

TOSHIBA

UNINTERRUPTIBLE POWER SYSTEM

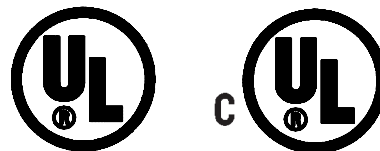
SINGLE PHASE - .6/.8/1.0/1.2 kVA
SINGLE PHASE - .6/.8/1.0 kVA PLUS

1500 and *1500 PLUS* SERIES

MANUFACTURED IN THE U.S.A.

OPERATION MANUAL

March, 2003
Part # 46370-002



NOTE

The instructions contained in this manual are not intended to cover all of the details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Toshiba sales office.

The contents of this instruction manual shall not become a part of or modify any prior or existing agreement, commitment, or relationship. The sales contract contains the entire obligation of Toshiba International Corporation's UPS Division. The warranty contained in the contract between the parties is the sole warranty of Toshiba International Corporation's UPS Division and any statements contained herein do not create new warranties or modify the existing warranty.

Any electrical or mechanical modifications to this equipment, without prior written consent of Toshiba International Corporation, will void all warranties and may void UL listing or other safety certification. Unauthorized modifications also can result in personal injury, death, or destruction of the equipment.

UNINTERRUPTIBLE POWER SUPPLY

If additional information or technical assistance is required call Toshiba's marketing department toll free at (800) 231-1412 or write to: Toshiba International Corporation, 13131 W. Little York Road, Houston, TX 77041-9990.

Please complete the following information for your records and to remain within this equipment manual:

Model Number: _____

Serial Number: _____

Date of Installation: _____

Inspected By: _____

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INTRODUCTION

Thank you for purchasing the 1500/1500 Plus Series UPS. This Series features the very latest state of the art microprocessor technology and also uses IGBT transistors for fast, high power and low noise PWM (pulse width modulation) switching. Also, the Plus Series features a low impedance transformer to provide isolation even during bypass operation.

It is the intent of this manual to provide a guide for **safely** installing, operating, and maintaining the UPS. This operation manual contains a section of general safety instructions and is marked throughout with warning symbols. **Read this operation manual** thoroughly before installation and operation of this electrical equipment.

All safety warnings must be followed to ensure personal safety.

Follow all precautions to attain proper equipment performance and longevity.

General safety instructions are found on page v and important safety instructions are found on pages vi, vii, and viii. Read and save these instructions for future reference.

The manual is divided into major sections of interest. Section 1 contains the product description with the theory of operation and applications. All of the initial inspection, storage, installation, operating, and prestart precautions can be found in Sections 2 and 3.

Section 4 contains the equipment standard specifications.

Section 5 outlines the operating modes, protective features, battery recharging, battery low voltage tolerances, alarm and panel indicator functions.

Section 6 shows the control interface pin configurations.

Sections 7 and 8 are devoted to troubleshooting procedures, preventative maintenance techniques and periodic parts replacement. A fuse rating chart is also shown.

Section 9 shows front, rear, and side panel layout views with dimensional data. Labels, connector and switch placement, and shipping weights are also shown.

We hope that you find this operation manual informative and easy to use. If additional information or technical assistance is needed, please call toll free (800) 231-1412 or write to: Toshiba International Corporation, 13131 W. Little York Road, Houston, TX 77041-9990.

Again, thank you for the purchase of this product.

TOSHIBA INTERNATIONAL CORPORATION

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GENERAL SAFETY INSTRUCTIONS

Warnings in this manual appear in any of four ways:

- 1) *Danger* - The danger symbol is a lightning bolt mark enclosed in a triangle which precedes the 3/16" high letters spelling the word "DANGER". The danger symbol is used to indicate imminently hazardous situations, locations, and conditions which, if not avoided, **WILL** result in death, serious injury, and/or severe property damage.



- 2) *Warning* - The warning symbol is an exclamation mark enclosed in a triangle which precedes the 3/16" high letters spelling the word "WARNING". The warning symbol is used to indicate potentially hazardous situations and conditions which, if not avoided **COULD** result in serious injury or death. Severe property damage **COULD** also occur.



- 3) *Caution* - The caution symbol is an exclamation mark enclosed in a triangle which precedes the 3/16" high letters spelling the word "CAUTION". The caution symbol is used to indicate potentially hazardous situations and conditions which, if not avoided may result in injury. Equipment damage may also occur.



- 4) *Attention warnings* - The attention warning symbol is an exclamation mark enclosed in a triangle which precedes the 3/16" high letters spelling the word "ATTENTION". The Attention warning symbol is used to indicate situations and conditions that can cause operator injury and/or equipment damage:



Other warning symbols may appear along with the *Danger* and *Caution* symbol and are used to specify special hazards. These warnings describe particular areas where special care and/or procedures are required in order to prevent serious injury and possible death:

- 1) *Electrical warnings* - The electrical warning symbol is a lightning bolt mark enclosed in a triangle. The Electrical warning symbol is used to indicate high voltage locations and conditions that may cause serious injury or death if the proper precautions are not observed:



- 2) *Explosion warnings* - The explosion warning symbol is an explosion mark enclosed in a triangle. The Explosion warning symbol is used to indicate locations and conditions where molten, exploding parts may cause serious injury or death if the proper precautions are not observed:



IMPORTANT SAFETY INSTRUCTIONS

SAVE THESE INSTRUCTIONS- This manual contains important instructions that should be followed during the installation and maintenance of the UPS and its batteries. Use for models UE1A1A006C6, UE1A1A006C6T, UE1A1A008C6, UE1A1A008C6T, UE1A1A010C6, UE1A1A010C6T, UE1A1A012C6.

- The maximum ambient temperature in which this UPS unit should be operated or stored is 104 °F (40 °C).
- The nominal battery voltage range is indicated in Section 5.6.
- Servicing of the batteries should only be performed by a qualified Toshiba Representative who is knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.
- When replacing batteries, use the same number and type of one of the following sealed, lead-acid batteries (do not mix types of batteries):

Model Capacity	Manufacturer	Type	Quantity
600 VA / 600 VA Plus	Yuasa	NP4-12FR	5
800 VA / 800 VA Plus			
1000 VA / 1000 VA Plus	Yuasa	HPH5-12FR	5
1200 VA			



CAUTION Misuse of this equipment could result in human injury and equipment damage. In no event will Toshiba Corporation be responsible or liable for either indirect or consequential damage or injury that may result from the use of this equipment.



CAUTION



Do not dispose of the batteries in a fire. The batteries may explode.



CAUTION

Do not open or mutilate the batteries. Released electrolyte is harmful to the eyes and skin and could also be toxic.



WARNING

This unit contains sealed lead acid batteries. Lack of preventative maintenance could result in batteries exploding and emitting gasses and/or flame. Annual preventative maintenance must be performed by an authorized, trained technician.



WARNING

Failure to replace a battery before it becomes exhausted may cause the case to crack, possibly releasing electrolytes from inside the battery, and resulting in secondary faults such as odor, smoke, and fire.

IMPORTANT SAFETY INSTRUCTIONS



WARNING

Installation and servicing of batteries should be performed by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from the batteries.



WARNING

Proper maintenance to the battery system of this unit must be done by a qualified service technician, this is essential to the safety and reliability of your UPS system. Refer to service manual.



