 24 hours a day, 7 days a week, 365 days a year. The worldwide service organization is capable of shipping parts within 4 working hours or on the next available flight, so that the parts may be shipped to the customer site within 24 hours.

#### 4.3 MAINTENANCE CONTRACTS

- A. A complete offering of preventative and full service maintenance contracts for the UPS system and the battery system are available from APC. All contract work is performed by APC factory trained service personnel.

End of Section 16611