Lucent Technologies
Bell Labs Innovations

Lineage® 2000 Flexible Power System DC/DC Converter Plant J85500K-1

Product Manual
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Lucent Technologies Lineage® 2000 Flexible Power System DC/DC Converter Plant

Notice:
The information, specifications, and procedures in this manual are subject to change without notice. Lucent Technologies assumes no responsibility for any errors that may appear in this document.

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1 Introduction

Description of Product

The Lineage® 2000 family of premier energy system products is globally recognized as the right choice for the ultimate in systems performance and reliability. Selecting this product brings the Lucent Technologies commitment to product and service excellence to your own telecommunications system. This long-standing Lucent Technologies commitment has been gained from over 80 years of worldwide telecommunications experience in the development, manufacturing, engineering, installation and servicing of leading edge energy systems, products and services.

This document is one of a set of product manuals which provides information on the Lineage® 2000 Flexible Power System (FPS) and its components. Each manual contains a technical description of the product followed by detailed information on engineering, installation, operation and maintenance.

The FPS DC/DC Converter Plant described in this manual is shown in Figure 1-1. This member of the FPS family of power plants converts dc source voltages typically provided by telecommunications battery plants into secondary dc voltages required by the load. When equipped with FPS converters, this plant offers customers a modular system capable of servicing a variety of needs. For example, FPS converter plants equipped with FPS 693AA DC/DC Converters may be used with 24-volt battery plants to provide 48-volt power in mobile radio cell-sites. DC/DC converters envisioned for future expansion of the product line may be used with 48-volt battery plants for 130-volt fiber-in-the-loop applications.

Because the FPS DC/DC Converter Plants are physically interchangeable with Lineage® 2000 Evolutionary Control System (ECS) rectifier shelves, these converter plants may be used with ECS systems to provide fully integrated systems where battery-backed secondary voltages are required. Additionally, these converter plants

can be installed in miscellaneous frames or in load equipment frames and powered from an available dc power source.

The Lineage® 2000 FPS DC/DC Converter Plant serves power needs within the 10 to 120 ampere range. To achieve this load current range, the system grows in capacity from a one-shelf plant, which accepts up to six converters, into a two-shelf plant capable of housing 12 converters.

Included in the shelf assemblies is a sophisticated plant Monitor and Control Unit and facilities to terminate the input distribution, output distribution, and protection panels. The controller can serve either one or two shelf plants. Input termination and output distribution/protection facilities are provided with each shelf. Figure 1-1 illustrates one and two shelf DC/DC Converter Plants. Figure 1-2 illustrates a typical FPS DC/DC Converter Plant with one converter removed.

Product Literature

The data listed below provide the J-codes and product manual select codes for the FPS products associated with the FPS DC/DC Converter Plant and the FPS Series Converter. Ordering information is provided in Section 5.

FPS DC/DC Converter Plant
J-Code: J85500K-1 List 10
Product Manual select code: 167-790-124

FPS Monitor and Control Unit
Apparatus code: 115B
Product Manual select code: 167-790-048

Technical Support

Technical support for Lucent Technologies equipment is available to customers around the world.

USA, Canada, Puerto Rico, and the US Virgin Islands

On a post-sale basis, during the Product Warranty period, our Technical Support telephone number 1-800-CAL RTAC (1-800-225-7822) provides coverage during normal business hours. Product Specialists are available to answer your technical questions and assist in troubleshooting problems. For out-of-hours EMERGENCIES, the 800 number will put you in touch with a Regional Technical Assistance Center Engineer via our 24 hour a day, 7 day per week Help Desk.

When Technical Support is required in the Post-Warranty Period, the service may be billable unless you hold an extended warranty or contractual agreement.

Central and South America

If you need product technical support, contact your local Field Support/Regional Technical Assistance Center or contact your sales representative who will be happy to discuss your specific needs.

Europe, Middle East, and Africa

If you need product technical support, contact your local Field Support/Regional Technical Assistance Center or contact your sales representative who will be happy to discuss your specific needs

Asia Pacific Region

If you need product technical support, contact your local Field Support/Regional Technical Assistance Center or contact your sales representative who will be happy to discuss your specific needs.

Product Repair and Return

Repair and return service for Lucent Technologies equipment is available to customers around the world.

USA, Canada, Puerto Rico, and the US Virgin Islands

For information on returning of products for repair, customers may call 1-800-255-1402 for assistance.

Central and South America

If you need to return a product for repair, your sales representative will be happy to discuss your individual situation.

Europe, Middle East, and Africa

If you need to return a product for repair, your sales representative will be happy to discuss your individual situation.

Asia Pacific Region

If you need to return a product for repair, your sales representative will be happy to discuss your individual situation.

Customer Service

For customer service, any other product or service information, or for additional copies of this manual or other Lucent Technologies documents, call 1-800-THE-1PWR (1-800-843-1797). Specify the select code number for manuals, or drawing number for drawings. These numbers are listed in the following reference table.

Contact your regional customer service organization or sales representative for information regarding spare parts.