DANGER



A battery can present a risk of electrical shock and high short circuit current. The following precautions should be observed

when working with batteries:

- 1) Verify that the UPS is off and that the power cord is disconnected from the power source.
- 2) Remove watches, rings or other metal objects.
- 3) Use tools with insulated handles to prevent inadvertent shorts.
- 4) Wear rubber gloves and boots.
- 5) Do not lay tools or metal parts on top of batteries.
- 6) Determine if the battery is inadvertently grounded. If inadvertently grounded, remove source of ground. **Contact with any part of a grounded battery can result in electrical shock.** The likelihood of such shock will be reduced if such grounds are removed during installation and maintenance.
- 7) Verify circuit polarities prior to making connections.
- 8) Disconnect charging source and load prior to connecting or disconnecting terminals.
- 9) VRLA batteries contain an explosive mixture of hydrogen gas. Do not smoke, cause a flame or spark in the immediate area of the batteries. This includes static electricity from the body.
- 10) Do not attempt to open the batteries in order to add water or sample the specific gravity of the electrolyte. The batteries are valve regulated lead acid type and such servicing is not possible without damaging the battery.
- 11) Use proper lifting means when moving batteries and wear all appropriate safety clothing and equipment.
- 12) Do not dispose of lead acid batteries except through channels in accordance with local, state and federal regulations.

INSTRUCTIONS IMPORTANTES CONCERNANT LA SÉCURITÉ

CONSERVER CES INSTRUCTIONS

Cette notice contient des instructions importantes concernant la sécurité.



ATTENTION

Une battery peut présenter un risque de choc électrique, de brûlure par transfert d'énergie.



ATTENTION

Pour le remplacement, utiliser le même nombre de batteries du modèle suivant.

Model Capacity	Manufacturer	Type	Quantity
600 VA / 600 VA Plus	Yuasa	NP4-12FR	5
800 VA / 800 VA Plus			
1000 VA / 1000 VA Plus	Yuasa	NPH5-12FR	5
1200 VA			



ATTENTION

L'élimination des batteries est réglementée. Consulter les codes locaux à cet effet.

1.0 Product Description

1.1 Theory of Operation

An uninterruptible power supply is a system that is installed between the commercial power and the load equipment. It is used during short-term blackouts or brownouts. The UPS provides steady ac output power during these commercial power interruptions. This power is provided for a long enough time so that the load can be shutdown in an orderly fashion. This prevents loss of data and possible damage to both hardware and software.

During normal operation the UPS uses commercial ac power. In addition, it also takes in all of the high voltage spikes and transients caused by switching and faults, and all of the common mode and normal mode noise which is associated with commercial ac power. The UPS converts it all to flat dc power. From this dc power, the UPS charges its batteries and generates its own extremely high quality ac waveform output. The result of this process is maximum power conditioning.

If the ac power supplied to the UPS drops below a specified voltage level, the unit's batteries automatically begin supplying power instead of receiving it. This insures that the loads connected to the UPS continue to receive power with no interruption. When ac input power becomes available again, operation returns to normal. The unit's batteries begin to recharge so they will be ready for the next power interruption.

1.2 Application and Use

Toshiba's 1500 and 1500 Plus Series of on-line uninterruptible power supply (UPS) systems provide continuous computer-grade ac power in a compact, high performance, and energy efficient unit. The UPS unit assures safe and reliable operation of critical office equipment. This can range from word processors and personal computers to mini-computers and local area networks. All units feature an audible alarm which sounds if the battery voltage drops below standard during use. This is an additional aid to help in retaining the valuable office data banks. All units allow for computer interfacing and an external battery pack option (see specifications).

1.3 Power Backup

When an electrical power failure occurs, the UPS unit's internal maintenance-free batteries automatically supply back-up power to the load without interruption. For example, when used to support a computer, the UPS back-up assures enough additional time to complete the activity and store data. This allows an orderly shutdown after a power failure has occurred.

1.4 Power Conditioning

When commercial power is present, the UPS supplies conditioned power to the load while maintaining its batteries in a charged condition. The UPS protects against the normal everyday problems associated with heavy use of raw commercial ac power, including power sags, surges, signal interference, and spikes. This protection keeps power-line problems from reaching the loads where they can cause equipment to operate erratically, hard-disk crashes, or cause damage to hardware and software.

2.0 Inspection/Storage/Disposal

2.1 Inspection of the new UPS equipment

Upon receipt of the UPS, a careful inspection for shipping damage should be made.

After Uncrating:

- 1) Check the unit for loose, broken, bent or otherwise damaged parts. If damage has occurred during shipment, keep all original crating and packing materials for return to shipping agent. Warranty will not apply to units which are damaged during shipment.
- 2) Check to see that the rated capacity and the model number specified on the nameplate conform to the order specifications.

2.2 Storage of UPS equipment.

If the UPS equipment is to be subject to long or short term storage the following guidelines should be used.

Avoid:

- 1) Storage in sites subject to extreme changes in temperature or high humidity.
- 2) Storage in sites subject to exposure of high levels of dust or metal particles
- 3) Storage on inclined floor surfaces or in sites subject to excessive vibration.

Before storing:

- 1) Charge the units batteries.
- 2) Place the STOP/RUN switch in the STOP position.

Storing:

- 1) Store within a temperature range of -20° to 40° C (-4° to 104° F).
- 2) For best results, store the UPS in the original shipping container and place on a wood or metal pallet.
- 3) The optimum storage temperature is 21° C (70° F). Higher ambient temperatures cause UPS batteries to need recharging more frequently.

After storing:

- 1) If stored in an ambient temperature under 20° C (68° F); recharge the batteries every 9 months.
- 2) If stored in an ambient temperature of 20° to 30° C (68° to 86° F); recharge the batteries every 6 months.
- 3) If stored in an ambient temperature of 30° to 40° C (86° to 104° F); recharge the batteries every 3 months.

2.3 Disposal

Please contact your state environmental agency for details on disposal of electrical components and packaging in your particular area.

It is illegal to dump lead-acid batteries in landfills or to dispose of them improperly.

Please help our Earth by contacting the environmental protection agencies in your area, the battery manufacturer, or call Toshiba toll-free at (800) 231-1412 for more information about recycling.

3.0 Precautions

3.1 Installation Precautions (General)



CAUTION

- 1) Install the unit in a well ventilated location; allow at least 10 cm (4 inches) on all sides for air ventilation and for maintenance.
- 2) Install the unit in a stable, level, and upright position which is free of vibration.
- 3) Install the unit where the ambient temperature is within the correct operating range (see Specifications Section 4.0).
- 4) Do not install the UPS in areas that are subject to high humidity.
- 5) Do not allow direct sunlight to shine on the unit.
- 6) Do not install the UPS in areas which are subject to contamination such as high levels of airborne dust, metal particles, or inflammable gas.
- 7) Avoid installation near sources of electrical noise and always make sure that the unit ground is intact to prevent electrical shock and to help reduce electrical noise.
- 8) Do not install where water or any foreign object may get inside the UPS.
- 9) This UPS generates and can radiate radio-frequency energy during operation. Although RFI noise filters are installed inside the unit, there is no guarantee that the UPS will not influence some sensitive devices which are operating close by. If such interference is experienced, the UPS should be installed farther away from the affected equipment and/or powered from a different source than that of the affected equipment.

3.0 Precautions

3.2 Prestart Precautions




CAUTION

- 1) Before connecting the UPS to a power source; move the operation switch (STOP/RUN), on the front panel (See sections 9.1), to the STOP position.

3.3 Operating Precautions



CAUTION

- 1) The UPS should not be powered up until the entire operation manual has been reviewed.
- 2) The input power source voltage and frequency must be within the specified ranges (See Specification sections 4.1 and 4.2). Voltages and frequencies outside of the permissible tolerance ranges may cause internal protection devices to activate.
- 3) The UPS should not be used with a load whose rated input is greater than the rated UPS output.
- 4) Do not use the UPS to provide power to motors that require high starting current or a long starting time such as vacuum cleaners and machine tools (oversizing for lock rotor current required).
- 5) Do not insert metal objects or combustible materials in the unit's ventilation slots.
- 6) Do not place, hang, or paste any objects on the top or on the exterior surfaces of the UPS.
- 7)  Always use caution when connecting or disconnecting load equipment. ***The UPS may be supplying power to the output load receptacles through the bypass circuit.*** This can occur when the STOP/RUN switch is in the STOP position and the unit is connected to a source of supply power (see Circuit-bypass Mode section 5.1.3).

