

**Lucent Technologies**  
Bell Labs Innovations



***Off Line Equalization (OLE)  
Panel and Converter  
for GPS4848 and GPS4812  
ED83143-30 G60/G61 (Panel)  
ES671 (Converter)***

Product Manual  
Select Code 167-792-200  
Comcode 108626409  
Issue 2  
November 1999  
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***ES671 (Converter)***

**Notice:**

Every effort was made to ensure that the information in this document was complete and accurate at the time of printing. However, information is subject to change.



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# ***1 Introduction***

## ***Off Line Equalization Panel and Converter***

***Overview*** This product manual (Select Code 167-792-200) describes the Off Line Equalization Panel and Converter designed for use in distributed architecture configurations of Lucent Technologies' -48V Galaxy Power Systems GPS4848 and GPS4812.

***OLE Panel*** The Off Line Equalization (OLE) Panel is primarily a three-string battery connection panel with a built-in capability to disconnect a battery string and apply an equalization voltage to the off-line battery string.

There are two available Off Line Equalization Panels:

- ED83143-30 G60, with a Low Voltage Battery Disconnect (LVBD) contactor
- ED83143-30 G61, without a Low Voltage Battery Disconnect (LVBD) contactor

***Converter*** The ES671 is a removable, integrated DC/DC converter that generates the equalization voltage that is applied to the off-line battery string.

## ***Documentation References***

### ***Product Manual***

This product manual is part of a set of documentation developed to assist engineering, installation, and maintenance personnel.

### ***Drawings***

Additional product information is available on the following drawings:

ED83143-30	Off Line Equalization Panel
H569-436	GPS4812
H569-434	GPS4848
T83314-30	Wiring Diagram

## ***Customer Assistance Contacts***

***Customer Training*** Lucent Technologies offers customer training on many Power Systems products. For information call 1-972-284-2163. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

***Customer Service*** For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-THE-1PWR (1-800-843-1797). Services provided through this contact include initiating the spare parts procurement process for out of service emergencies, ordering Lucent Technologies documents, and providing other product and service information.

For other customers worldwide, call 001-972-840-0382. This number is answered from 8:00 a.m. until 4:30 p.m., Central Time Zone (Zone 6), Monday through Friday.

***Technical Support*** Technical support for Lucent Technologies customers is available around the world during the normal product warranty period and also while specific contractual agreements extend this service.

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-CAL-RTAC (1-800-225-7822) to contact a product specialist to answer your technical questions and assist in troubleshooting problems.

For other customers worldwide, contact your local field support center or your sales representative to discuss your specific needs.

***Product Repair and Return*** Repair and return service is provided for Lucent Technologies customers around the world.

For customers in the United States, Canada, Puerto Rico, and the US Virgin Islands, call 1-800-255-1402 for information on returning of products for repair.

For other customers worldwide, contact your sales representative to discuss your particular circumstances.

## ***Customer Assistance Contacts, continued***

***Warranty Service*** For domestic warranty service, contact your Warranty Service Manager (WSM). For international warranty service, contact your sales representative.

***On-Line Power Systems Product Manuals*** For Lucent Technologies users logging in from inside the corporate firewall, the address of the “Power Systems On-Line Product Manuals” page is <http://www.cic.lucent.com/lineage.html>.

For customers logging in from outside the firewall, the address is <http://www.lucent8.com/lineage.html>. The annual subscription fee for access to this site is \$25. To obtain a password, follow the instructions on-line or call 1-888-Lucent8 (1-888-582-3688). When prompted for an order number, enter or say “167-790-010.”

## **2**                      ***Product Description***

### ***Overview***

#### ***Introduction***

The distributed architecture configurations of the -48V GPS4848 and GPS4812 Galaxy Power Systems can be fitted with the Off Line Equalization (OLE) Panel. The panel can be ordered with or without a Low Voltage Battery Disconnect (LVBD) contactor.

One panel per bay can be used in multi-bay systems. Each panel occupies 15 inches of vertical space in the bay.

The OLE panel will accept a custom designed DC/DC converter (ES671) that provides power to a battery string section taken off line to be equalized.

