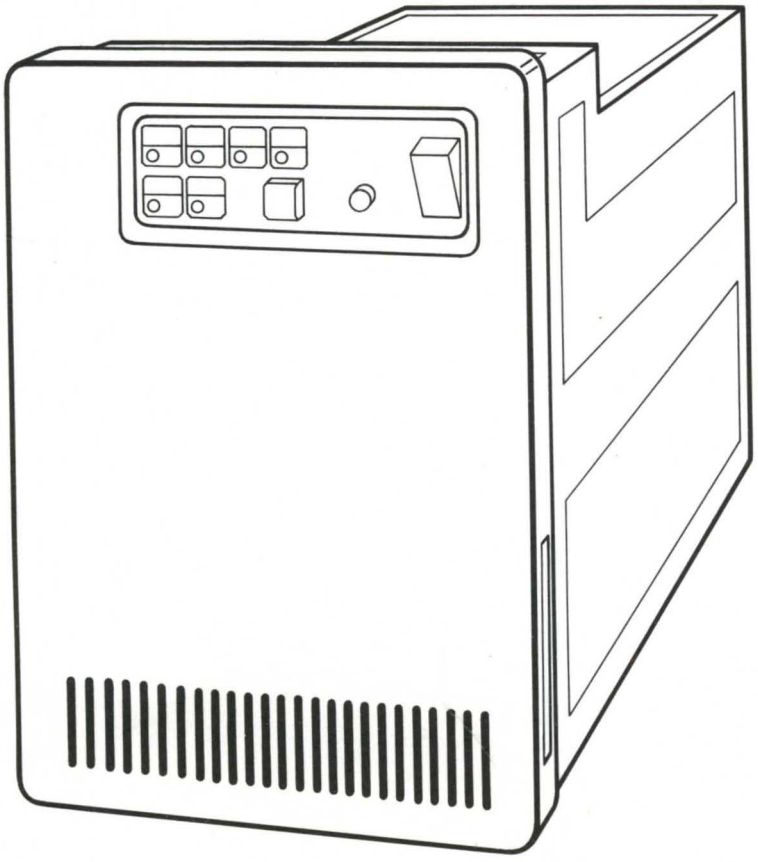
IBM

Series/1

GA34-0032-0

File No. S1-10

IBM Series/1
4999 Battery Backup Unit
Description



BATTERY BACKUP DESCRIPTION

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BATTERY BACKUP DESCRIPTION

First Edition (March 1977)

This manual contains information previously contained in the IBM 4955 and 4953 Processor and Processor Features Description manuals GA34-0021-0 and GA34-0022-0 respectively and obsoletes the Battery Backup Unit chapters in the referenced manuals.

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Preface

This publication describes the IBM Series/1 4999 Battery Backup Unit. The battery backup unit supplies and monitors ac utility power to the IBM Series/1 4955 or 4953 Processor units and, when the utility power is inadequate, it substitutes dc-to-ac inverted backup power from a customer-supplied battery. This backup power prevents the loss of main storage data during a utility power failure. The topics discussed include:

- Physical and functional descriptions
- Controls and indicators
- Customer battery, battery charger, and environmental requirements

This document is written primarily for IBM and customer service personnel, engineers, and technicians.

Related Publications

- *IBM Series/1 System Summary,* GA34-0035
- *IBM Series/1 4955 Processor and Processor Features Description,* GA34-0021
- *IBM Series/1 4953 Processor and Processor Features Description,* GA34-0022
- *IBM Series/1 Installation Manual–Physical Planning,* GA34-0029
- *IBM Series/1 Operator's Guide,* GA34-0039

Chapter 1. Introduction

The IBM Series/1 4999 Battery Backup Unit (Figure 1-1) supplies and monitors ac utility power to the IBM Series/1 4955 or 4953 Processor units and, when the utility power is inadequate, it substitutes dc-to-ac inverted backup power from a customer-supplied battery. This backup power prevents the loss of main storage data during a utility power failure. The IBM Series/1 4999 Battery Backup Unit will be referred to as the "4999" in the remainder of this document.