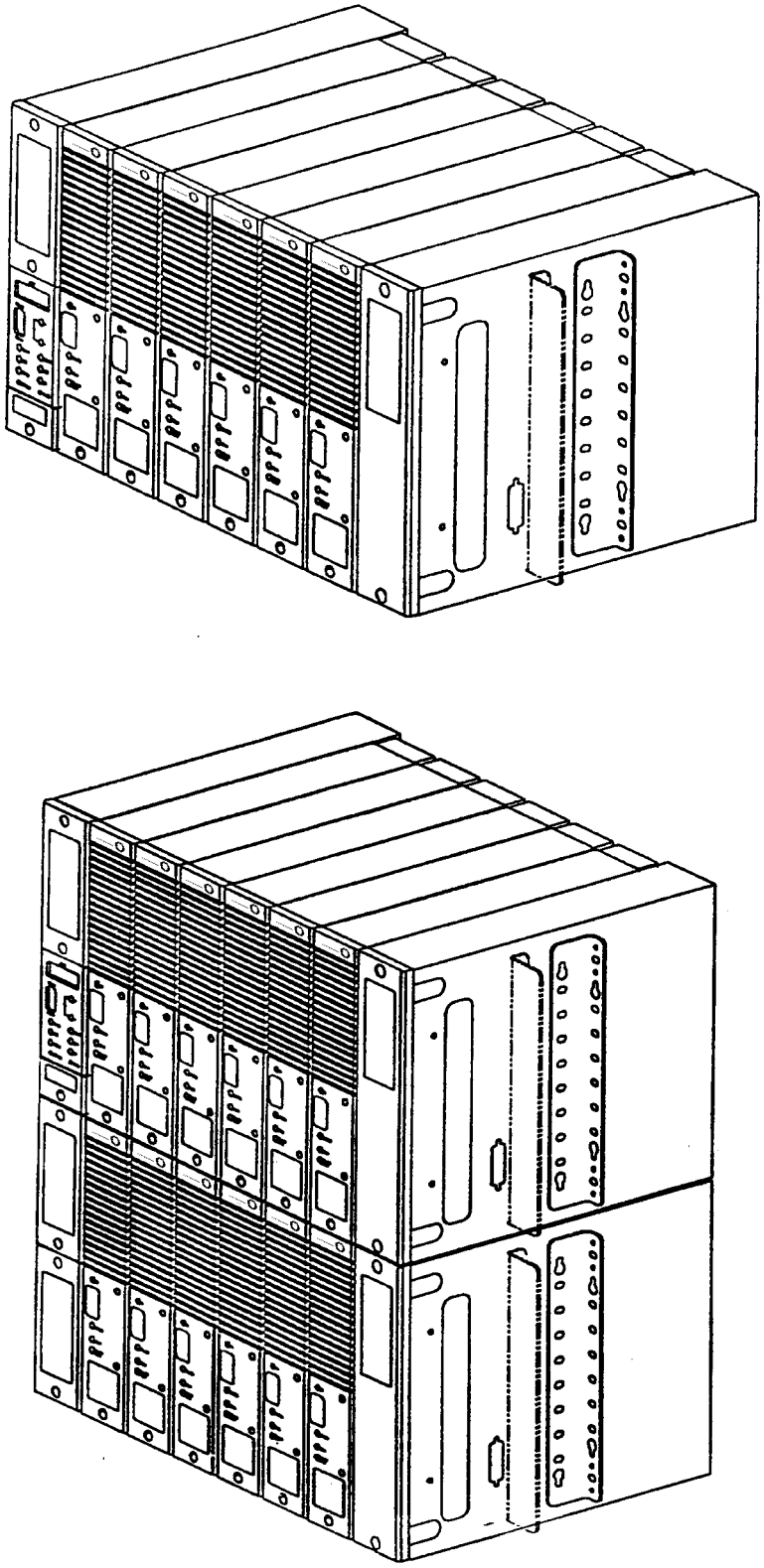

Figure 1-1: FPS DC/DC Converter Plants

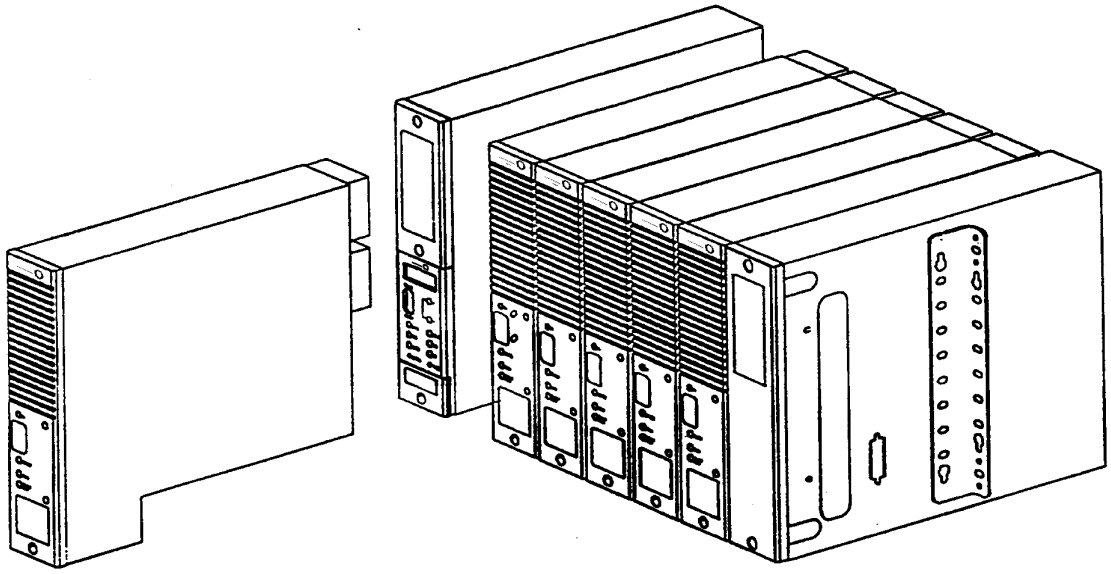

Figure 1-2: FPS DC/DC Converter Plant with Converter Removed

2 Product Description

Converter Plant Specifications

Table 2-A: FPS 24/-48 Volt DC/DC Converter Plant

Power Units	693AA DC/DC Converters Maximum of six units per shelf and 12 units per plant (see note 1).
Monitor and Control Unit	115B
Nominal Output Voltage	-50 volts dc
Operating Voltage Range	48-52 volts dc
Output Current	0-60 amperes per shelf
Nominal Input Voltage	±24 volts dc
Input Voltage Range	20-30 volts dc
Input Current	List 1 current: 132 amperes per shelf List 2 current: 180 amperes per shelf Maximum input current: 190 amperes per shelf
Efficiency	83% typical
Regulation	±3.5%
Ripple	250 millivolts peak to peak maximum, over the range 10 Hz to 20 MHz
Output Noise	32 dBrnc
Load Share Accuracy	0.5 amperes
Heat Dissipation	575 watts/1970 BTU/hr typical

Table 2-A: FPS 24/-48 Volt DC/DC Converter Plant

Temperature	32 to 122 degrees Fahrenheit 0 to 50 degrees Celsius
Altitude	-200 to 13,000 feet -61 to 3962 meters For altitudes above 5000 feet, derate the temperature by 3.6 degrees Fahrenheit per 1000 feet. For altitudes above 1524 meters, derate the temperature by 0.656 degrees Celsius per 100 meters.
Humidity	10-95% Noncondensing
Audible Noise	57 dBa measured from 2 feet or 0.6 meters from the plant
Electrostatic Discharge	IEC 801-2 Level 3
Radiated and Conducted Emissions	FCC Part 15, Level A
Electromagnetic Immunity	10 V/m over the range of 20 to 2000 MHz
Earthquake Rating	Zone 4, upper floors
Safety Agency Approvals	Converter Shelf equipped with Converter Modules: U. L. listed per Subject Letter 1801, Power Distribution Center for Communications Equipment (See "Restrictions.")