Figure 2-1 illustrates the OLE Panel, and Figure 2-2 illustrates the ES671 DC/DC Converter.

#### ***Safety Certifications***

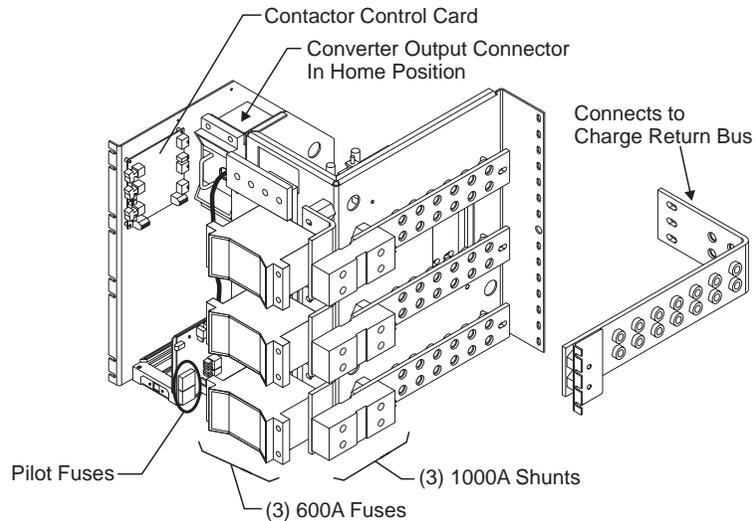
The safety certifications (UL, CE, and/or VDE) applicable to the installation bay (GPS4848 or GPS4812) will still apply when the optional OLE panel and converter are installed.

#### ***EMI Performance***

EMI performance continues to meet CISPR 22 Class B for emissions with the OLE panel installed. However, the system emissions only meet Class A when the ES671 converter is operating and batteries are being equalized.

## OLE Panel

### Illustration



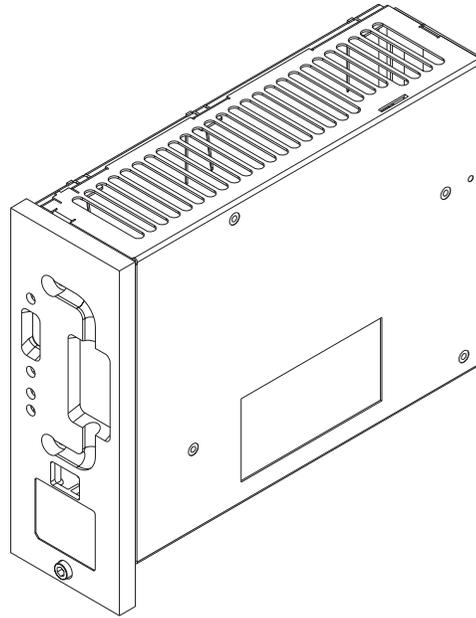
**Figure 2-1: ED83143-30 Off Line Equalization (OLE) Panel**

### Features

- Low Voltage Battery Disconnect (LVBD) contactor (optional) with the associated drive circuitry to disconnect all three battery string sections
- Connection points for up to three separate battery string sections
- Battery shunt for each battery string section (1000A)
- Protection fuse for each battery string section (315-500A)
- Circuitry to provide controller interface for fuse alarms and shunt monitoring
- Manual mechanism to disconnect the battery string sections individually from the main charge bus and to connect them to the OLE converter voltage for equalization
- Slot to accommodate a single OLE DC/DC Converter (ES671) that is powered from the main charge bus

## ***ES671 Converter***

### ***Illustration***



***Figure 2-2: ES671 Converter***

### ***Features***

- Pluggable design
- Adjustable output voltage (56-67Vdc)
- Automatically timed shut-off (12 or 24 hours)
- Shutdown on plant alarm
- Internal current limit (66A or 100A nominal)
- DC input from the main charge bus of the system
- On/Standby switch on the front panel for local, manual control
- Alarm circuitry to indicate internal faults and OLE non-availability
- Capability to withstand connection to a partially or fully discharged battery string without damage to the converter or delivering excessive current to the battery
- Front panel indicators (see Table 3-A)