Two models of the 4999 are available:

Model 1–50/60 Hz utility power with a nominal voltage between 100V and 127V RMS
Model 2–50/60 Hz utility power with a nominal voltage between 200V and 240V RMS

Both models mount in one-half width of a 483 mm (19 in.) wide by 356 mm (14 in.) high rack position in the IBM 4997 Rack Enclosure. The mounting requires a rack mounting fixture.

The battery and battery charger are supplied by the customer to meet the specific requirements of his application.

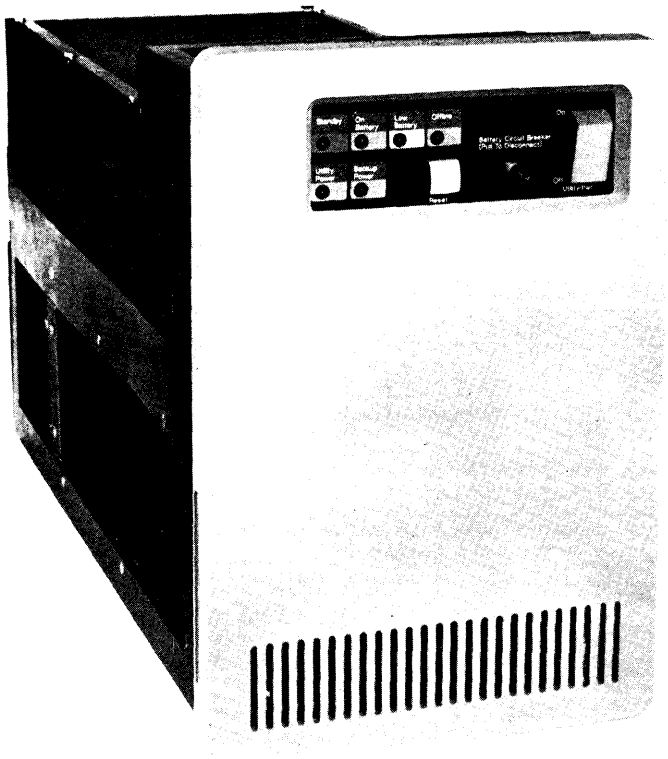


Figure 1-1. IBM 4999 battery backup unit

General Description

The 4999 can power only one processor and its associated cooling fans and is not designed to back up an I/O expansion unit or any I/O devices. However, the 4999 can support a processor containing any combination of the following:

- 125W or 300W power supply
- Up to 128K bytes of storage
- A full complement of I/O feature cards

During normal operation, the 4999 supplies ac utility power directly to the processor (Figure 1-2). If the ac utility power dips below approximately 80 volts (160 volts for Model 2) or is lost completely, the 4999 dc-to-ac inverter is activated and the transfer circuitry supplies square-wave ac power to the processor. If the ac utility power returns before the battery capacity has been exceeded, the 4999 switches the processor back to the ac utility power source. If the battery capacity is depleted, the 4999 will switch the processor back to the ac utility power source (whether the voltage has returned or not) and enter an offline condition (the Offline indicator lights). Refer to "Chapter 2. Functional Description" for a more detailed description of the functions performed by the 4999.

An ac failure produces a class interrupt in the processor causing PSW bit 15 to remain on as long as power is supplied by the battery.