Note 1: Data specified for a six converter plant having an input voltage of 27 volts and output of 50 volts and 60 amperes.

List 1 input current specified at input voltage of 27 volts and output of 50 volts and 60 amperes and efficiency of 83%.

List 2 input current specified at input voltage of 20 volts and output of 50 volts and 60 amperes and efficiency of 83%.

Maximum input current specified at input voltage of 20 volts and output of 52 volts and 60 amperes and efficiency 83%.

Physical Description

The FPS DC/DC Converters are plug-in units designed for use with FPS power plants as illustrated in Figure 1-2. The frame mounting dimensions and weight of converters and the plants are given below.

Converter	Height: 12 inches Width: 2.6 inches Depth: 15 inches Weight: 10 pounds
Single-shelf plant	Height: 12 inches Width: 21.5 inches Depth: 15 inches Weight: 35 pounds
Single-shelf plant equipped with six converters	Weight: 95 pounds
Frame Mounting Requirements	Standard 23 and 26 inch relay racks Vertical mounting centers: 1.00 inches (25mm) Horizontal mounting centers: 22.32 inches (567mm) or 24.32 inches (618mm)

Additional Information

Dynamic Response

Step changes in load over the range of 10 to 90 percent, or 90 to 10 percent, will not cause the voltage measured at the point of regulation to overshoot or undershoot more than 5 percent. After the step change, the voltage will return to and stay within the regulation band within 300 milliseconds.

Lightning protection: The converters are capable of withstanding without damage repeated surges of the following waveforms (per ANSI C62.1, C62.2 and 587-1980 requirements):

Rise time of 8 microseconds to 3000 amperes peak amplitude and decay time to 1500 amperes in 20 microseconds.

0.5 microsecond - 100 kHz ring wave with a peak voltage of 6000 volts.

Module Compatibility

The flexibility of the FPS system is based on mixing physically similar modules in the same shelf assembly. To avoid accidents, these modules are keyed to prevent incompatible modules from being installed in the same shelf. As an additional aid, labels on the modules are coded using symbols, colors, and alpha-numeric designation to allow a visual check of module compatibility.

The keying system depends on coded keying brackets installed in the power modules and corresponding keying strips installed in the shelf assemblies. The Monitor and Control Unit is keyed using pins located on the face plate and slots in the shelf assembly side panel.

Symbols on the labels indicate the module input and/or output and its functional classification, colors indicate compatible voltages, and alpha-numeric codes are used to show voltage and current levels and functional classification. These descriptors are defined below:

- module input
- module output
- rectifier module
- converter module

Blue: denotes 48 volts
Violet: denotes 24 volts

As an example of these conventions, the labels above define a J85500K-1 List 10 DC/DC Converter Plant equipped with 693AA, 24-to-48 volt converters. When properly configured the colors appearing in each of the columns on the label will match.

Restrictions

The FPS system is intended for installation in controlled environments as defined in Bellcore document TR-EOR-000063. For UL compliance, the product must be installed only in restricted access areas (dedicated equipment rooms, equipment closets or the like) in accordance with Articles 110-16, 110-17, and 110-18 of the National Electric Code, ANSI/NFPA Number 70, and per the requirements of other local codes, and in controlled environments with a room ambient of 25°C (temporary fluctuations in temperature are allowed). In

addition, DC input voltages must originate from an SELV source or from a DC source which is electrically isolated from the AC source and is reliably connected to earth ground.

FPS DC/DC Converter Plant Subsystems

Figure 2-1 illustrates the subsystems typical of an FPS Converter Plant. These subsystems are described below.

FPS DC/DC Converters

The FPS series converters are designed specifically for applications where size, weight, ease of installation, and maintenance are of overriding importance. When plugged into a converter plant as shown in Figure 2-1, all interconnections between the converter, the Monitor and Control Unit and the input and output distributions are completed. This front access, plug-in design plant permits growth and easy maintenance without interrupting service.

Switchmode circuit design provides excellent output regulation over a wide range of load currents and input voltages. Processing the power at higher frequencies allows for substantial reduction in the size and weight of the energy storage elements. Higher frequencies and the use of forced-air cooling help achieve high power density and light weight. Each unit is equipped with field replaceable, self-contained cooling fans. Thermal alarm circuitry offers additional protection by shutting the converter down and providing an alarm when the internal temperature exceeds approximately 70° C. Forced air cooling improves the reliability of the converter by reducing the internal ambient temperatures of the converter to essentially the outside ambient temperature.

FPS series converters feature automatic load-share circuits that force the converters to equally share the plant load, reducing the stress on individual converters. FPS series converters are self protected, and short circuits and system overloads are handled automatically; if the short circuit is removed or the system load reduced, the converters automatically resume normal operation.

Signal interfaces between the FPS series converters and the plant Monitor and Control Unit provide alarm monitoring, converter output voltage adjustment, plant current monitoring, lamp test, and converter On/Standby control.

The initial FPS Converter Plant is equipped with the 693AA converter, which operates from a nominal 24-volt source and provides 50 volts dc at 10 amperes over the temperature range 0 to 50° C. Planned expansion of the FPS converter product line includes a converter which operates from 48-volt sources and provides 130 volts at approximately 4 amperes. These converters provide highly regulated, low noise power in either the FPS Converter or Rectifier/Converter Plants.

When used in the FPS Converter Plant, the 693AA power system can serve telecommunication power needs within the 10 to 120 ampere range by growing from one converter in a single shelf to two full shelves of converters.