## **3 Converter Status Indicators**

### **Front Panel**

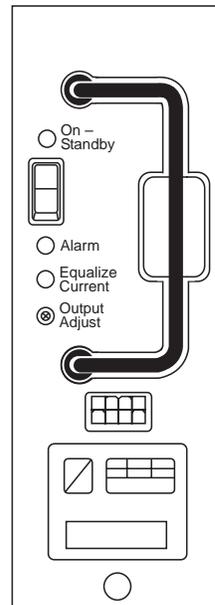
#### **Status Indicator LEDs**

The front panel of the ES671 converter has three status indicator LEDs:

- On/Standby (LED #1)
- Alarm (LED #2)
- Equalize Current (LED #3)

Refer to Figure 3-1 for an illustration of the ES671 converter front panel, and to Table 3-A for the function and description of the three status indicator LEDs on the panel.

#### **Illustration**



**Figure 3-1: Front Panel of ES671 Converter**

## Front Panel, continued

### LED Functions and Descriptions

**Table 3-A: LED Functions and Descriptions**

LED	Function	Description
On/ Standby (LED #1)	Power ON (OLE on, with power applied)	Green, continuous
	Standby (switch in Standby position) (OLE in charge mode and providing current >8A)	Yellow, continuous
	Battery voltage too low (after trickle charge interval)	Yellow/Green, alternating
	Timer expiration	Yellow, blinking
Alarm (LED #2)	Plant alarm	Red, flashing (resets when plant alarm cleared)
	Converter alarm (output voltage <55V or >67V) (OLE fault)	Red, continuous
	Converter thermal alarm	Red, flashing (remains on until converter is reset; this distinguishes it from a plant alarm)
Equalize Current (LED #3)	Converter delivering power (>8A)	Yellow, continuous
	Completed timed equalization interval (12/24 hour)	Yellow, blinking

## **4**                      ***Converter Installation***

### ***Installation Guidelines and Procedures***

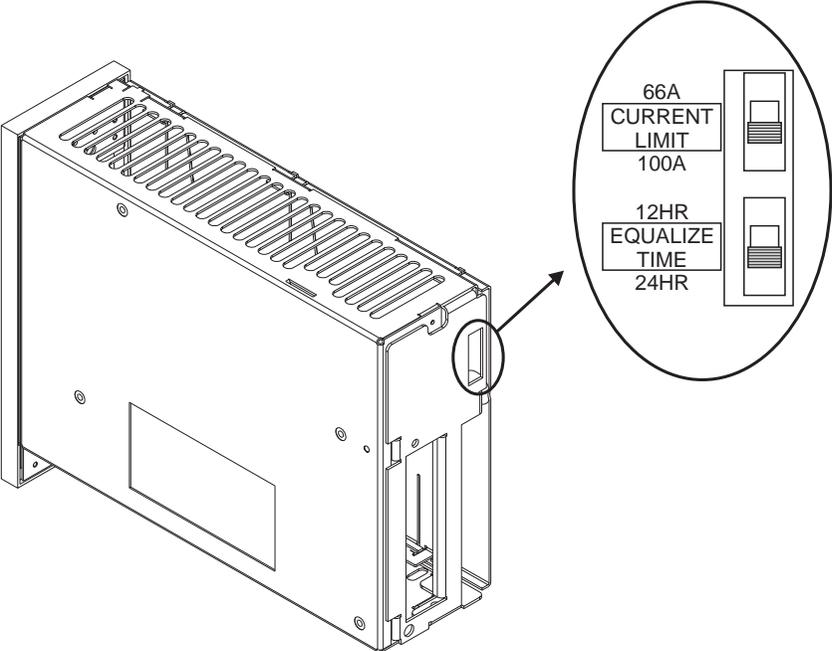
#### ***Guidelines***

- The ES671 DC/DC Converter is installed in the left-most slot of the ED83143-30 panel.
- A single converter may be used in multiple panels in multiple plants since the use of the OLE function is limited to a regular maintenance schedule, and it is desirable that no more than one battery string section per plant be taken off line at any given time.

