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4500 POWER SUBSYSTEM MAINTENANCE

1. INTRODUCTION

This publication provides preventive maintenance, adjustment, troubleshooting, and repair information for the Central System Unit and Expansion Cabinet power subsystems in Honeywell's Total Distributed Control 4500 process computer systems. The power subsystem consists of AC Power Entry, a Basic Power Module, an optional Auxiliary Power Module, and an optional Memory Battery Power Pack. Expansion cabinets usually contain a power entry module and one or two types of power supplies. The power modules contain vendor supplied dc power supply modules which are not covered in this publication. Refer to the appropriate manuals supplied by the vendors for these power supply modules.

2. PRECAUTIONS

The ac distribution system, including the cabinet power entry panels, circuit breakers, blowers, and power supply input terminals have 115 Vac present and can present an electrical shock hazard. Protective covers are provided on the terminals which carry ac power and warning labels are attached nearby. The protective covers should be removed only by qualified personnel and care should be taken when the covers are removed to avoid contact with the conductors. Observe the warning labels. The blower fan blades can also be a hazard if the protective grills are removed while the blowers are running. Refer to the General Information section of the Computer Maintenance manual for general information on safety.

All adjustments and/or repairs made to the Basic Power Module, Auxiliary Power Module and Memory Battery Power Pack must be performed: (1) after the unit(s) is (are) removed from the CPU cabinet and placed on a suitable workbench and (2) dummy loads must be used on the outputs of the unit. Observe all caution and warning labels.

Do not short out the battery in the Memory Battery Power Pack as this could cause the battery to explode.

3. OPTIONS

3.1 Auxiliary Power Module

The Auxiliary Power Module is located at the bottom of the CPU on the 19 inch rack, and is used to supply the dc power required by the optional Input/Output chassis. This power module is virtually identical to the Basic Power Module with the exception that it does not contain the monitoring and control logic of the Basic Power Module. The Auxiliary Power Module produces +28, -15, +15, and +5 Vdc power for the additional I/O chassis.

3.2 Memory Battery Power Pack

The Memory Battery Power Pack is located at the top of the CSU and is used to supply dc power to the memory, both in the CPU and the Memory Expansion unit, during a power failure. This unit will supply power for a minimum of 15 minutes to the memory so that the loss of memory contents is avoided.

3.3 Expansion Cabinet Power Supplies

Expansion Cabinets may contain the basic and/or Auxiliary CPU power modules described above. They may also contain Basic and Auxiliary Video power supplies. Video power supplies are nearly identical to the two CPU supplies but provide \pm 12 Volt power in addition to the standard voltages.

4. REFERENCES

4.1 Site Planning Manual

The 4500 Site Planning Manual, PTH-020, describes the recommended method for connecting ac power to the cabinets, recommends the appropriate system grounding practices, and lists the input power required by the standard subsystems and devices.

4.2 Theory of Operation

Publication ACPUIPS-T describes the theory of operation of the 4500 power subsystem and all of its options. The theory of operation for the dc power supply modules is provided in the manuals supplied by the vendors of those modules. Where very little theory information is provided in a vendor's manual, it is because field repair of the module is not intended. The vendor manuals are normally included in the same section of the Computer Maintenance manual as this publication. Where a large number of such manuals are required to cover all power supplies in the system, it is sometimes necessary to place them in separate binders, which are marked to indicate their contents.

4.3 Schematics and Logic Drawings

The CSU power subsystem's ac/dc distribution subsystem logic drawing number is 51300824. That drawing is used with logic drawing 51301587 to describe the expansion cabinet video power supplies. Honeywell drawing 51301768 illustrates methods of sequencing and grounding.

5. COMPONENT LOCATIONS

Component locations for the principal CPU power subsystem components are shown in Fig. 1. Power subsystem components along with power connections are illustrated on sheets 2 and 3 of the logic drawing.