4.0 Specifications

4.1 Standard Series Specifications

MODEL NUMBER		UE1A1A006C6	UE1A1A008C6	UE1A1A010C6
CAPACITY		600 VA (0.42 kW)	800 VA (0.56 kW)	1000 VA (0.7 kW)
Input	Input voltage	Single phase, 120 Vac, +10% to -30% (*)		
	Input frequency	45 to 65 Hz		
	Input capacity	600 VA	800 VA	1000 VA
	Input power factor	Approximate unity (0.95 to 1.0)		
Battery	Battery rated voltage	60 Vdc		
	Battery backup time when fully charged with 0.7 power factor at 77° F (25° C)	12 min. at full load (**) 30 min. at half load (**)	8 min. at full load (**) 20 min. at half load (**)	7 min. at full load (**) 18 min. at half load (**)
	Recharge time	Maximum 24 hrs to 100% (90% recharge after 8 hrs) (***)		
	Type of batteries	Sealed lead-acid		
Output	Output voltage	Single-phase, 120 volts		
	Output voltage regulation	Within +/- 3%, steady state		
	Output frequency	50/60 Hz +/- 0.5% in free-running mode (line sync range +/- 1Hz)		
	Output voltage waveform	Computer-grade sine wave with less than 3.0% total harmonic distortion with linear load		
	Rated load power factor	0.7 lagging (0.6 to 1.0)		
	Voltage transient characteristic	+/- 8% under 100% load step change		
	Rated output current (rms)	5.0A	6.7A	8.3A
	Maximum output current (peak)	15.0A	20.0A	25.0A
	Inverter overload capacity	150% for 30 seconds		
	Crest factor	3.0		
Environment	Operating temperature	32 to 104° F (0 to 40° C), optimal at 77° F (25° C)		
	Storage temperature	-4 to 104° F (-20 to 40° C)		
	Operating humidity	30 to 90%, no condensation		
	Altitude(****)	Less than 3000 ft (1000 m) above sea level		
	External dimensions	8.00W x 20.38D x 10.00H in (203W x 518D x 254H mm)		
	Net weight	40.3 lb (18.3 kg)	40.3 lb (18.3 kg)	43.7 lb (19.8 kg)
	Acoustical noise	50 dB at max. output, measured 3.3 ft (1 m) from front panel		
	Efficiency (ac-dc-ac)	85%	85%	87%
Switches	Bypass switch	Automatic bypass is provided when the run switch is in the stop position, if a fault occurs, or if an overload occurs (transfer time is approximately 4 msec)		
Interfaces	IBM (TM) AS/400	See section 6.0 for details.		
	LAN Manager			
	Fault detect and input power loss			
	RS232 ASCII			
Options	Software for unattended computer shutdown	Contact Toshiba for details on this option		
	External battery pack	Contact Toshiba for details on this option		

(*) Output capacity reduced when input voltage is between -15% and -30% of nominal.

(**) Battery backup time may vary depending on the operating conditions including ambient temperature at the installation site.

(***) An initial charge time of 24 hrs. is necessary to obtain proper battery performance level before unit is used for battery backup.

(****) Above 3000 ft (1000 m), output capacity reduced.

4.0 Specifications

4.1 Standard Series Specifications (Cont'd)

MODEL NUMBER		UE1A1A012C6
CAPACITY		1200 VA (0.84 kW)
Input	Input voltage	Single phase, 120 Vac, +10% to -30% (*)
	Input frequency	45 to 65 Hz
	Input capacity	1200 VA
	Input power factor	Approximate unity (0.95 to 1.0)
Battery	Battery rated voltage	60 Vdc
	Battery backup time when fully charged with 0.7 power factor at 77° F (25° C)	5 min. at full load (**) 12 min. at half load (**)
	Recharge time	Maximum 24 hrs to 100% (90% recharge after 8 hrs) (***)
	Type of batteries	Sealed lead-acid
Output	Output voltage	Single-phase, 120 volts
	Output voltage regulation	Within +/- 3%, steady state
	Output frequency	50/60 Hz +/- 0.5% in free-running mode (line sync range +/- 1Hz)
	Output voltage waveform	Computer-grade sine wave with less than 3.0% total harmonic distortion with linear load
	Rated load power factor	0.7 lagging (0.6 to 1.0)
	Voltage transient characteristic	+/- 8% under 100% load step change
	Rated output current (rms)	10.0A
	Maximum output current (peak)	30.0A
	Inverter overload capacity	150% for 30 seconds
	Crest factor	3.0
Environment	Operating temperature	32 to 104° F (0 to 40° C), optimal at 77° F (25° C)
	Storage temperature	-4 to 104° F (-20 to 40° C)
	Operating humidity	30 to 90%, no condensation
	Altitude(****)	Less than 3000 ft (1000 m) above sea level
	External dimensions	8.00W x 20.38D x 10.00H in (203W x 518D x 254H mm)
	Net weight	43.7 lb (19.8 kg)
	Acoustical noise	50 dB at max. output, measured 3.3 ft (1 m) from front panel
	Efficiency (ac-dc-ac)	87%
Switches	Bypass switch	Automatic bypass is provided when the run switch is in the stop position, if a fault occurs, or if an overload occurs (transfer time is approximately 4 mS)
Interfaces	IBM (TM) AS/400	See section 6.0 for details.
	LAN Manager	
	Fault detect and input power loss	
	RS232 ASCII	
Options	Software for unattended computer shutdown	Contact Toshiba for details on this option
	External battery pack	Contact Toshiba for details on this option

(*) Output capacity reduced when input voltage is between -15% and -30% of nominal.

(**) Battery backup time may vary depending on the operating conditions including ambient temperature at the installation site.

(***) An initial charge time of 24 hrs. is necessary to obtain proper battery performance level before unit is used for battery backup.

(****) Above 3000 ft (1000 m), output capacity reduced.

4.0 Specifications

4.2 Plus Series Specifications (w/ isolation transformer)

MODEL NUMBER		UE1A1A006C6T	UE1A1A008C6T	UE1A1A010C6T
CAPACITY		600 VA (0.42 kW)	800 VA (0.56 kW)	1000 VA (0.7 kW)
Input	Input voltage	Single phase, 120 Vac, +10% to -30% (*)		
	Input frequency	45 to 65 Hz		
	Input capacity	600 VA	800 VA	1000 VA
	Input power factor	Approximate unity (0.95 to 1.0)		
Battery	Battery rated voltage	60 Vdc		
	Battery backup time when fully charged with 0.7 power factor at 77° F (25° C)	12 min. at full load (**) 30 min. at half load (**)	8 min. at full load (**) 20 min. at half load (**)	7 min. at full load (**) 18 min. at half load (**)
	Recharge time	Maximum 24 hrs to 100% (90% recharge after 8 hrs) (***)		
	Type of batteries	Sealed lead-acid		
Output	Output voltage	Single-phase, 120 volts		
	Output voltage regulation	Within +/- 3%, steady state		
	Output frequency(****)	50/60 Hz +/- 0.5% in free-running mode (line sync range +/- 1Hz)		
	Output voltage waveform	Computer-grade sine wave with less than 3.0% total harmonic distortion with linear load		
	Common mode	Less than 0.5V peak		
	Normal mode	Less than 10V peak		
	Rated load power factor	0.7 lagging (0.6 to 1.0)		
	Voltage transient characteristic	+/- 8% under 100% load step change		
	Rated output current (rms)	5.0A	6.7A	8.3A
	Maximum output current (peak)	15.0A	20.0A	25.0A
	Inverter overload capacity	150% for 30 seconds		
	Crest factor	3.0		
Environment	Operating temperature	32 to 104° F (0 to 40° C), optimal at 77° F (25° C)		
	Storage temperature	-4 to 104° F (-20 to 40° C)		
	Operating humidity	30 to 90%, no condensation		
	Altitude(****)	Less than 3000 ft (1000 m) above sea level		
	External dimensions	8.00W x 20.38D x 10.00H in (203W x 518D x 254H mm)		
	Net weight	57.5 lb (26.1 kg)	57.5 lb (26.1 kg)	60.9 lb (27.6 kg)
	Acoustical noise	50 dB at max. output, measured 3.3 ft (1 m) from front panel		
	Efficiency (ac-dc-ac)	83%	83%	85%
Switches	Bypass switch	Automatic bypass is provided when the run switch is in the stop position, if a fault occurs, or if an overload occurs (transfer time is approximately 4 msec)		
Interfaces	IBM (TM) AS/400	See section 6.0 for details.		
	LAN Manager			
	Fault detect and input power loss			
	RS232 ASCII			
Options	Software for unattended computer shutdown	Contact Toshiba for details on this option		
	External battery pack	Contact Toshiba for details on this option		