## Installation Guidelines and Procedures, continued

### Installation Sequence

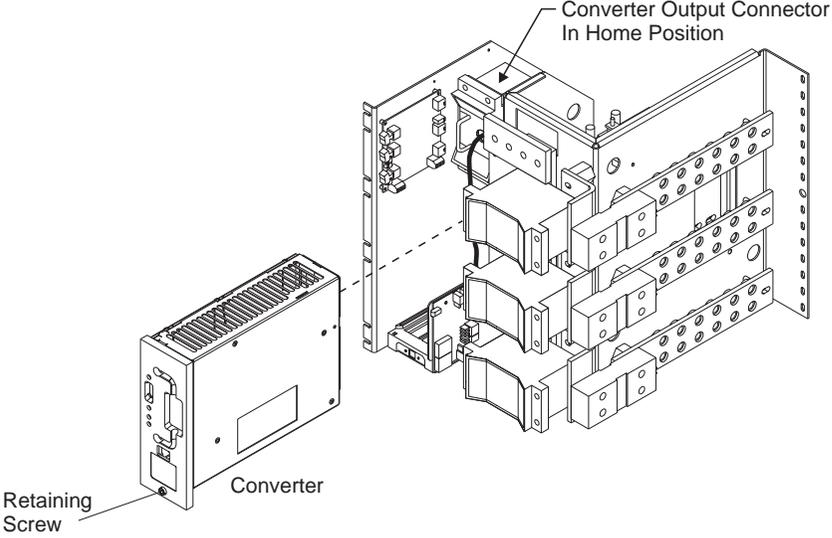
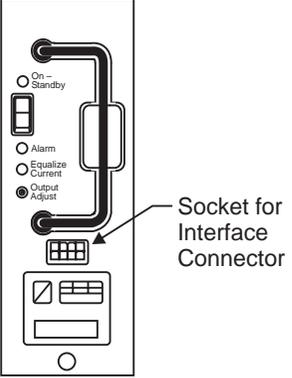
Installing the ES671 Converter	
Step	Action
1	Ensure that the front panel switch on the converter is in the <b>Standby</b> position.
2	Set the time interval switch to the desired position (12/24 hours). See Figure 4-1.
3	Set the current limit switch to the desired position. See Figure 4-1.



**Figure 4-1: Switch Positions on the ES671 Converter**

Continued on next page.

## Installation Guidelines and Procedures, continued

<b>Installing the ES671 Converter, continued</b>	
<b>Step</b>	<b>Action</b>
4	Ensure that the Converter output connector on the ED83143-30 panel is in the <b>Home Position</b> . See Figure 4-2.
 <p style="text-align: center;"><b>Figure 4-2: Home Position on the OLE Panel</b></p>	
5	Push converter firmly into the slot, ensuring that the bottom of the converter is aligned in the plastic rail in the slot.
6	Screw in the retaining screw at the bottom of the converter front panel.
7	Plug the interface connector into the socket on the front of the converter, ensuring full insertion and latching. <div style="float: right; text-align: center;">  </div>



# 5 *Converter Installation Testing*

## *Checking Converter Operation*

### *Test Procedure*

After completing the converter installation, use the following test procedure to verify that the ES671 converter operates correctly.

<b>Testing the Converter After Installation</b>	
<b>Step</b>	<b>Action</b>
1	Verify that the converter output connector is in the <b>Home Position</b> on the panel.
2	Switch on the converter. Verify that the <b>On/Standby</b> LED remains in the Yellow condition.  Note: The output of the converter is interlocked with a signal that is only received when the output is connected to one of the battery string connectors.
3	Connect a resistive dc load box in place of one of the battery strings.
4	Remove the pilot fuse associated with the battery string connector selected for the load box.
5	Switch the converter to <b>Standby</b> . Remove the battery fuse attached to the load box and replace with the converter output connector.
6	Verify that the plant voltage is 52-56V. If not, adjust to within this range.  Note: If a live load is already connected, verify that this is acceptable before making any plant voltage changes.
<i>Continued on next page.</i>	

## ***Checking Converter Operation, continued***

<b>Testing the Converter After Installation, continued</b>	
<b>Step</b>	<b>Action</b>
7	Switch the load box to zero current, and switch on the converter. Apply a load of 10-15A. Using a DVM connected as shown in Figure 6-1, verify that an output voltage is generated.  Note: The output voltage should be in the range of 56-67V and be adjustable using the front panel trim potentiometer.
8	Adjust the output voltage to the desired value.
9	Switch the converter to <b>Standby</b> and return the plant to normal operating voltage.
10	Remove the converter output connector and disconnect the load box.
11	Reconnect the battery string, if applicable.
12	Replace the battery fuse, returning the batteries to float condition.
13	Replace pilot fuse.