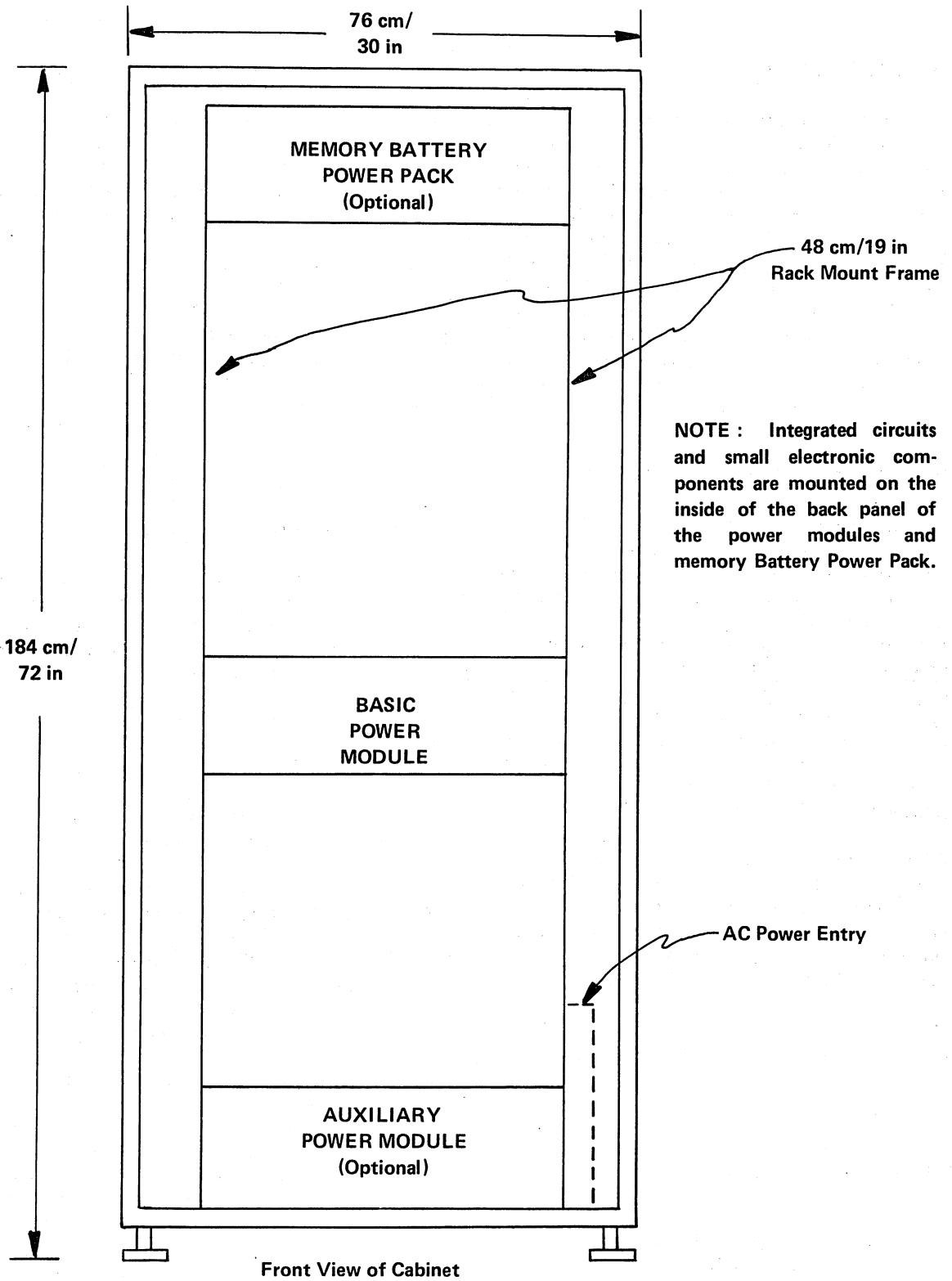


Fig. 1 CSU Cabinet Power Component Locations

6. TEST EQUIPMENT AND MATERIALS

Two test equipment items are mandatory for power subsystem maintenance: An oscilloscope and a precision voltmeter. The oscilloscope should have dual traces, and a dc to 10 MHz vertical amplifier bandpass. The precision dc voltmeter must be capable of measuring voltages from 100 mV to 30 V. A suitable oscilloscope is a Tektronix 465 or 475 with two P6011 probes. A suitable precision voltmeter is Precision Standards DC200C.

In addition, a multimeter, such as a Simpson 260 or Triplett 630 and a collection of jumper wires and test leads will be useful.

A variac is required for performing adjustment procedure 10.2.2. This adjustment will not normally be required in the field unless a component is replaced within its circuit. The variac should have a voltage range of 0 to 130 Vac and an output of approximately 100 VA.