FPS DC/DC Monitor and Control Unit

Included in the shelf assemblies is a sophisticated plant Monitor and Control Unit. A single Monitor and Control Unit serves both one and two shelf plants, providing plant monitoring, display and control features, and office alarm outputs. A complete feature set is provided for converters in Converter Plants and rectifiers in Rectifier/Converter Plants. Alarms are provided for converters in Rectifier/Converter Plants. Features include:

- A digital meter that displays plant voltage or current (switch-selectable) when used in the Converter [only] Plant. When used in the Rectifier/Converter Plant, the meter displays rectifier plant output voltage or current.
- Green, yellow, and red LEDs that display the plant status.
- A connector to provide form-C office alarms corresponding to the alarm indicators.
- A customer-accessible potentiometer to adjust the plant voltage.
- An alarm monitor circuit that determines the status of the installed rectifiers and converters and incorporates this information into the plant power minor or power major alarms.
- An LED test switch that activates all plant LEDs (note: the status LEDs on the battery modules may have separate test switches.)
- Capability for a customer-provided remote On/Standby control that is "passed-on" to the installed power modules. In Rectifier/Converter Plants, unique On/Standby controls are provided for rectifiers and converters.

FPS Shelf Assemblies

Shelf assemblies house and interconnect power modules, the Monitor and Control Unit, and the distribution modules. All interconnections between these components are completed as the components are plugged into the shelf assembly. This front access, plug-in designed plant permits growth and easy maintenance without interrupting service. Keying prevents improper module insertion.

FPS Distribution Modules

The FPS provides input termination and output distribution protection facilities with each shelf. For each shelf, you may select one of three output distribution modules: twenty-four telecommunication type fuses (0.5-10 amperes), six plug-in circuit breakers (3-30 amperes), or eight Lucent Technologies 74-type or KS23753-type fuses (1-20 amperes). Each module provides the means to interconnect the output of two shelves or connect the outputs to an external circuit breaker or fuse panel through an unprotected bulk feed path. Each module also provides a signal to the Monitor and Control Unit to signify an operated circuit breaker or cleared fuse.

Telecommunications Fuse Module

This module provides twenty-four 0.5-10 ampere fuse positions that accept telecom-type fuses. Twenty-four load and return wire termination slots are provided with each module. The maximum wire size that the terminal blocks can accept is 14 gauge. The total output current of the module is limited to 60 amperes at all voltages. Figure 2-1 describes this fuse module. See Section 5 for additional information.

Note 1: This module may not be acceptable to protect building wiring as defined by the NEC. Protection for internal wiring or short interconnecting cables that are not a part of the building wiring is acceptable.

Note 2: Distribute system loads across the fuse blocks.

Note 3: Do not load fuses to more than 80 percent of their rated capacity.

Warning: Installing fuses not specified for use in this distribution module may result in injury to the service personnel or damage to the unit. Installing telecom-type fuses not equipped with safety caps may result in injury to the service personnel.

Plug-In Circuit Breaker Module

The List 11 converter shelf with a plug-in circuit breaker distribution module provides six 3-30 ampere circuit breaker positions which accepts KS-23616 plug-in style breakers. These breakers have interrupt ratings of 7500 amperes at voltages less than 65Vdc and 5000 amperes at voltages between 65 and 145Vdc. Six load and return wire lugs (10-12 gauge) are provided with each module. The total output current is limited to 60 amperes at all voltages. Figure 2-2 describes this circuit breaker module. See Section 5 for additional information.

The List 15 converter shelf with a plug-in circuit breaker distribution module provides twelve 3-30 ampere circuit breaker positions that accept KS-23616 plug-in style breakers. Twelve load and return wire lugs (10-12 gauge) are provided with each module. The total output current is limited to 60 amperes at all voltages. Figure 2-3 describes this circuit breaker module. See Section 5 for additional information.

Warning: Installing circuit breakers not specified for use in this distribution may result in injury to the service personnel or damage to the unit.

Lucent Technologies 74-Type Fuse Module

This module provides eight 1-30 ampere load and alarm fuse positions that accept either Lucent Technologies 74-type or KS23753-type fuses. The alarm fuse is a Lucent Technologies 70G and 0.5 ampere fuse. Eight load and return wire lugs (10-12 gauge) are provided with each module. The total output current of the module is limited to 60 amperes at all voltages. Figure 2-4 describes this fuse module. See Section 5 for additional information.

Note 1: This module may not be acceptable to protect building wiring as defined by the NEC. Protection for internal wiring or short interconnecting cables that are not a part of the building wiring is acceptable.

Note 2: Distribute system loads across the fuse blocks.

Note 3: Do not load fuses to more than 80 percent of their rated capacity.

Warning: Installing fuses not specified for use in this distribution module may result in injury to the service personnel or damage to the unit.