## **6                      *Off Line Equalization Operation***

### ***Preparation***

#### ***Guidelines***

It is important that the battery string to be equalized be fully charged prior to performing the equalization operation. To ensure full state of charge, equalization should not be performed within 48 hours after a significant discharge event.

## ***Equalization***

### ***Notes***

- During the equalization process the gassing rate of the batteries will be dramatically increased. Ensure that adequate ventilation is provided during this period.
- During the equalization process the converter status LEDs should be as follows:
  - On/Standby LED is Green, indicating ***On***.
  - Alarm LED is not lit.
  - Equalize Current LED is Yellow, indicating current >10A.
- As the equalization process proceeds the battery current will steadily decrease and the Equalize Current LED will go off; this is normal operation.
- At the end of the 12/24-hour period the converter should switch to standby mode, and LEDs should be as follows:
  - On/Standby LED is Yellow, indicating ***Standby***.
  - Alarm LED is not lit.
  - Equalize Current Yellow LED is flashing, indicating that the equalization process is complete.
- The equalization process will terminate automatically after a period of time set by the switch on the back of the converter (12/24 hours).

## Equalization, continued

### Procedure

Equalization Procedure	
Step	Action
1	Remove the battery string pilot fuse.
2	Remove the battery string power fuse.
3	Ensure converter is switched Off and set to desired time interval (12/24 hours).
4	Install converter.
5	Insert the equalize cable into the battery string fuse block that was vacated in Step 1.
6	Turn the converter On and adjust the output voltage.  <b>DANGER</b> <b>High voltage during equalize mode.</b>
7	Verify that the voltage being applied to the battery string reaches the desired value. When the voltage is first applied to the battery the converter will usually go into current limit, and the current limit setting will regulate the voltage. Once the charge on the battery string has increased to where the converter is no longer in current limit, the voltage can be verified using a DVM at the points indicated in Figure 6-1.

The diagram shows a perspective view of the converter and fuse block assembly. A 'Converter Output Connector' is shown being inserted into its 'Home Position' on the main panel. A separate 'Charge Return Bus' is shown connected to the main panel. A Digital Voltmeter (DVM) is connected to the output terminals of the converter. Arrows indicate the specific points where the DVM leads are connected to the converter's output and the charge return bus.

**Figure 6-1: Voltage Measurement Points**

## ***Output Voltage Adjustment***

### ***Guidelines***

If the output voltage of the converter is not at the desired level, it can be adjusted using the trim potentiometer on the converter front panel. Voltage should be monitored using a portable DVM at the points shown in Figure 6-1.

### **Note**

<p>It is important that adjustment of the output voltage be done slowly to allow the voltage on the battery string to keep up with the converter adjustment, since rapid changes can cause the converter to current limit. When the converter is in current limit the output voltage does not track the set point voltage.</p>
--

Once the voltage has stabilized at the required level the DVM can be removed and equalization can be completed.

## ***Partially Discharged Batteries***

### ***Guidelines***

If the battery string voltage is less than the plant float voltage ( $V_f$ ) the equalization process will not start. In this situation, the converter will attempt to raise the voltage to  $V_f$  using the built-in “trickle charge” mode. In this mode the output current of the converter is limited to approximately 3A for a period of about ten minutes. During trickle charge mode it is normal for the Alarm LED (Red) to be lit, indicating that the output voltage is outside the acceptable range.

If at the end of this 10-minute period the voltage is still lower than  $V_f$ , the converter will shut down and the On/Standby LED will alternate (Yellow/Green), indicating low battery voltage. Also, the Alarm LED (Red) will be on, indicating that the output voltage is out of the acceptable range. If during the 10-minute trickle charge period the battery voltage rises to  $V_f$ , the converter will automatically switch to normal Equalize mode and the Alarm LED will extinguish. (There may be a delay of 20-30 seconds as the battery voltage rises above 56V before the Alarm LED extinguishes.)

