

UNINTERRUPTIBLE POWER SYSTEMS

- 250-, 500-, 1000-VA Outputs
- Highly Efficient Operation
- 2:1 Power Surge Capability
- Frequency-Stable Inverter
- Rugged, Compact Construction



500-VA - MODEL 1408

Applications

Serious problems may result when commercial ac power is unexpectedly interrupted to sensitive loads such as point-of-sale registers and terminals, communications equipment, small computers, or security systems. Unfortunately, such interruptions are becoming more commonplace. Consequently, many people are turning to point-of-use uninterruptible power systems like Wilmore's Series 1400 to keep their equipment operating. Wilmore's aim in the design, development, and manufacture of the Series 1400 standby power systems is to provide, at low cost and with uncompromised performance, a reliable alternative to more expensive and complex UPS systems.

General Approach

There are two approaches to the design of an uninterruptible power system (UPS). One method is to process commercial power through a battery charger, a battery and a dc-to-ac inverter, always powering the user's equipment from the UPS's internal inverter. The other method is to power the user's equipment from the UPS's internal inverter only upon failure of the commercial ac power source. The first method is inherently more expensive initially because it requires two power supplies (battery charger and inverter), both sized to the user's full power requirement. It also is less efficient and consequently more costly to operate since all of the output power must undergo two transformations: ac-to-dc rectification followed by dc-to-ac inversion. In the second method, which is the one used by the Series 1400, since the battery charger is used only to float charge the battery during normal operation, the battery charger can be rated at a small fraction of the power rating of the inverter. Furthermore, when commercial ac power is present, the load is directly supplied through a transfer relay and only a very small fraction of the rated output power goes to maintaining the standby battery at full charge and in providing system control functions. Operating costs in the Series 1400 approach are thereby much lower than when all of the load must be twice transformed inside the UPS.

Installation

Installation of the system only requires plugging the UPS into the commercial power source with the power cord provided, plugging

the load into one of the two standard 3-prong outlets on the UPS, and connecting the UPS to the standby battery bank with properly sized battery cables.

Automatic Transfer

An important feature of the Series 1400 is the speed with which the transfer from ac-line operation to inverter operation occurs and the caution with which the return-to-normal operation takes place. The sense and control circuits of the Series 1400 UPS operate continuously and, within milliseconds after interruption of the commercial power, the power stage of the internal inverter picks up the load. In the reverse direction, to avoid annoying premature switchovers when restoration of the commercial power may be sporadic, a five-to-seven second period of continuous normal ac power must be sensed before the reverse switchover from inverter to normal ac-line operation takes place. With the load again being supplied directly from the commercial line, the battery charger inside the UPS begins to recharge the batteries.

Inverter Output

The output waveform of the inverter of the Series 1400 UPS is a three-level-step approximation to a sine wave. This waveform achieves the same high-efficiency performance as square-wave inverters which are well adapted to powering loads such as small motors, heaters, lighting and power hand tools. At the same time, by providing peak and rms voltages that approximate those of a pure sine wave, the Series 1400 inverter effectively powers many additional loads such as electronic instruments, small computers, chart recorders and video tape recording equipment. This waveshape has been specifically designed for compatibility with most sensitive electronic equipment for which sine wave power would normally be specified.

Series 1400 uninterruptible power systems are available in any one of three continuous ac output ratings: 250 volt-amperes, 500 volt-amperes, or 1000 volt-amperes. All models within the Series 1400 can be specified with either 115-volt 60-hertz ac output or 230-volt 50-hertz ac output. The frequency of the inverter in all models is regulated to within ± 0.15 Hz over the full range of output power and input voltage. An important feature of these inverters is the surge

Inverter Output (cont.)

capability that permits supplying of up to twice the continuous ac output rating to accommodate such difficult-to-handle loads as small motors that demand a large inrush current on starting.

Inverter efficiency is a characteristic of primary importance in a standby power system because it directly affects the drain on the battery and the internal temperature rise of the unit. The high efficiency of the Series 1400 UPS's inverters (greater than 80% from half load to full load) insures effective utilization of the batteries in maximizing backup times for any size battery and permits the conservative rating of components essential for reliable operation. An additional feature that contributes significantly to long backup times is the very small battery drain and power loss, typically less than 20 watts, that occurs when the inverter is providing the output voltage but there is no load demand.

Batteries

Standby power for the system is provided by external batteries which are maintained at full charge by the built-in battery charger. Backup time is determined by the rating of the battery bank employed by the customer. The 250- and 500-VA units may be ordered for either 12- or 24-Vdc batteries. The 1000-VA units are available for 24-Vdc batteries only. Because of the widely varying requirements of different users, batteries are not supplied by Wilmore with the Series 1400 UPS.

Battery Charger

The battery charger, which is an integral part of each Wilmore UPS, is a precision current-limited charger which float charges the battery at a pre-established level whenever commercial ac power is present and the charging-current demand by the battery does not exceed the current-limit level. The float-charge voltage is factory adjusted to match any special requirements of the batteries being charged. The standard setting for 12-volt batteries is 13.65 Vdc and for 24-volt batteries is 27.3Vdc. The charging-current levels for the 250-VA systems are 3 amperes for 12-Vdc batteries and 2 amperes for 24-Vdc batteries. For 500-VA systems, the charging-current levels are 6 amperes for 12-Vdc batteries and 3 amperes for 24-Vdc batteries. The power drain from the ac source to maintain the batteries on float charge and to power the sense and control circuitry is typically less than 15 watts.