(*) Output capacity reduced when input voltage is between -15% and -30% of nominal.

(**) Battery backup time may vary depending on the operating conditions including ambient temperature at the installation site.

(***) An initial charge time of 24 hrs. is necessary to obtain proper battery performance level before unit is used for battery backup.

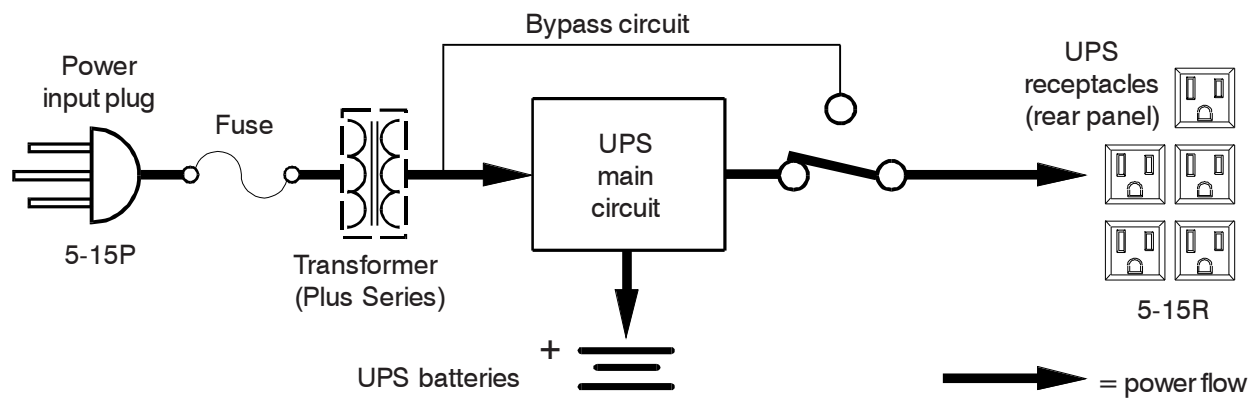
(****) Above 3000 ft (1000 m), output capacity reduced.

(*****) Output voltage and capacity derated for 50 Hz output.

5.0 Operating the UPS

5.1 Operation Modes

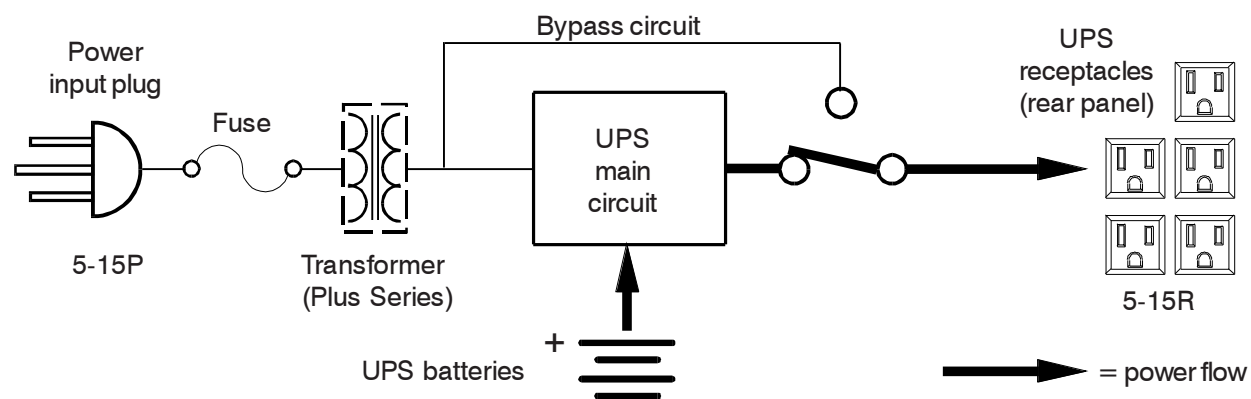
5.1.1 AC Input Mode (normal operation)



Power flow in AC input mode

The above illustration shows circuit power flow in the ac input mode. The UPS unit's rectifier, included in a boost chopper circuit, converts ac input power to dc power. This dc power runs the unit's transistor inverter and charges the batteries. The boost chopper circuit maintains a constant voltage, with current limiting, for charging the batteries and assures proper sine waveform generation for the output current. The unit's batteries are maintained in a constantly charged state when the UPS is in the normal operation mode. On the front panel, LED's labeled "On Line" and "AC Input" should be on and the "Fault" LED should be off (See Section 9.2 Panel Layout).

5.1.2 Battery Backup Mode



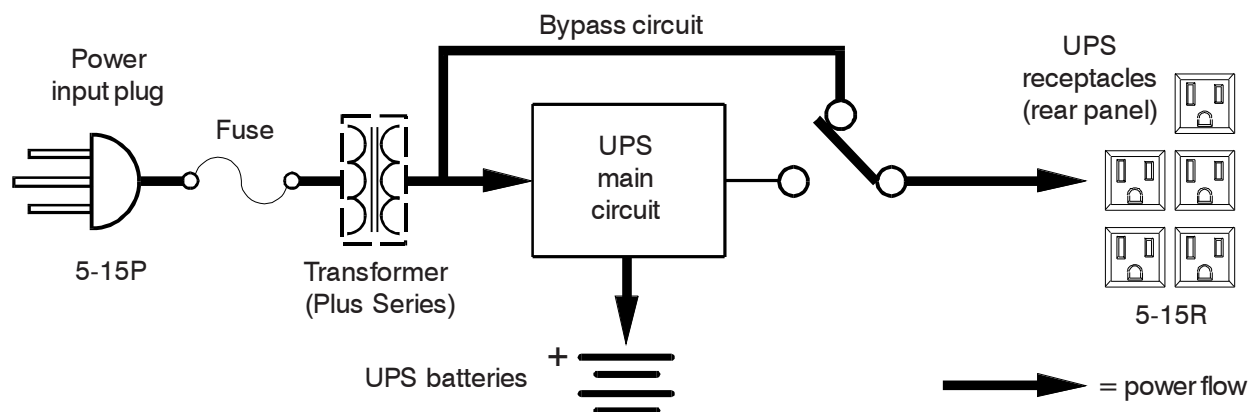
Power flow in battery backup mode

The above illustration shows circuit power flow in battery backup mode. When commercial ac power failures occur, the UPS's batteries instantly begin supplying dc voltage to the UPS's main inverter circuit. This circuit changes (inverts) the dc power into ac power. The ac power is available at the unit's output receptacles. This back-up process will continue until the UPS's battery voltage drops below a specific minimum level. When this occurs, the batteries will stop supplying power to the load. This minimum level is the rated minimum voltage (Vmin). The rated battery voltage chart in section 5.6 (See Section 5.7 for battery backup time) shows (Vmin). On the front panel, LED's labeled "AC Input" and "Fault" should be off. The "On Line" and "Backup" LED's should be on (See Section 9.2 Panel Layout).