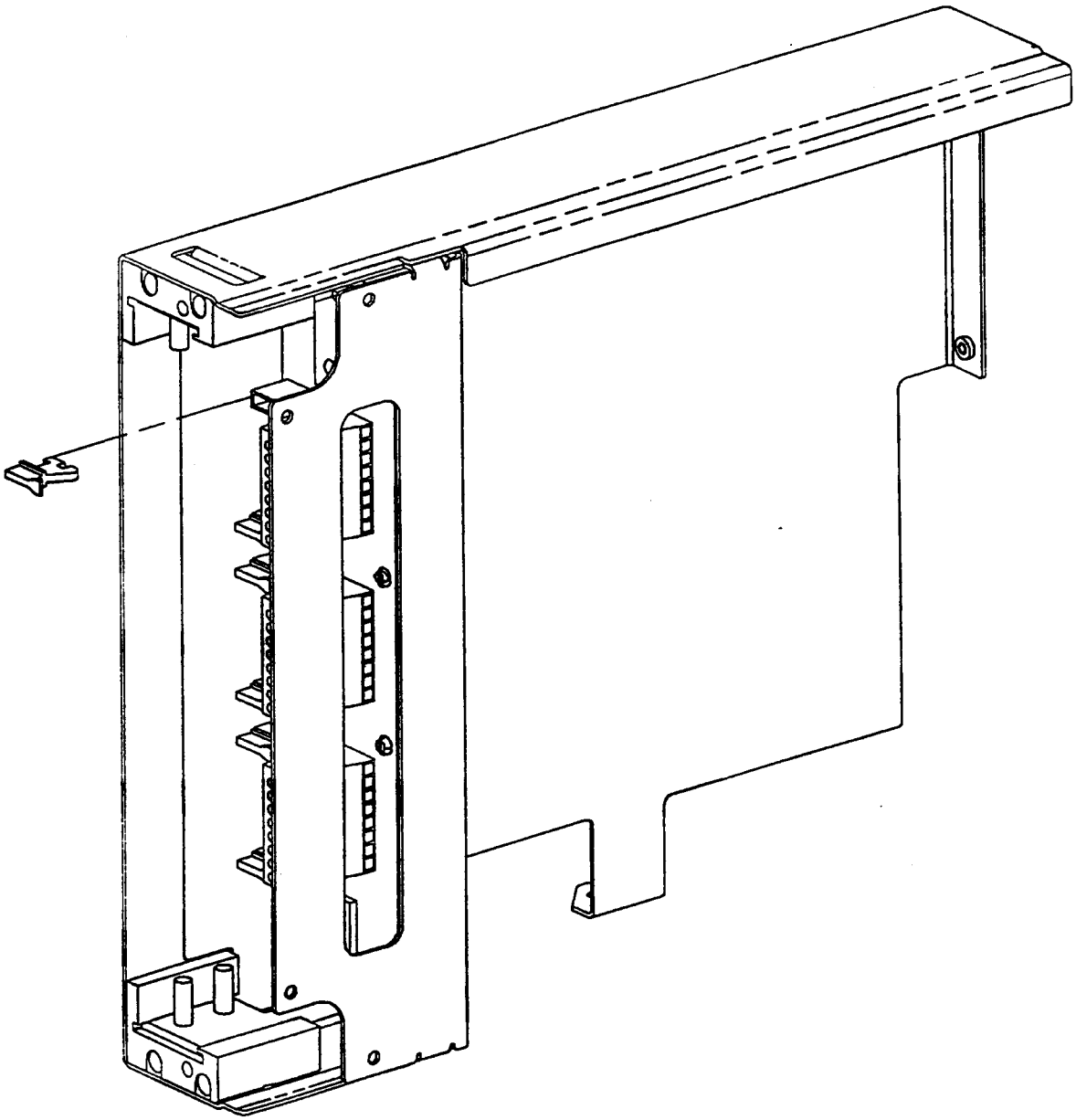

Figure 2-1: Telecommunications Fuse Module

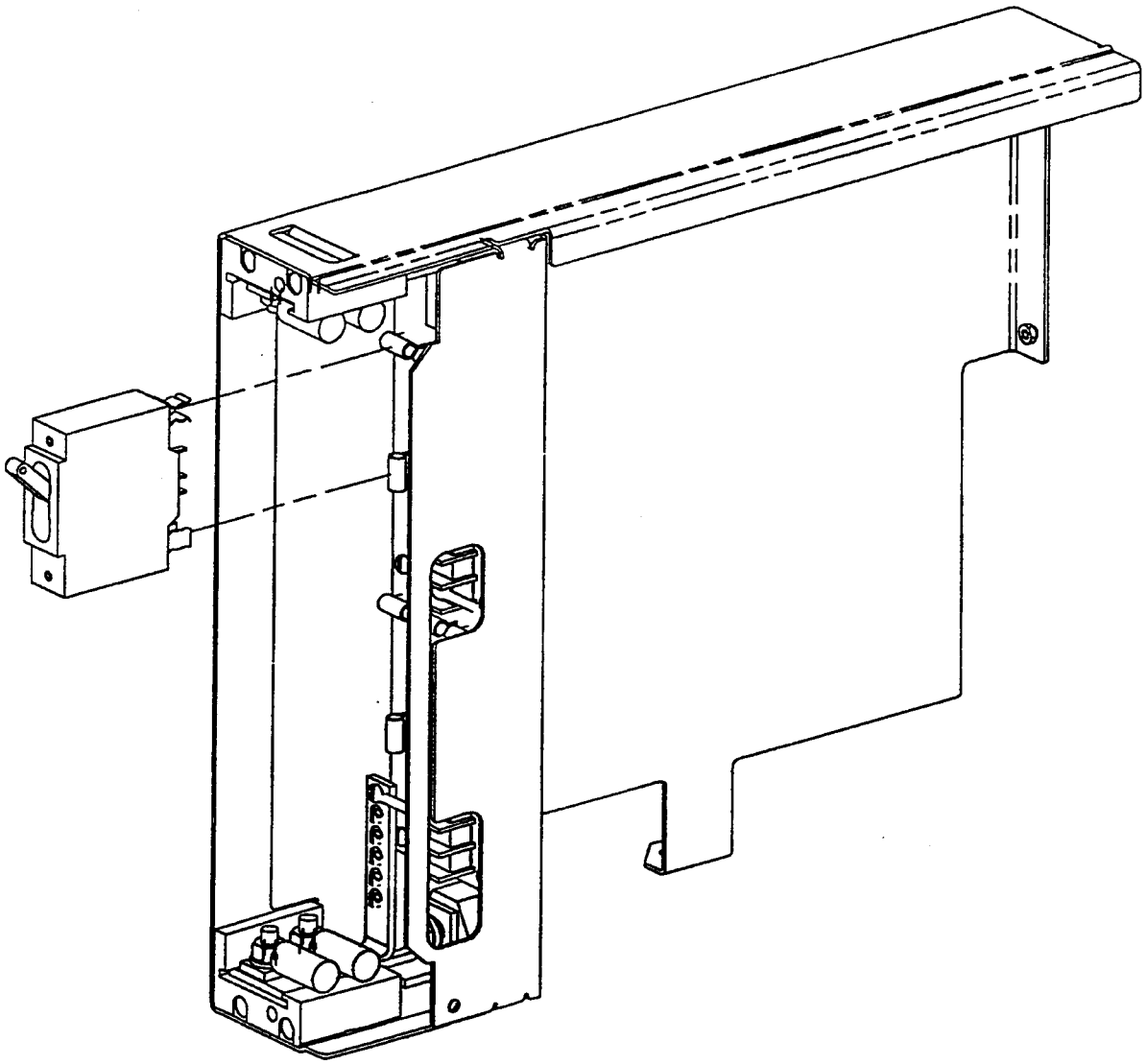

Figure 2-2: Circuit Breaker Distribution Module (6 Positions)