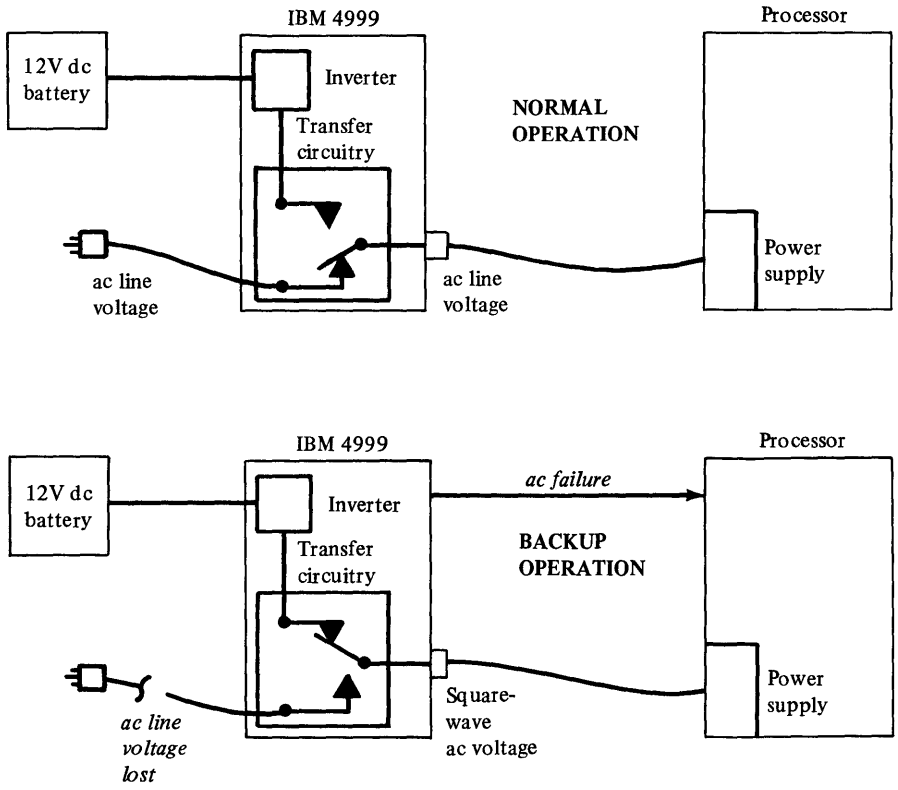


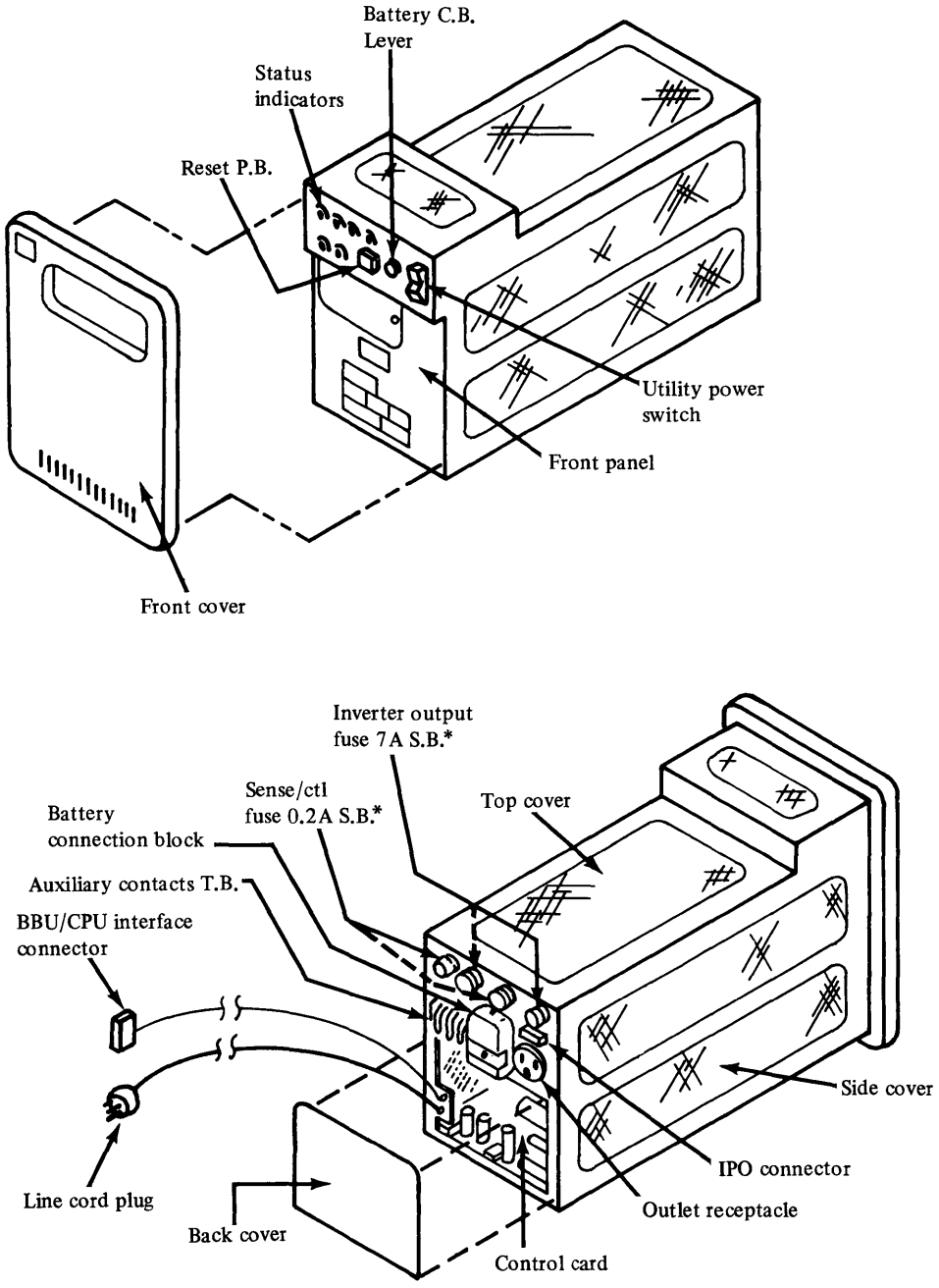
Figure 1-2. IBM 4999 operation

Physical Description

The following are the physical specifications of the 4999:

Depth	508 mm (20 in.) plus 38 mm (1.5 in.) for battery connection block
Width	216 mm (8.5 in.)
Height	356 mm (14.0 in.)
Weight	31.98 kg (70.5 lb)

The 4999 is mounted via an adapter into one-half width of a standard Electronic Industry Association RS-310B (19 inch) rack. The controls and indicators are located on the front console and the fuses are accessible on the rear panel, on the inverter card through the front panel, and on a frame cross member through the top cover. Figure 1-3 shows the locations of the external components.



* For Model 2, sense/ctl uses two 0.1 A S.B. fuses; and inverter output uses two 4A 250V fuses.

Figure 1-3. Physical details

Customer Requirements

Battery and Battery Charger

The customer-supplied battery should be a sealed lead-acid or nickel-cadmium type designed for use near electronic equipment. The battery should have a capacity of 40-ampere hours minimum at a one-hour discharge rate. A 12-volt dc lead-acid, sealed-cell automotive battery rated at 100 ampere hour minimum is recommended. A battery of this type can power the 4999 from 20 to 60 minutes (depending on load, temperature, condition of battery, etc.).

The battery charger has to be selected to fit the customer's application. Obviously, it should be capable of maintaining the battery at a sufficient level to support the processor as needed. Normally, a 30-hour recharge rate is sufficient, but if utility power experiences more interruptions than normal, a charger with a 10-hour rate may be required. The charger should have a 3-conductor cord and be Underwriter's Laboratory (U.L.) approved.

A charger which operates from 100–127 Vac may be used for a 4999 Model 2.

Environment and Battery Wiring

Environmental and battery wiring requirements are detailed in *IBM Series/1 Installation Manual–Physical Planning,* GA34-0029. Detailed installation instructions are shipped with the 4999.

Instant Power Off (IPO) Interlock

A mating cable is provided with the 4999 to connect it from the 3-position IPO connector (Figure 1-3) to the IBM 4997 Rack Enclosure utility power assembly. This cabling provides IPO capability. If the 4999 is not installed in an IBM 4997 rack, provisions for IPO must be made. This can be accomplished by the customer integrating the cable into his IPO system by connecting it to a single set of 1-ampere, 16-volt dc non-inductive contacts which open when IPO is invoked.