5.0 Operating the UPS

5.1 Operation Modes

5.1.3 Circuit-bypass mode



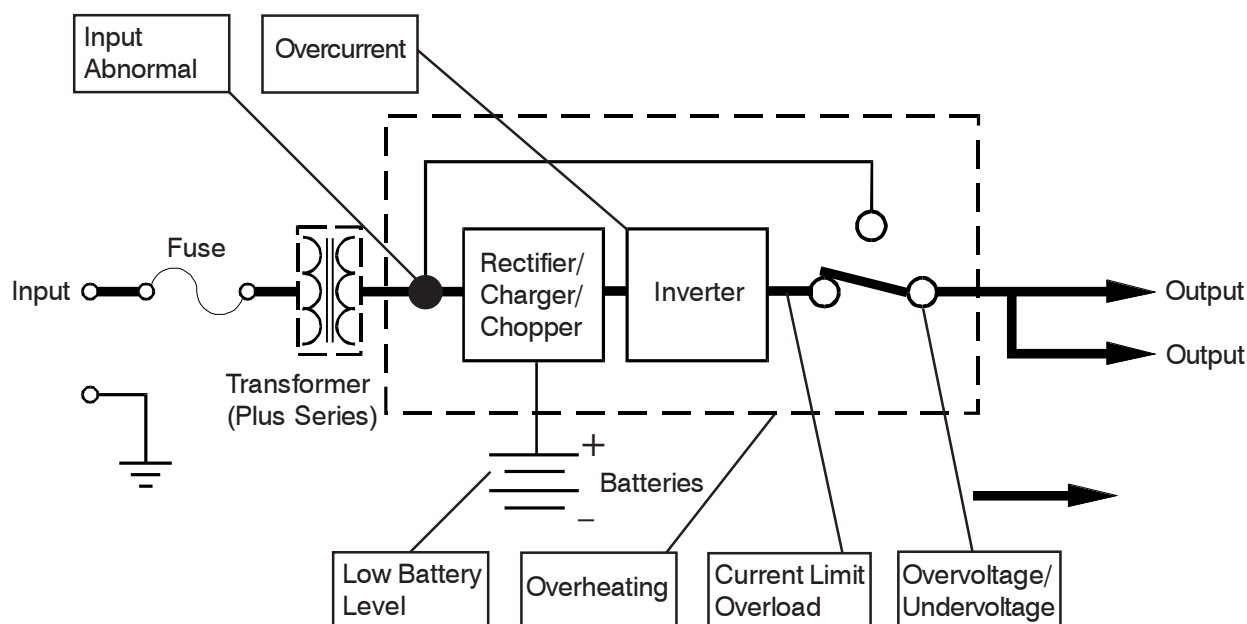
Power flow in circuit-bypass mode.

If the UPS unit is severely overloaded or develops an internal fault, the power flow is automatically switched from the unit's main circuit to the bypass circuit mode. Power flow through the bypass is shown in the above illustrations. This change-over occurs automatically in approximately 4 milliseconds. The switching period is not long enough to cause interruptions to occur in most UPS equipment loads.

The energy flow must be transferred manually from the UPS's bypass circuit back to the inverter circuit after first correcting the fault. Toggle the STOP/RUN switch (on the unit's front panel) first to STOP and then back to RUN. This procedure resets the UPS and transfers back to inverter. During circuit-bypass mode the AC-Input LED is ON, the On-Line LED is OFF, and the Fault LED may be ON or OFF. (See Section 9.2 Panel Layout).

5.2 System Protection Features

The schematic shown below depicts the electrical locations of the protection devices on the UPS.



5.0 Operating the UPS

5.3 Operation Monitoring

5.3.1 Visual Indicator Functions

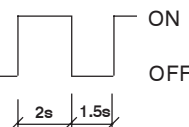
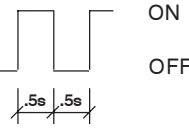
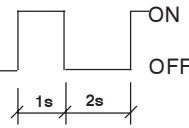
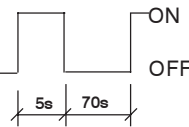
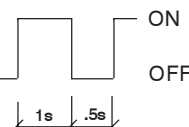
The following LED (light emitting diode) indicators are located on the front panel (see Section 9.2 "Panel Layout"). Refer to these lamps for visual information about the operating condition of the UPS (see Section 5.3.3 "Visual and Audible Indicator Function Chart").

- 1) **AC Input:** This green LED lights when normal ac input power is being supplied to the UPS unit.
- 2) **On Line:** This green LED lights when the inverter output voltage is normal.
- 3) **Fault:** This red LED lights when an abnormal operating condition is detected. Operation of the unit's inverter is inhibited until the fault has been corrected and the system reset (see Section 5.10 "System Reset").

5.3.2 Audible Alarm Functions

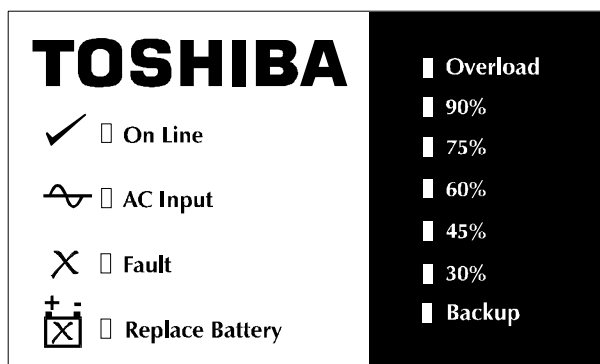
The UPS is equipped with an audible alarm system which activates under various operating conditions. Sound patterns are used to indicate these conditions (see Section 5.3.3 "Visual and Audible Indicator Function Chart"). Alarms for the battery backup mode or low battery voltage will stop automatically when AC input voltage is restored. Alarms for a fault condition will continue to sound until the UPS has been reset (see Section 5.10 "System Reset").

5.3.3 Visual and Audible Indicator Function Chart

Condition	Cause	Audible Alarm Pattern	Visual Indicators	UPS Operation
Overcurrent (OC)	Problem in chopper or inverter circuit.		1) "Fault" LED is ON 2) "On Line" LED is OFF 3) "AC Input" LED is ON	1) Auto transfer to bypass 2) Chopper stopped 3) Inverter stopped
DC Bus Overvoltage (DCOV)	DC Bus > 115% of rated.			
Output Overvoltage (OV)	V out > 110% of rated.			
Undervoltage (UV)	V out < 85% of rated.			
Overheat (OH)	Heatsink exceeds 90° C.			
Overload (OL)	Output current and overload specifications have been exceeded.		1) "Replace Battery" LED is ON	1) Bypass or On-Line mode.
Battery problem	Problem in battery circuit.			
Normal battery backup operation	Loss of AC power		1) "Fault" LED is OFF 2) "On Line" LED is ON 3) "AC Input" LED is OFF	1) Chopper running 2) Inverter running
Low battery voltage	Battery voltage too low, Shutdown imminent.			

5.0 Operating the UPS

5.4 Front Panel Layout



- On Line** ON LINE (green lamp)
 Lights **green** when the UPS's inverter is supplying power to the load.
- AC Input** AC INPUT (green lamp)
 Lights **green** when normal ac input power is being supplied to the UPS Unit.
- Fault** FAULT (red lamp)
 Lights **red** when the UPS unit has tripped in the fault mode.
- Replace Battery** REPLACE BATTERY (red lamp)
 Lights **red** to indicate batteries may need to be replaced.