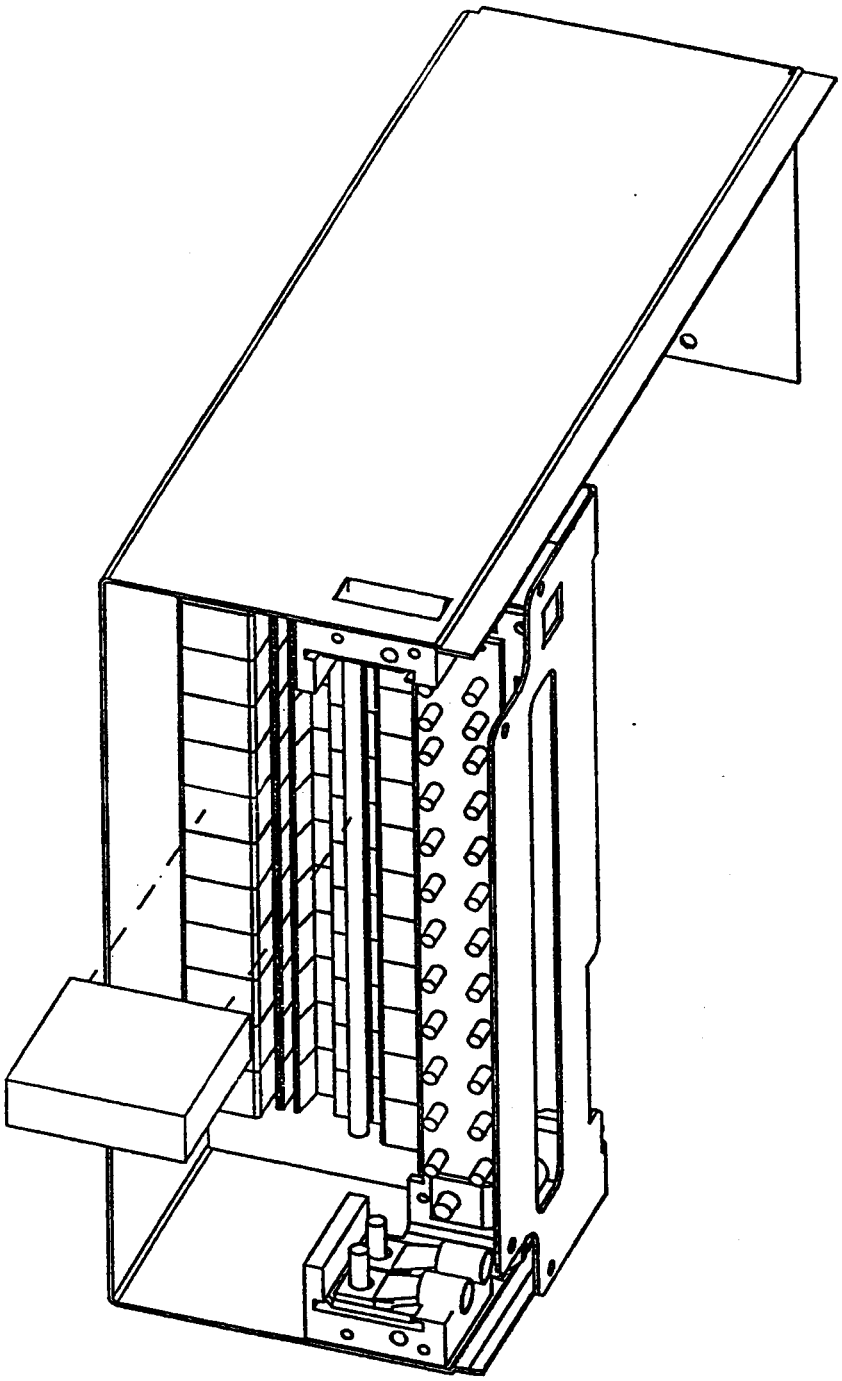

Figure 2-3: Circuit Breaker Distribution Module (12 Positions)