Detailed IPO installation instructions are shipped with the 4999.

Chapter 2. Functional Description

Description

To provide backup should a line-voltage dip or loss occur, the 4999 must perform ac and dc voltage sensing and switching. These functions are described briefly in the following sections. The function blocks shown in Figure 2-1 are number keyed to the descriptions.

AC Power

AC power 1 is supplied to the 4999 and the processor power supply when (1) the Utility Power On/Off switch is On, (2) the IPO interlock is closed, and (3) the Reset button is pressed. With these conditions met, the Utility Power indicator lights.

Once the processor power supply is energized, a processor-on signal 2 is sent back to the 4999.

DC Power

When the 70-ampere circuit breaker is closed, battery power is available at the inverter 3 for backup when needed.

Line Voltage Sensing

The 4999 monitors ac line voltage for any drops below a set point of 80 volts ± 0.5 volts (160 volts ± 1 volt for Model 2) 4 . If a drop of this magnitude occurs, the 4999 disconnects ac line voltage and switches the processor to dc-to-ac inverted backup power. The energy stored in the processor power supply is sufficient to carry the processor while the 4999 is switching it to backup power. The processor will remain on battery backup power for at least one-half second.

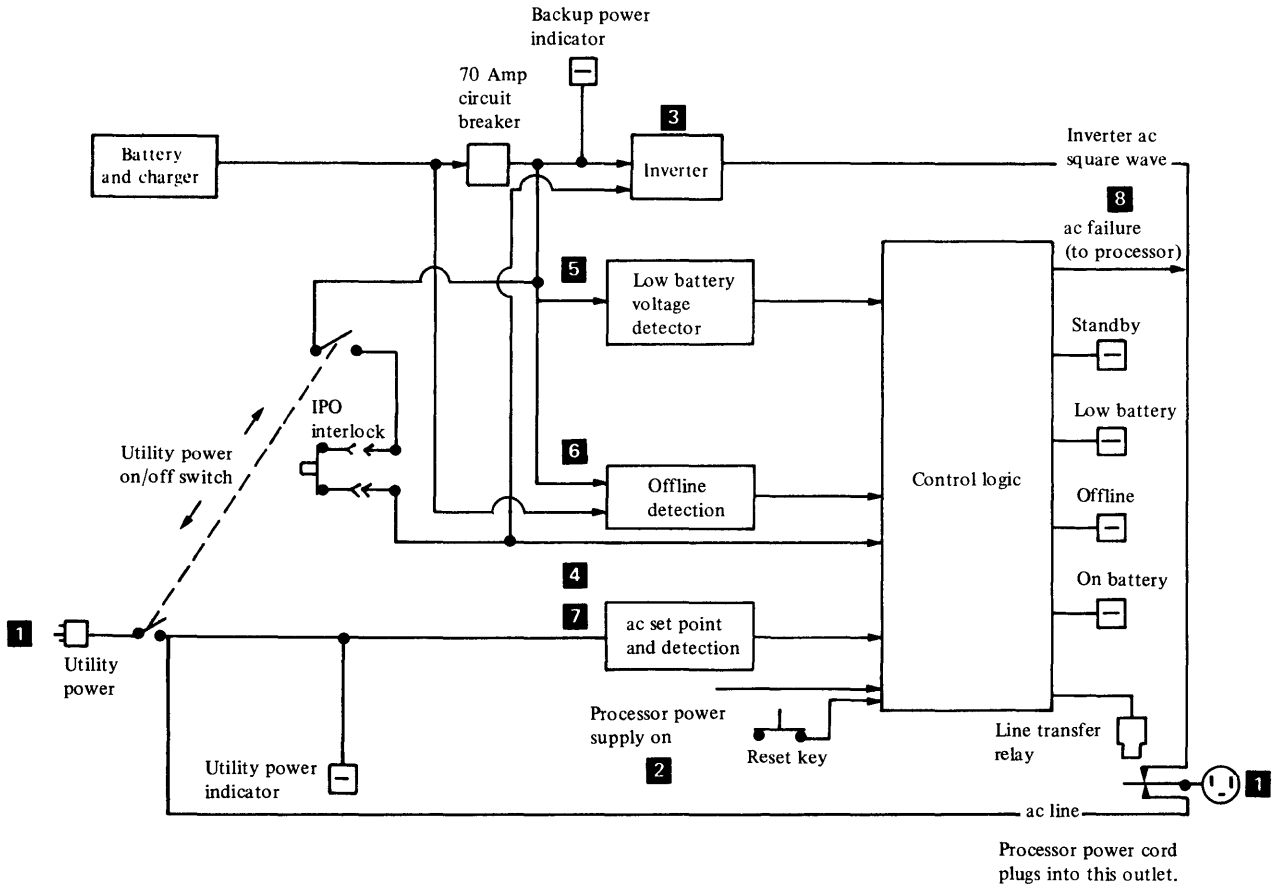


Figure 2-1. IBM 4999 block diagram

Battery Voltage Sensing

The 4999 continuously monitors the battery voltage 5 and if it drops below 11.2 volts ± 1.8%, the Low Battery indicator lights. If a battery voltage drop to 10.8 volts ± 1% is detected 6, the Offline indicator lights. If the 4999 is supplying dc-to-ac inverted backup power to the processor when the Offline indicator lights, the processor is returned to the utility ac line. This reversion to the utility ac line power occurs whether the line voltage has returned or not. If the utility ac line voltage has not returned, the processor automatically initiates a shutdown sequence.

After an Offline indication, the 4999 cannot switch the processor to backup power until the battery has recovered to 12.5 volts +3%, −2% and the Reset button has been pushed.