7. PREVENTIVE MAINTENANCE

The following preventive maintenance schedule is provided for guidance. It may be modified locally, by authorized personnel, according to local experience and conditions. If the power subsystem appears to be operating normally, unnecessary testing and adjustments should be avoided, as more troubles may be introduced than prevented.

Each six months or 2500 hours:

10.1 AC and DC Voltage Checks and Adjustments

Each year or 5000 hours:

10.2 Power Fail Detection Checks and Adjustments

10.3 Charge Rate Float Check and Adjustment (if Memory Battery Power Pack is implemented)

10.4 MBPP Output Voltage Adjustment (if Memory Battery Power Pack is implemented)

8. PERFORMANCE TESTS

8.1 Individual Module Test

Apply power to the modules and verify that their output voltages are within tolerances as specified in Table 1. If any voltage is out of tolerance, perform the appropriate adjustments per section 10.

8.2 Power Subsystem Test

Verify that the following functions occur during power up of the subsystem:

- Cooling fans start running and the MBPP's PWR ON indicator illuminates when the main circuit breaker (AC Power Entry CB-1) is turned ON.

- Sequenced ac power is enabled by the energization of AC Power Entry relay K1 when the Console ON/OFF switch is turned ON. Observe that the PWR ON indicators on the Basic Power Module and Auxiliary Power Module are illuminated. Also, note that the Console REGISTER display is displaying something (undefined on power up) and that the CS register indicator is illuminated.
- Verify that other associated cabinet power subsystems are sequenced on. Expansion cabinet power may or may not be sequenced.

9. ASSEMBLY AND DISASSEMBLY

All components of the power subsystem are mounted and fastened with ordinary hardware and require no special assembly or disassembly procedures. The dc power supplies are not normally repaired in the field and are, therefore, not normally disassembled in the field.

10. ADJUSTMENTS

NOTE

It is not intended that power supplies be adjusted in the field. However, when the situation dictates it, the following procedure should be followed.

All adjustments to the power subsystem require the removal of the unit (module) to be adjusted from the CPU cabinet and dummy loads must be connected on the units outputs prior to adjustment. Use dummy loads as specified in Table 1 or their equivalent.

10.1 AC and DC Voltage Checks and Adjustments

If this check is being made as a part of a system installation, the ac voltage to be supplied to the system should be checked before the main circuit breaker on the power entry module is closed. The voltage must also be checked after the circuit breaker is closed and power is applied to the unit.

CAUTION

Protect yourself and others from electrical shock when the protective covers are removed from any conductors carrying 115 Vac. Replace the covers as soon as the measurements are finished. Many of the smaller dc power supplies have the ac input on the same terminal board as the dc output. Determine the output pins carefully to protect yourself and the voltmeter.

1. Remove the protective cover from the ac power entry module in the cabinet and measure the ac voltage.

When checking with the circuit breaker open, measure between the black and white wires on the input side of the circuit breaker. The breaker is connected in series with the ac high line, which typically consists of a black wire. Neutral is typically white, and green is the safety ground. The safety ground should not be carrying current. The voltage with the circuit breaker open and closed should measure between 104 Vac and 127 Vac.

2. At the CPU Programming and Maintenance Console, enable the console panel security switch and place the PWB ON/OFF switch in the ON position to turn-on sequenced ac power. If several console indicators are on, sequenced ac power is on.
3. Use an accurate dc voltmeter to measure the dc output of each of the dc power supplies. See sheets 2 and 3 of the 51300824 logic drawing for voltage output locations on the backpanel. Fig. 2 shows the locations of output terminals and adjustments inside the power module (front cover removed). Table 1 lists most of the outputs and their tolerances. If any dc outputs are out of the tolerance range, or obviously misadjusted, readjust them to as near the exact nominal voltage as possible. Note that voltage adjustments require the removal of the power module from the cabinet and removal of the front and top covers. The adjustments then are accessible through holes in the power supply cases which are marked to indicate that they are the output voltage adjustments. The voltages should be recorded so that they can be compared the next time this check is made to see if any supply is deteriorating.

Virtually all of the dc power supplies used on systems contain built-in or built-on overvoltage crowbars which short the output if the voltage rises more than 10% to 20% above the nominal voltage. The trip points for these crowbars are adjustable, but they are considered factory adjustments and are not normally adjusted in the field. Typically, when a crowbar fires, the power supply's current limiter holds the output current to a safe level. If the cause of the trip clears, and the ac input is removed for one or two seconds, normal operation can resume.