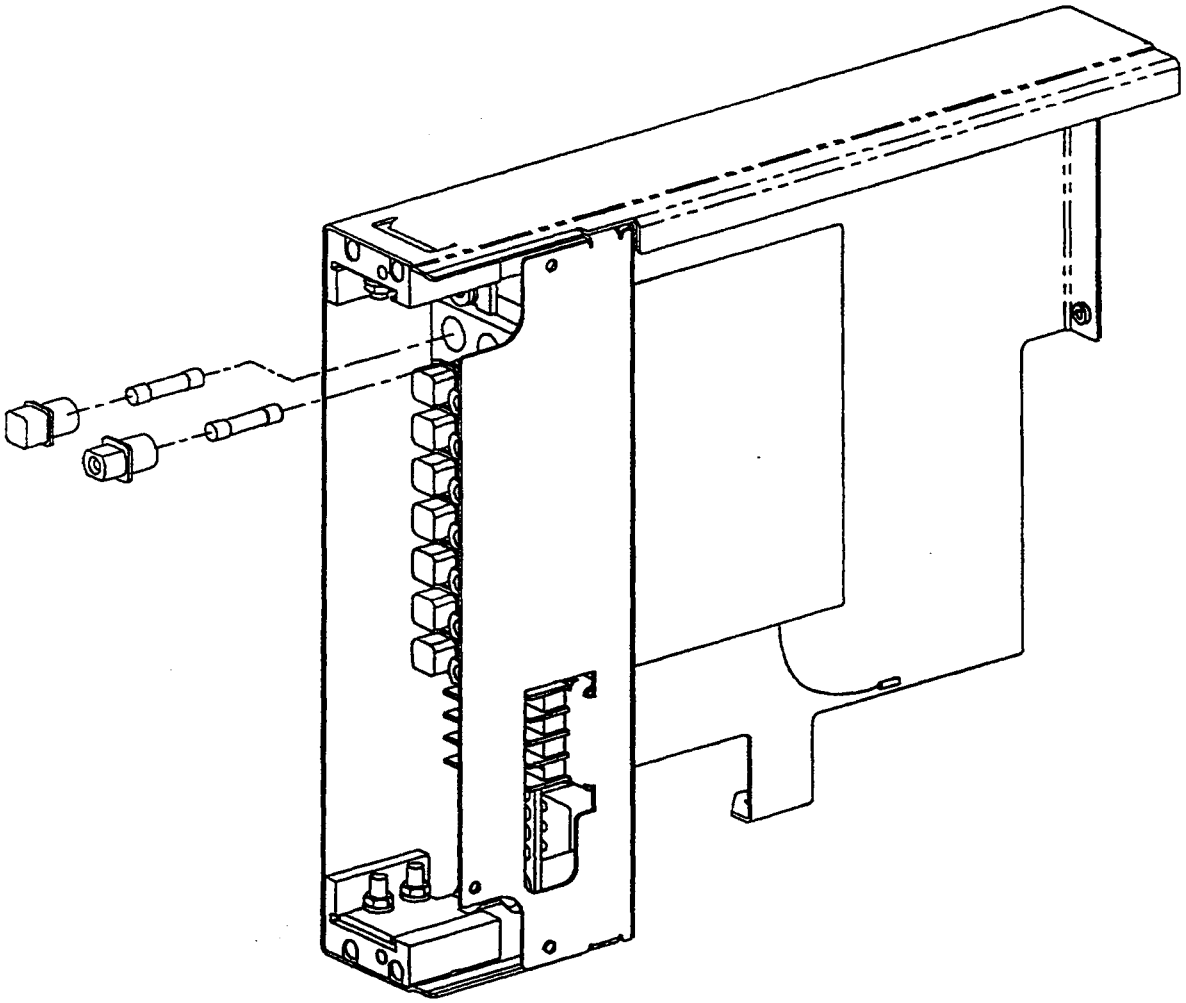

Figure 2-4: Lucent Technologies 74-Type Module

3 Installation

Installation Tools Required

General	- 5mm Allen wrench (one provided with each shelf)
	- Wire cutters and strippers
	- Heat-shrink gun
	- Torque wrench (0-60 in-lbs), with attachments as defined below
Shelf	- 5/16 inch hex driver (shelf mounting screws)
Input Wiring	- Standard blade screw driver bit for torque wrench (maximum blade width: 0.25 inches; maximum blade thickness: 0.04 inches)
	- Thomas and Betts hand crimping tool # WT1300
Control and Monitor Wiring	- Small standard blade screw driver (maximum blade width: 0.125 inches)
Output Distribution with Telecomm Fuses	- No crimping tool required
	- Small standard blade screw driver (maximum blade width: 0.125 inches)

Output Distribution with Circuit Breakers, 74-type or KS19780-type Fuses

- Thomas and Betts hand crimping tool # WT1300

- Standard blade screw driver bit for torque wrench (maximum blade width: 0.25 inches; maximum blade thickness: 0.04 inches)

Bulk Feed

Bulk feed distribution can be accommodated using any of the three distribution modules.

- Thomas and Betts

Part #54108 for 2 gauge Crimping die: color-coded green
Part #54106 for 4 gauge Crimping die: color-coded grey
Part #54105 for 6 gauge Crimping die: color-coded blue
Part #54130 for 8 gauge Crimping die: color-coded red

- 7/16 inch socket for torque wrench

Suggested Installation Sequence for All Modules

General Information

1. The dc source voltage input wiring enters the plant on the left; the plant output wiring exits the plant on the right. The alarm wiring to the ECS controller's basic control board (CP1) and/or general office alarms exits the plant on the left; wiring to the ECS datalogger board (CP3) exits the plant on the right. (See the Monitor and Control Unit product manual for more information, Select Code 167-790-048.)

2. When running the dc source voltage cables, care should be taken to pair the positive and negative conductors over as much of their length as possible.

3. All electrical connections must be made using the proper crimping tools and dies and shall be torqued to their specified values.

4. All wiring must comply with the NEC and other applicable local codes.

Shelf

If the shelf is already mounted in a frame, proceed to "Input Wiring."

Warning: Only qualified personnel may install and service the FPS. Hazardous energy may be present in the unit or on the interface cables which could cause serious injury. Follow all safety warnings and practices when servicing this unit.

Step A: Insure that adequate space is available for mounting the shelf. The shelf requires a minimum of 12 inches of vertical height and 17 inches of depth, including two inches for the fan exhaust. Twelve inches of space in front of the shelf is required for insertion and removal of the shelf power units and four inches is required for air intake. The shelf may be mounted in either 23 inch (factory shipped) or 26 inch (requires bracket rotation) frameworks. Figure 3-1 illustrates brackets installed for either of the two frame widths.

Step B: Mount the shelf in the frame space using the 12-24 x 5/8 hex-head self-tapping screws provided. A minimum of three screws per side is required, torqued to a minimum of 30 in-lbs.

Input Wiring

The first step in connecting the input wiring is to connect the frame ground. Refer to T-83158-30, Figure H, to connect this ground.

Step C: Remove the input wiring compartment cover (left upper front), using the 5mm Allen wrench provided. Dress the input wiring from the source to the opening on the left side of the shelf. Insure that the input protection devices are either turned off or removed. Terminate the input wiring at the source voltage end following the instructions provided with that equipment. Terminate the input wiring at the shelf end on TB1(+) and TB2(-) using the appropriate crimping tool and the lugs provided with the shelf. See Figure 3-2. Apply the heat-shrink tubing over the exposed portion of the lug barrel; shrink the tubing using the heat gun.

Note: The Monitor and Control Unit may be powered from shelf positions one or two; however, shelf positions one and two must

both be powered to insure continued operation following the failure of one input circuit breaker or fuse.

After the lugs have been terminated in the appropriate positions, torque them to a minimum of 13 in-lbs. Secure the wires to the tie-bar on the left side of the shelf using the cable ties provided.