## Equalization Completion

### Introduction

As indicated previously, equalization can be terminated by the automatic timer in the converter or by switching off the converter manually. Use the following procedure to return the plant to normal operation after termination of the equalization process.

### Returning to Normal Operation

Returning to Normal Operation	
Step	Action
1	Switch the converter to the off ( <b>Standby</b> ) state and return the battery string to the main charge bus by disconnecting the converter output connector from the battery string position and returning it to the home position.
2	Replace the battery fuse, noting the following warning.  <b>Warning</b>  <b>The equalization process raises the battery string voltage considerably above the plant bus voltage. Before reconnecting the battery string to the charge bus, allow the battery string to self-discharge back to a voltage close to the plant float voltage (<math>V_f</math>). This will take 10-60 minutes, depending on the capacity of the battery string and the equalization voltage used.</b>  <b>Failure to allow the battery string to self-discharge may result in damage to the fuse connector contacts and possible personal injury.</b>
3	Once the battery has self-discharged and the battery fuse has been replaced, replace the battery pilot fuse.



**Warranty Period**

Product Type	New Product	Repaired Product or Part*
Central Office Power Equipment**	24 Months	6 Months

\*The Warranty Period for a repaired Product or part thereof is as listed or, in the case of Products under Warranty, is the period listed or the unexpired term of the new Product Warranty Period, whichever is longer.

\*\*The Warranty Period for Products ordered for Use in Systems or equipment Manufactured by and furnished by Seller is that of the initial Systems or equipment.

- C. If, under normal and proper use during the applicable Warranty Period, a defect or nonconformity is identified in a Product and Customer notifies Seller in writing of such defect or nonconformity promptly after Customer discovers such defect or nonconformity, and follows Seller's instructions regarding return of defective or nonconforming Products, Seller shall, at its option attempt first to repair or replace such Product without charge at its facility or, if not feasible, provide a refund or credit based on the original purchase price and installation charges if installed by Seller. Where Seller has elected to repair a Seller's Manufactured Product (other than Cable and Wire Products) which has been installed by Seller and Seller ascertains that the Product is not readily returnable for repair, Seller will repair the Product at Customer's site.

With respect to Cable and Wire Products manufactured by Seller which Seller elects to repair but which are not readily returnable for repair, whether or not installed by Seller, Seller at its option, may repair the cable and Wire Products at Customer's site.

- D. If Seller has elected to repair or replace a defective Product, Customer shall have the option of removing and reinstalling or having Seller remove and reinstall the defective or nonconforming Product. The cost of the removal and the reinstallation shall be borne by Customer. With respect to Cable and Wire Products, Customer has the further responsibility, at its expense, to make the Cable and Wire Products accessible for repair or replacement and to restore the site. Products returned for repair or replacement will be accepted by Seller only in accordance with its instructions and procedures for such returns. The transportation expense associated with returning such Product to Seller shall be borne by Customer. Seller shall pay the cost of transportation of the repair or replacing

Product to the destination designated by Customer within the Territory.

- E. The defective or nonconforming Products or parts which are replaced shall become Seller's property.
- F. If Seller determines that a Product for which warranty service is claimed is not defective or nonconforming, Customer shall pay Seller all costs of handling, inspecting, testing, and transportation and, if applicable, traveling and related expenses.
- G. Seller makes no warranty with respect to defective conditions or nonconformities resulting from actions of anyone other than Seller or its subcontractors, caused by any of the following: modifications, misuse, neglect, accident, or abuse; improper wiring, repairing, splicing, alteration, installation, storage, or maintenance; use in a manner not in accordance with Seller's or vendor's specifications or operating instructions, or failure of Customer to apply previously applicable Seller modifications and corrections. In addition, Seller makes no warranty with respect to Products which have had their serial numbers or month and year of manufacture removed, altered, or with respect to expendable items, including, without limitation, fuses, light bulbs, motor brushes, and the like.

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