10.2 Power Failure Detection Adjustments

The following adjustments are made in the factory and normally will not require adjustment in the field. Component replacement in the detection circuits may make it necessary to perform these adjustments. These procedures apply to all "Basic-type" power supplies in the CPU or expansion cabinets.

10.2.1 Power Interruption Adjustment

1. Power unit down. Remove clip, in Basic Power Module backpanel PWB, from TC4 - OPERATE and place clip in TEST - OPERATE position.
2. Connect dual-trace scope to test points TP1 and TP2. This will show a trigger on one trace and the timer output pulse on the other trace.
3. Apply power to the unit and adjust R28 for a 34 ms timer output pulse width. Remove and reapply power several times as needed.
4. Remove power from the unit and relocate the clip to its original position, TC4 - OPERATE.

10.3 Battery Charge Float Adjustment

NOTE

This adjustment requires that the battery be fully charged.

1. Connect the voltmeter between TP1 (Battery Sense) and TP10 (DC Common).
2. With the unit operating, adjust R12 for a 20.3 Vdc reading.
3. Disconnect the voltmeter and return the unit to normal operation.

TEST POINT	ADJUSTMENT	VOLTAGE	DUMMY LOAD
<u>Basic Power Module</u>			
+ 5 Vdc Output Lug	PS-1 (As Indicated)	+ 5.05 Vdc +9 mV -0 mV	0.25 Ω \pm 10%, 100 W
+15 Vdc Output Lug	PS-1 (As Indicated)	+15.00 Vdc \pm 100 mV	4.7 Ω \pm 10%, 100 W
-15 Vdc Output Lug	PS-1 (As Indicated)	-15.00 Vdc \pm 100 mV	10 Ω \pm 10%, 50 W
+28 Vdc Output Lug	PS-1 (As Indicated)	+28.00 Vdc \pm 250 mV	22 Ω \pm 10%, 50 W
+12 Vdc Output Lug	CPU Supply Not Adjustable	+12.00 Vdc \pm 0.6 V	
+12 Vdc Output Lug	R3 On Video Supply	+12.00 Vdc \pm 1%	
-12 Vdc Output Lug	R5 On Video Supply	-12.00 Vdc \pm 1%	
TP9	Not Adjustable	+ 5.00 Vdc \pm 3%	
TP6	Not Adjustable	+ 2.50 Vdc \pm 3%	
TP5	Not Adjustable	+ 5.10 Vdc \pm 3%	
TP4 (120 Hz Half Wave)	Not Adjustable	+ 8.9 V peak \pm 10%	
<u>Auxiliary Power Module</u>			
+ 5 Vdc Output Lug	PS-1 (As Indicated)	+ 5.05 Vdc +9 mV -0 mV	0.25 Ω \pm 10%, 100 W
+15 Vdc Output Lug	PS-1 (As Indicated)	+15.00 Vdc \pm 100 mV	4.7 Ω \pm 10%, 100 W
+12 Vdc Output Lug	R3 (Video Supply Only)	+12.00 Vdc \pm 1%	
-12 Vdc Output Lug	R5 (Video Supply Only)	-12.00 Vdc \pm 1%	
-15 Vdc Output Lug	PS-1 (As Indicated)	-15.00 Vdc \pm 100 mV	10 Ω \pm 10%, 50 W
+28 Vdc Output Lug	PS-1 (As Indicated)	+28.00 Vdc \pm 250 mV	22 Ω \pm 10%, 50 W
<u>Memory Battery Power Pack</u>			
+ 5 Vdc Output Lug	PS-2 (R9)	+ 5.00 Vdc \pm 3%	2.2 Ω \pm 10%, 25 W
+12 Vdc Output Lug	PS-3 (R9)	+12.00 Vdc \pm 3%	10 Ω \pm 10%, 25 W
TP2	Not Adjustable	24 Vac RMS \pm 10%	

Table 1 Output Voltages

10.4 MBPP Output Voltage Adjustment

NOTE

The adjustments are R9 on each of the Dc-to-Dc Converters, PS2 (+5 V) and PS3 (+12 V). With the cover removed from the MBPP Unit, R9 on each converter module is accessible through a slot near the "+OUT" terminal. Check the output voltages before removing the MBPP Unit from the CSU. Remove the unit and readjust R9 only if the voltages are not within the tolerances indicated in steps 1 and 2 below.