On–Battery Mode

The 4999 is in the on-battery mode while it is supplying backup power to the processor. This mode is indicated when the On-Battery indicator is lit.

While in the on-battery mode, the 4999 monitors the battery and ac line voltages. If the battery power dissipates to a low enough level, the Offline indicator lights as detailed in the previous section.

When the 4999 senses that the utility ac line voltage has returned to 87.5 volts +0, −2.5 volts (175 volts +0, −5 volts for Model 2) 7, it switches the processor back to ac line power.

While the 4999 is in the on-battery mode, it continuously sends an ac failure signal 8 to the processor to maintain an "ac warning" condition. This signal produces a class interrupt in the processor by causing PSW bit 15 to remain on as long as the power is being supplied by the battery.

Auxiliary Transfer Contacts

A single-pole double-throw relay contact set that is synchronous with the transfer circuitry shown in Figure 2-1 is available for the customer's use. The relay contacts are wired to the screw-type terminal block at the rear of the unit. The relay contacts are rated for a 5 ampere, 24 volt dc non-inductive load. The terminal board positions are:

Terminal 1: Normally closed
Terminal 2: Common (movable)
Terminal 3: Normally open

The relay contacts transfer, in either direction, within 15 milliseconds of the transition of the ac failure signal.

Controls and Indicators

The controls and indicators shown in Figure 2-2 are located on the front panel (console).

Utility Power On/Off Switch

In the On position, this rocker switch applies ac power to the 4999, the processor receptacle, and the Utility Power indicator. When in the Off position, it removes all ac power from the 4999, turning off the Utility Power indicator.

Battery Circuit Breaker

The 70-ampere Battery Circuit Breaker protects the processor by automatically removing the battery power if excessive current is drawn.

When the circuit breaker is pushed in, battery power is applied to the inverter, detection, and control circuitry and the Battery Power indicator is lit. When pulled out to the disconnect position, all battery power is removed and the Battery Power indicator goes off.