5.5 UPS On-Line Mode Display

The following chart shows normal operating conditions when the UPS On-Line lamp is **green**.

Output	Display Status	Explanation	Output	Display Status	Explanation
Normal	Overload 90% 75% 60% 45% 30% Backup	When output current is between 30% and 100%, the green lamps light in 15% increments (from bottom to top) to indicate relative output value (This sample display shows output current at 45% to 60% of rated current).	Battery Backup	Overload 90% 75% 60% 45% 30% Backup	During battery backup all green lamps flash and the red Backup lamp is lit continuously. As the batteries discharge, the green lamps extinguish from top to bottom to indicate remaining battery capacity (This sample display shows battery voltage between 75% and 90% of battery capacity).
Overload	Overload 90% 75% 60% 45% 30% Backup	All the green lamps will light and the red Overload lamp will flash. If the load exceeds 135% of the max. rated output the red Overload lamp will light continuously. Remove overload as quickly as possible to prevent fault (fault timeouts vary depending on overload condition).	Low Battery During Battery Backup	Overload 90% 75% 60% 45% 30% Backup	All green lamps are off and the red Backup lamp is lit continuously or flashing.

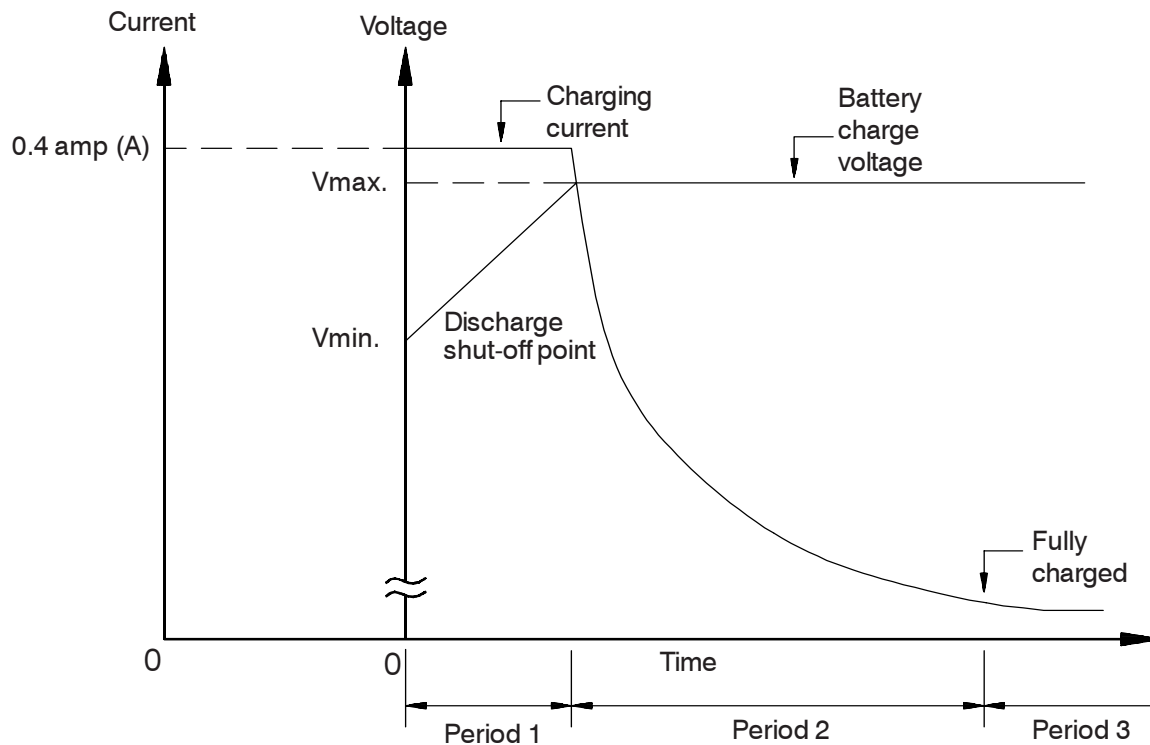
= Flashing LED

= Steady-lit LED

5.0 Operating the UPS (Cont'd)

5.6 Battery Recharging

The graph below shows the typical voltage requirements for recharging the UPS unit's batteries.



The recharge process usually consists of three periods. During the first period, the current is maintained at approximately 0.4 amperes. In the second period, the constant-voltage control starts and the current gradually decreases as the batteries continue to charge. In the third period, a slight current flows into the batteries to keep them fully charged. After a complete discharge, a full recharge usually requires 24 hours (90% recharge in 8 hours).

The chart depicted below shows the rated maximum and minimum battery voltages, and the charge current for each of the sizes.

Rated battery voltages

Model	$V_{max.}$	$V_{min.}$	Charge
600 VA / 600 VA Plus	68.2	48.0	0.4 (A)
800 VA / 800 VA Plus	68.2	48.0	0.4 (A)
1000 VA / 1000 VA Plus	68.2	48.0	0.4 (A)
1200 VA	68.2	48.0	0.4 (A)

5.0 Operating the UPS

5.7 Battery Backup Time

The UPS unit's batteries provide about 5-12 minutes of back-up time depending on the capacity of the UPS. These times are valid when a unit is operating under full load. When the units are operating at half load, the batteries can power the load equipment about 3 times longer. The exact length of these times will depend on the UPS model used, condition of the batteries, amount of load, temperature and other variables. See battery backup time in the standard specifications Sections 4.1 through 4.2.

5.8 Battery Low Voltage Tolerances

Excessive discharge will cause the UPS unit's battery voltage to drop. The chart shown below lists the voltage level at which each UPS unit's low-voltage alarm will sound and also at what level the low-voltage condition will cause the unit to automatically shut down.

UPS Capacity	600VA	800VA	1000VA	1200VA	600VA Plus	800VA Plus	1000VA Plus
Nominal voltage in Vdc	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Alarm voltage in Vdc	52.8	52.8	52.8	52.8	52.8	52.8	52.8
Shutdown voltage	48.0	48.0	48.0	48.0	48.0	48.0	48.0

5.9 Battery Check Function

Part of the UPS start-up procedure is an automatic 'Battery Check' to see if a problem exists in the battery circuit. When the UPS is started it will begin operation in the bypass mode. An automatic voltage level test of the batteries is made while operating in the bypass mode for five seconds. A failure of this first test will activate visual and audible alarms (see section 5.3.3 "battery problem"). If this test is passed, then the UPS will auto-transfer from bypass mode to on line operating mode. A ten second automatic voltage check of the batteries is made after the UPS has auto-transferred from bypass to on line mode. Normal on line operation continues if the second test is passed. If the second test fails, then the "Fault" LED will flash and up to three additional automatic battery voltage checks are made at 3 hour intervals while the inverter continues to operate. If the batteries are found to be normal during one of these three tests then the "Fault" LED will stop flashing and normal inverter operation will continue. A failure of the third and final check will activate visual and audible alarms (see section 5.3.3 "battery problem") causing an auto-transfer back to bypass. ***If the batteries are indicated "bad" then STOP the UPS and allow a 24 hour charge on the batteries before restarting.***

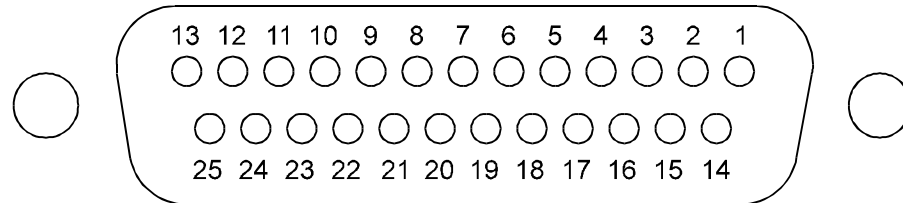
5.10 System Reset

The UPS is reset by moving the STOP/RUN switch from "run" to "stop" and then back to "run". Use the reset procedure to transfer from bypass back to inverter after a fault occurs. Some faults may only be cleared by shutting down the UPS, waiting for all LED's on the front panel to go off, and then restarting the UPS.