1. Measure the +5 Vdc output between the "+5B" terminal on the MBPP backpanel and "GND". It should be between 4.85 V and 5.15 V. If it is not, go to step 3 after checking step 2.
2. Measure the +12 Vdc output between the "12" terminal on the MBPP backpanel and "GND". It should measure between 11.6 V and 12.4 V. If it is not, go to step 3. If the +12 V and +5 V outputs are within tolerance, this procedure is complete.
3. Remove the MBPP and set it up on a test bench with dummy loads connected between the outputs and "GND", as indicated on Table 1. Connect the ac input plug to a 115 Vac, 50 Hz or 60 Hz source. Turn the OPERATE/OFF switch to OPERATE.
4. Readjust R9 on either converter, PS2 or PS3, as appropriate to set the output to as near the nominal output (+5 Vdc or +12 Vdc) as possible. Remove the ac input and the dummy loads, replace the top cover, and reinstall in the CSU. Check that the OFF switch is in the OPERATE position.

11. TROUBLESHOOTING

Some of the regulated dc power supplies used in the TDC 4500 process computer system are purchased by PMSD/Phoenix from outside vendors. These should be replaced, rather than repaired in the field. The vendor supplied power supplies have lethal voltages present within them. Special training and equipment are required for the repair of these power supplies. All of these supplies are covered by warranties and will be repaired or replaced by the manufacturer at no charge during the warranty period.

The turn-on procedure under 11.1 provides a check that should correct improper positioning of various controls, which might prevent a successful power-on sequence. The remaining paragraphs under this heading provide some suggestions for finding and correcting power subsystem faults.

11.1 Power-Up Procedure

1. Verify that all power cabling is connected properly.
2. Set the following switches as specified:
 - a. Basic Power Module - OPERATE/OFF switch to OPERATE.
 - b. Auxiliary Power Module (if implemented) - OPERATE/OFF switch to OPERATE.
 - c. Memory Battery Power Pack (if implemented) - OPERATE/OFF switch to OPERATE.
 - d. CPU ac Entry - circuit breaker CB1 to ON.
3. Check that all blowers are operating with air flowing in the proper direction and that non-sequenced ac power is available at duplex outlet J5.
4. Switch the Programming and Maintenance Console's Panel Security switch to its enable position. This places the system in manual mode.
5. Place the Console's Power ON/OFF switch in the ON position; sequenced power should come on. Various console indicators will illuminate when sequenced power comes on. If sequenced power fails to come on or stay on, refer to 11.2 Power-Up Failure.

11.2 Power-Up Failure

11.2.1 Non-Sequenced Power

Failure of non-sequenced power to come on and stay on is accompanied by the following symptoms:

1. No ac power comes on when circuit breaker CB1 is turned ON.
2. Non-sequenced ac power is available at duplex outlet J5 but the cooling fans do not operate.
3. Non-sequenced ac power comes on, holds for a period of time (minutes to days), and then drops out.

Suggested remedies for symptom 1:

Check the procedure under 11.1. Check to see if the customer supplied power to the CPU is good (CB1-01 to NEUT BUSS). If customer supplied power is good, check CB1 for continuity (CB1-02 to NEUT BUSS). If power is available from CB1 but not at outlet J5 then filter FL1 may be at fault.

Suggested remedies for symptom 2:

Check fuse FU1 and the cable from J3 to the fans.

Suggested remedies for symptom 3:

Check power entry circuit breaker, CB1. If it is tripped, then the failure will probably be due to an excessive power drain. Isolate the problem area by removing all plugs in J4 and J5 and then replacing them one at a time with each plug replaced followed by an attempted power-up sequence.

11.2.2 Sequenced Power

Failure of sequenced power to come on and stay on is accompanied by the following symptoms:

1. Nothing happens when the Programming and Maintenance Console ON/OFF switch is placed in the ON position.
2. Sequenced ac power comes on, holds for a period of time (minutes to hours), and then drops out.

Suggested remedies for symptom 1:

Check the procedure under 11.1. Check for non-sequenced power to the fans. Check for unregulated (about +24 V) dc power on terminal strip TB2-05 (positive) to TB2-02 (common), sequencer control power. If sequencer control power is present, then trouble may be in the console ON/OFF switch, connecting cables, or relay K1.

Suggested remedies for symptom 2:

Problem may be caused by an excessive power drain. Perform remedy for symptom 3 of 11.2.1 Non-Sequenced Power.