Protection

The system approach applied to the design of the Series 1400 provides protection of the UPS from electrical stresses entering either from the commercial ac line or from the load. When the load is supplied from the ac line through the transfer relay, protection against overload is provided by a fuse accessible from the front panel. When the inverter is supplying the load, a circuit breaker at the dc input to the UPS provides overload protection to the UPS and the batteries. Electronic circuitry which responds in approximately 0.3 ms helps to protect against short circuits.

SERIES 1400 UPS SPECIFICATIONS

Model Number	AC Output Power (Volt-Amps)	Battery Input Voltage Range (Volts DC)	Rated Battery Charger Current (Amps DC)	Size (h" x w" x d")	Weight (Pounds)
1407-12	250	11 to 14.5	3	8.75x12.75x11	42
1407-24	250	22 to 29	2	8.75x12.75x11	42
1408-12	500	11 to 14.5	6	9x12.75x16	56
1408-24	500	22 to 29	3	9x12.75x16	56
1409-24	1000	22 to 29	3	9x12.75x16	60

Operating Temperature: -20°C to +55°C

Surge Capability

All models have a surge capability that permits supplying of up to twice the rated output power for loads that demand large inrush current on starting.

INVERTER OPERATION

Output Voltage

Standard: 115 volts, 1 60 hertz, single phase
Option 230/50: 230 volts, 1 50 hertz, single phase

Output Voltage Waveshape

Three-level-step approximation to a sine wave with peak, average, and rms values approximately those of a sine wave.

Output Frequency

± 0.15 Hz maximum variation with load and input voltage variations.
Temperature coefficient: ±0.02% maximum per °C.

Efficiency

Inverter efficiencies exceed 80% for half to full load. See Figure 1 for typical Model 1408 inverter efficiencies.

The power demand for the inverter at no load is typically less than 20 watts.

Protection

Front-panel circuit breaker protects against accidental reversal of dc polarity when connecting batteries, and against long-term output overload.

Short-circuit protection with automatic recovery once normal operating conditions return is provided electronically.

Electronic protection circuit turns off the inverter when the input voltage exceeds the nominal range of 9.0 to 16.5 Vdc for 12-v batteries or 18.0 to 33.0 Vdc for 24-V batteries.

Footnote 1. Peak and average values of output voltage vary directly with dc-input voltage.

AC LINE OPERATION

Battery Charger

Battery chargers are current-limited, and rated charging current for each model is shown in the table of specifications.

Standard factory settings for float-charge voltage levels are 13.65 Vdc for nominal 12-Vdc systems and 27.3 Vdc for nominal 24-Vdc systems.

Standby Power Drain

Approximately 15 watts when trickle charging batteries

Protection

Fuse between ac power input and ac power output

Automatic Transfer

Switchover to inverter operation occurs in less than 16 ms after the ac line voltage drops below the factory-set level of 90 Vac for 115-Vac 60-Hz systems or 180 Vac for 230-vac 50-Hz systems.

Return to ac line operation from the inverter-output mode occurs only after 5 to 7 seconds of continuous normal ac voltage greater than 95 Vac for 115-vac 60-Hz systems of 190 Vac for 230-Vac 50-Hz systems.

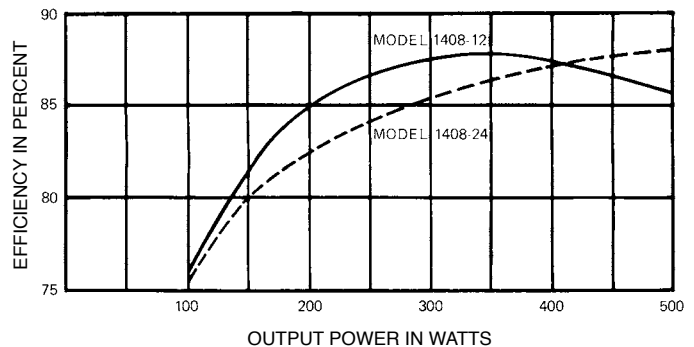


FIG. 1 TYPICAL INVERTER EFFICIENCY VERSUS OUTPUT POWER AT NOMINAL DC INPUT VOLTAGE

HOW TO ORDER

To order a Series 1400 UPS, find the associated model number in the specifications table that matches your particular requirement for output power and battery input voltage. Unless otherwise specified, the **standard** output of 115 Vac at 60 Hz will be provided. For an output of 230 Vac at 50 Hz, designate **Option 230/50** after the model number.

Additional options such as synchronization of the inverter to the commercial ac line are available on special order.

WILMORE ELECTRONICS COMPANY, INC.

P.O. Box 1329, Hillsborough, N.C. 27278 • Telephone (919) 732-9351 • FAX: (919) 732-9359
www.wilmoreelectronics.com