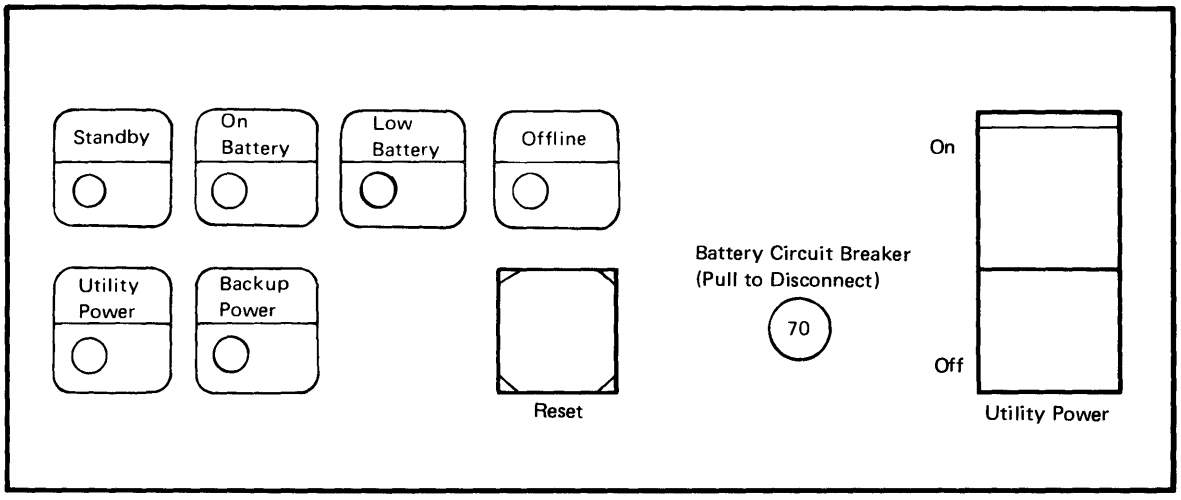


Figure 2-2. Controls and indicators

Reset Pushbutton

The Reset switch, a momentary pushbutton, resets the 4999 control logic to the Standby mode after ac power is turned on during initial startings or after the battery has recovered from an offline condition (see "Offline Indicator" in this section).

Utility Power Indicator

The Utility Power indicator lights when the Utility Power switch is placed in the On position and ac line voltage is available to the 4999.

Backup Power Indicator

The Backup Power indicator lights when the Battery Circuit Breaker is pushed in and battery power is available.

Standby Indicator

The Standby indicator lights when the following conditions are satisfied:

- The Utility Power switch is On.
- The processor power supply is On.
- The ac line voltage is at least 80 volts ± 0.5 volts (160 volts ± 1 volt for Model 2).
- The battery voltage has not dropped below 10.8 volts ± 1% causing an offline condition.

On–Battery Indicator

The On-Battery indicator lights when battery power is being supplied to the processor via the dc-to-ac inverter. This on-battery mode occurs within 15 milliseconds of a low-voltage detection and lasts for at least 0.5 second. The on-battery mode is exited when the line voltage reaches 87.5 volts +0.0, −2.5 volts, (175 volts +0.0, −5 volts for Model 2) provided no offline condition has occurred (see "Low Battery and Offline Indicators").

Low Battery Indicator

During the on-battery mode, both the ac line and battery voltages are monitored. If the battery drops below 11.2 volts ± 1.8%, the Low Battery indicator lights. The indicator remains lit until the battery has recovered to 12.5 volts +2%, −3%. If the battery voltage drops to below 10.8 volts ± 1% and adequate ac voltage is not available, the 4999 automatically enters an offline mode.

Offline Indicator

The Offline indicator lights when the battery voltage drops below 10.8 volts ± 1%. If the battery voltage drop occurs while the 4999 is in the on-battery mode, the processor is switched to ac line power. If adequate ac power is not available, the processor automatically powers down.

If the battery voltage drop occurs while the 4999 is in the standby mode, the processor remains on ac line power. If this ac power is lost, the processor is powered down.

The Offline indicator remains lit until:

1. The battery voltage has recovered to 12 volts +3%,−2%.
2. The Reset pushbutton is pressed.

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