Check fuse FU1 to see if it is blown. If it is blown, check the fans and sequencer control power supply for a failed component.

Somebody turned the Programming and Maintenance Console ON/OFF switch OFF.

11.3 Additional Troubleshooting Suggestions

The following symptoms pertain to specific subsystem components:

1. Loss of dc power from the Basic Power Module or the Auxiliary Power Module.

2. Power failure indication when no power failure occurred.
3. Power failure of the Memory Battery Power Pack.

Suggested remedies for symptom 1:

Loss of voltage may be because of an overvoltage condition for which PS1 provides protection for the +5, +15, and -15 volt outputs. This protection is independent of the supply and will crowbar the output. The crowbaring of any of these voltages will normally indicate that the power supply is at fault. Loss of all voltages may indicate that sequenced ac power was lost.

Loss of power (undervoltage) condition will probably be the result of misadjustment or an overload condition. All of PS1's outputs are provided with overcurrent protection of the "Fold Back" current limiting type. If a low or zero output is found, disconnect its output feeder and recheck. If removal of the load restores the correct output voltage, consider the possibility of an overload. One method for finding such an overload is to reconnect the output lead, and remove each PWB served by the supply in turn. (Always remove power before removing or reinstalling a PWB). If the removal of a PWB removes an overload, repair the PWB or replace it.

Somebody turning the OPERATE/OFF switch to the OFF position.

Suggested remedies for symptom 2:

This indicates a possible misadjustment of the undervoltage detection logic, a component failure, or failure of the +15 or +5 volt power from PS1.

Suggested remedies for symptom 3:

This falls under two different types of failure; the first type is a loss of power while non-sequenced power is available, and the second is failure of the battery to supply power.

1. Possible component failure in PS1, PS2, or PS3. Somebody flipping the OPERATE/OFF switch to the OFF position.
2. Battery was not charged due to insufficient charging period, malfunction of the battery charger, or battery failure. Somebody flipping the OPERATE/OFF switch to the OFF position.

12. PARTS

AC Distribution	51400156	Power Module Backpanel	51301051-100
Circuit Breaker, CB1, 20A.	.68A8947P003	Fan Asm, MF1 & MF2	.70B173606G1
Transformer, T1	.68A8568P6	Diode Light Emitting	.68A8249P3
Filter, FL1	.51190900-101	Diode Light Emitting	.68A8249P9
Relay, K1	.68A8166P01	Video Power Module	51301632-100,101
Component Board, TB1	.51102802-100	AC Toggle Switch	.51190559-101
Component Board, TB2	.51102802-101	Transistor	.51190310-100
Fuse Holder Extractor, FU1	.68A8516P2	Positive Regulator	.68A8401P1
Fuse, SLO-BLO, FU1, 5A.	.68A8519P28	Negative Regulator	.68A8400P1
Terminal Strip, TB3.	43C950098P51	Capacitor, 500 uf, 50V.	51190062-305
Diode, Rectifier	.68A8201P3	Memory Battery Power Pack	51450021-200
Connector, 3 Pin Plug.	.68A8739P108	AC Toggle Switch, SW1	.51190559-101
Connector, 4 Pin Plug.	.68A8739P110	Filter, FL1.	.68A988705P1
Outlet, Duplex, Grounded.	43A950117P1	Pushbutton Switch, SW1.	.51190550-100
Basic Power Module	51300817-100	Diode, LED	.68A8249P3
AC Toggle Switch, SW1	.51190559-100	Diode, LED	.68A8249P9
Power Supply, Purch Spec, PS1	.51190402-200	Fuse, FU1, 2½ A.	.68A8519P24
Power Module Backpanel	51301034-100	Fuse Holder Extractor, FU1	.68A8516P2
Fan Asm, MF1 & MF2	.70B173606G1	Transformer, T1	.51190656-100
Diode Light Emitting	.68A8249P3	Batteries, BT1, BT2, & BT3.	.51190407-100
Diode Light Emitting	.68A8249P9	Power Supply, PS1	.51301154-100
Auxiliary Power Module	51300817-101	Dc to Dc Converter, PS2, 5 V.	.51400416-100
AC Toggle Switch, SW1	.51190559-100	Dc to Dc Converter, PS3, 12 V.	.51400416-101
Power Supply, Purch Spec, PS1	.51190402-200	Fan Assembly	.70B173606G1
		Backpanel Ass'y	.51300839-100

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