6.0 UPS Control Interface

6.1 DB25 Connector Pinout

RS-232C serial communication and Dry Contacts are both standard features available through a DB25 female connector located on the back panel of the UPS (see Section 9.1). The RS-232C serial communication interface allows control of the UPS from a personal computer running special Toshiba software. The computer is connected to the UPS through a serial RS-232C communication port. The Dry Contact interface is available as open or closed contacts. An adapter is available from Toshiba for splitting the RS-232C and Dry Contact interfaces into two separate DB9 connectors. Contact Toshiba for more information on this option. The following chart shows the pin assignments for the DB25 connector.



	Pin	Symbol	Description
RS-232C Serial Interface	1	0V	Supply used by Slide-In Options cards (-)
	2	+9V	Supply used by Slide-In Options cards (+)
	3	RXD_UPS	UPS receive line
	4	TXD_UPS	UPS transmit line
	5	TXD_AUX	Auxiliary transmit line
	6	RXD_AUX	Auxiliary receive line
	7		(not used)
	8	SNMPSIG1	SNMP option card function
	9	RS_Common	Common line for RS-232C communication
	10	SNMPSIG2	SNMP option card function
	11	DTR	UPS data terminal ready
	12	DSR	UPS data set ready
	13	RTS	UPS request to send
	14	CTS	UPS clear to send
Dry Contacts	15		(not used)
	16	Dry_Common	Common line for Dry Contact signals
	17	Backup_O	Open during Battery Backup
	18	Backup_C	Closed during Battery Backup
	19	Low_Battery	Closed during Low Battery
	20	Inverter	Closed during On-Line mode
	21	Bypass	Closed during Bypass mode
	22	Fault	Closed during Fault
	23		(not used)
	24	SD_Signal	Shutdown command signal line
	25	SD_Common	Shutdown command common line

6.0 UPS Control Interface

6.2 RS-232C Serial Communication Interface

The available data from the UPS, via RS-232C communication, is shown below:

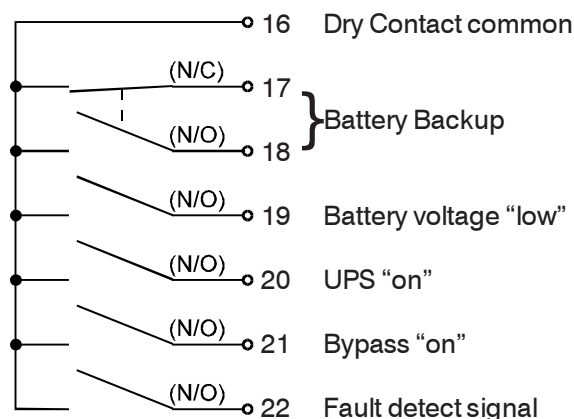
Operating conditions	Output voltage Output current Battery voltage Input frequency Output frequency
UPS operating status (described as 'yes' or 'no')	Utility power OK Low battery voltage detected UPS in BYPASS mode UPS in NORMAL mode Input and output frequency synchronized UPS 'fault' occurred
'Fault' details (described as 'occurred' or 'not occurred')	DC bus overcurrent DC bus overvoltage DC bus undervoltage Input overcurrent Overheat Overload being timed Overload (allowable time exceeded) Output overvoltage (during NORMAL mode) Output undervoltage (during NORMAL mode)

6.2.1 UPS Shutdown (via RS-232C)

When the UPS is operating from its internal batteries, a 'shutdown' order can be sent to the UPS telling it to turn OFF after a user-specified amount of time. This function can allow you to stop discharging the UPS batteries after an orderly system shutdown has been completed. The UPS can be programmed to turn OFF up to 8 minutes after the 'shutdown' command is given. This command can be cancelled before the specified time has elapsed.

6.3 Dry Contact Interface

The Dry Contact interface uses pins 16 through 22. Pins 24 and 25 are used for the shutdown function. The following schematic shows the contact state and pin assignments for each signal output along with the associated DB25 connector pinout.



Notes:

- 1) Pin "switches are shown in their **inactive states** (ex. if battery voltage is low then pin 19 will be connected to pin 16)
- 2) Contacts are rated as follows:
dc: 48V, 0.1A
ac: 30Vrms (42V-peak)
0.07A(0.1A-peak)

7.0 Troubleshooting Procedures

Faults are those abnormal conditions that can occur and cause the unit to shutdown normal operation. The faults are detected by the protection circuitry (see System Protection Features Section 5.2) in the unit. The UPS "Fault" lamp will light **red**. "Troubleshooting" involves monitoring the bar graph lamps on the front panel and then interpreting the readout by using the fault mode display charts.

7.1 Non-Fatal Fault Mode

Non-fatal faults may or may not cause the unit to shut down. These faults normally will cause the UPS to transfer to bypass mode. Use "System Restart" procedures (see Section 5.10) to transfer the UPS back to "On Line" mode. Use the following chart to decode the display. All non-fatal faults will cause the red "Fault" LED to flash.

Non-Fatal Fault Mode Display Chart

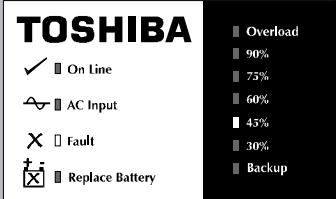
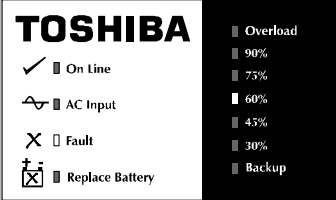
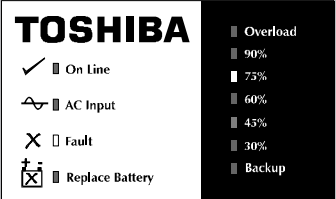
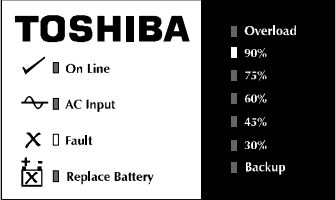
Fault	Display status	Probable cause	Corrective action
Output low voltage		Inverter fault or short circuit in UPS output	Remove cause of short circuit. If none is found, contact your Toshiba service representative.
Output overvoltage		Resonance with load equipment	Remove load equipment one piece at a time.
DC undervoltage		Chopper fault	Contact your Toshiba service representative.
Cooling fin overheating		Cooling fan outage or closed cooling airflow path	Check for airflow restriction. If none is found, contact your Toshiba service representative.
Battery problem		Battery damaged or something wrong in the battery circuit (battery may not be connected)	Contact your Toshiba service representative.
Output overload		Capacity of load equipment to high	Review UPS rating or reduce load equipment.

7.0 Troubleshooting Procedures


7.2 Fatal Fault Mode

Fatal faults may or may not cause the UPS to shutdown. Use "System Reset" procedures (see Section 5.10) to transfer UPS back to "On Line" mode. Use the following chart to decode the display. All fatal faults will cause the red "Fault" LED to light continuously.

Fatal Fault Mode Display Chart

Fault	Display status	Probable cause	Corrective action
DC overcurrent		Inverter fault	Contact your Toshiba service representative.
DC overvoltage		Chopper fault	
Input overcurrent		Chopper fault	
UPS system error		Trouble with the control PWB	

 = Flashing LED

 = Steady-lit LED

8.0 Preventive and Scheduled Maintenance/Parts Replacement

8.1 Preventive Maintenance

Toshiba's 1500 and 1500 Plus Series of uninterruptible power systems have been designed to provide years of trouble-free operation requiring a minimum of preventive maintenance.

The best preventive measure that the UPS user can take is to keep the area around the unit, particularly the air inlet vents, clean and free of moisture and dust accumulations. If the atmosphere of the installation site is very dusty, use a vacuum cleaner to periodically remove dust accumulations from the system. Schedule authorized service centers to perform internal parts inspections annually.



CAUTION

Before performing any maintenance, the technician should be familiar with and follow the important safety instructions located on pages vi and vii.



WARNING

Proper maintenance of the battery system of this unit by a qualified service technician is essential to the safety and reliability of your UPS system. Refer to service manual.

8.2 Parts Replacement

The following list shows intervals for periodic maintenance and replacement of certain UPS parts.

- 1) Batteries: VRLA batteries are maintenance free with respect to electrolyte only. The charging voltage, temperature, performance and connection resistance must be monitored periodically. Necessary corrective actions must be made in order to assure safe reliable power is supplied by the UPS. The aforementioned items affect the life of batteries, so replacement should be done once every 3 to 5 years at a minimum. All of the batteries must be replaced at the same time.

Quarterly maintenance

- a) Visual checks
 - 1) Leakage
 - 2) Corrosion on positive terminal
- b) Check battery temperature at the negative terminal.
- c) Measure and record the system float charging voltage.
- d) Measure and record the individual units float charging voltage.

Semi-Annual maintenance

- a) Repeat the quarterly checks.
 - b) Perform a 10 second high rate (e.g. 100 amp) load test on the individual batteries.
 - c) Optionally test for the purpose of trending the battery over time.
 - d) Re-torque all inter-battery connecting hardware (if applicable).
 - e) Perform inter-battery connector resistance checks.
- 2) Aluminum electrolytic capacitors: Replace once every 5 years.
 - 3) Fuses: Replace once every 7 years (see output fuse rating chart on the following page).
 - 4) Cooling fan: Replace once every 3 years.

8.0 Preventive and Scheduled Maintenance/Parts Replacement

8.3 Fuse Rating Chart

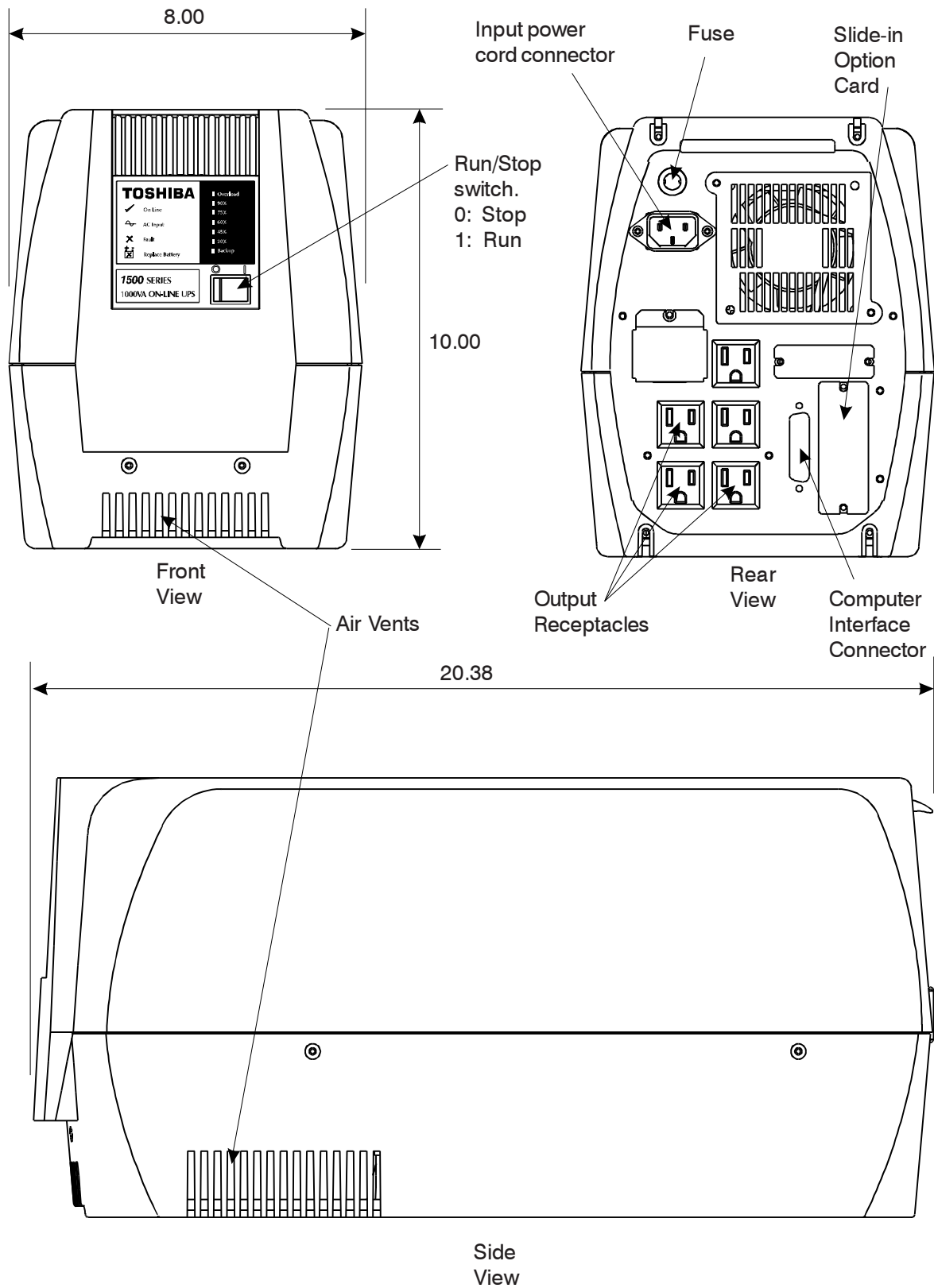
The following chart shows the recommended fuses for all UPS sizes.

Fuse rating

Model	Amp rating	Fuse model no.
600 VA	15.0A	LittleFuse 314015
800 VA	15.0A	LittleFuse 314015
1000 VA	15.0A	LittleFuse 314015
1200 VA	15.0A	LittleFuse 314015
600 VA Plus	15.0A	LittleFuse 314015
800 VA Plus	15.0A	LittleFuse 314015
1000 VA Plus	15.0A	LittleFuse 314015

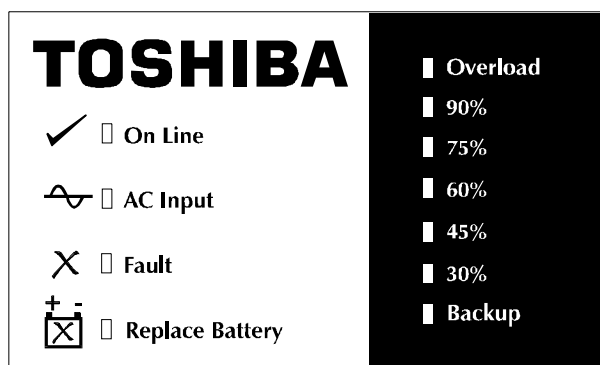
9.0 External Dimensions/Shipping Weights/Panel Layout

9.1 External Dimensions



9.0 External Dimensions/Shipping Weights/Panel Layout

9.2 Panel Layout



9.3 Shipping Weights

UPS Model	Shipping Weight	
	Pounds	Kilograms
600 VA	48.8	22.2
800 VA	48.8	22.2
1000 VA	52.2	23.7
1200 VA	52.2	23.7
600 VA Plus	66.0	30.0
800 VA Plus	66.0	30.0
1000 VA Plus	69.4	31.5

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