Note: All input wiring should have a temperature rating of greater than 75° C and must be sized in compliance with local codes based on 60° C ampacity tables. The following table, based on Article 310-16 of the NEC, specifies wire size and protection requirements.

Code	Protection	Wire Size	Crimp Tool
693AA	30A	10 Gauge	WT1300

Plant Monitoring and Control Considerations

A single Monitor and Control Unit may be used to control one or two shelf plants, or plants may be operated without the Monitor and Control Unit. When installed, this unit monitors the plant voltage and current and *also* provides the office alarm interface.

Step D: If a two-shelf plant is required, install the inter-shelf cable assembly (comcode 847059789) from J400 on the rear of the first shelf to J400 on the rear of the second shelf. Connecting this cable requires that the two shelves be mounted one on top of the other. If rear access is not possible, the converters in slots one and two must be removed to install this cable.

Step E: Determine if a Monitor and Control Unit is to be installed. If this unit is not required for this plant, skip to "Distribution Wiring."

General Office Alarm Wiring

Office alarms may be accessed on TB4, located on the left side of the shelf adjacent to the Monitor and Control Unit (see Figure 3-2). These alarms are provided on Form-C, or transfer type contacts, allowing the alarms to be provided as a normally open or normally closed set of isolated contacts. The three contacts associated with each alarm are labeled NC, NO, and C on TB4. When an alarm occurs, or when power is removed from the Monitor and Control Unit, a closure exists between the NC and C contacts. The alarm contacts are rated at 60 volts dc and 0.5 amperes maximum.

Warning: The alarm relay contacts are not fuse protected within the unit since an open fuse may obscure an alarm. Therefore, the current limiting protection for the alarm relay contacts must be designed into the external circuit. Exceeding the maximum rating may result in fire or damage to the unit.

Step F: Wire to the office alarms provided on TB4 as required by the job wiring drawing.

Facilities for remote On/Standby control of the power modules are provided on TB3; see Figures 3-2 and 3-3.

Step G: To force the power modules into the Standby mode, place a short circuit between terminals 5 and 6 (CONV O/S and O/S RTN).

ECS Controller CP1 Wiring

Alarms may be reported to the office using the interface located on TB3 and TB4 or may be reported through the ECS controller. Where appropriate, terminals on TB3 and TB4 are labeled as NEC Class 2 sources.

Step H: If the alarm outputs are to be reported to the office alarm system through an ECS controller, connect wire from TB3 positions 1, 2, and 3 (BATT, AUX PMJ, and AUX PMN) to TB101 on the 113A2 or 113B circuit packs in the ECS controller.

Note: Both reporting methods may be employed (that is, reporting alarms through an ECS and directly to the office alarm systems); however, this practice may be cost prohibitive.

Note: The alarm wiring is governed by the NEC and/or the local building codes. The wire size shall be limited to 22-24 AWG.

ECS Controller CP3 Wiring

Step I: If the datalogger function of an ECS controller (CP3) is used to monitor the plant output current and/or voltage, locate the interface cable (comcode 847099603). Plug the connector end of the cable into the P601 receptacle located on the right side of the shelf (see Figure 3-3). Dress the cable to input terminal blocks TB301 or TB302 on CP3 of the ECS controller. Cut and strip the loose end of this cable to length and terminate. See the Lineage® 2000 ECS controller options product manual, select code 167-790-109, for information on terminal block location and programming the datalogger channel. The P601 outputs are

class-two sources; therefore, the limiting resistors described in the ECS controller product manual are not required.

DC Distribution Wiring

Step J: Remove the cover on the output distribution module using the 5mm Allen wrench provided (see Figure 3-4). Determine the appropriate wire size for each load and return lead. Dress the wire from the load to the output holes in the right of the shelf. Terminate the wire with the proper connector using the proper crimping tool. Apply heat-shrink tubing over the exposed barrel of the lug. Secure the terminated wire to the correct output position, torque to 4.5 in-lbs for the telecomm fuses and 10 in-lbs for all other modules. Strain relief the wires to the tie bar using the cable ties provided. Record the amperage and the load designation for each load on the label provided on the inside of the door.

Monitor and Control Unit

Step K: Insure that the proper Monitor and Control Unit has been ordered and received.

While handling the Monitor and Control Unit, insure that you are properly grounded to prevent ESD induced failures. Insert the Monitor and Control Unit into the lower left of the shelf (see Figure 3-3). A firm push on the right edge of the front face plate will seat the connector; the face plate should now be flush with the input cover on the shelf.

Note: To seat the Monitor and Control Unit, the removal latch must be in full upright position. Install the latch cover using the 5mm Allen wrench provided (torque to a maximum of 12 in-lbs).

Installing Converters in a New Plant

Step L: Insure that the proper power modules have been ordered and received.

Insure that each module's "On/Standby" switch is in the "Standby" position. Insure that the input power to the shelf is disconnected by turning the circuit breakers off or by removing the fuses. Install each module by placing it on the shelf and carefully sliding it toward the backplane until the module's mounting screw prevents any further backward motion. Using the 5mm Allen head wrench provided, seat the modules by turning their mounting screws clockwise.

Initial Start-up and Checkout

Step M: Apply power to the modules by turning the circuit breakers on or installing the input fuses.

- Verify that the yellow standby LED lights on all power modules.
- If two or more power modules are installed, verify the PMN and PMJ LEDs are lit on the Monitor and Control Unit.
- If only one power module is installed, verify that only the PMN LED is lit.
- Set the converter plant voltage to the desired output voltage by adjusting the “V adj” potentiometer on the Monitor and Control Unit.
- Simulate a distribution alarm: insert a blown fuse in the fuse distribution modules or place a clip lead between the upper distribution block and the alarm bus in the circuit breaker distribution module. See Figure 2-2 for the location of the clip lead. Blown SAN-O fuses are required to test the Telecommunications Fuse Module. Blown 70A alarm fuses are required to test the 74-type Distribution Module. See Figure 2-3 for the location of the alarm fuse.
- Verify that the simulated distribution alarms light the MJF and PMJ LEDs on the Monitor and Control Unit.
- Clear these alarms by removing the blown fuses or clip lead.
- Press the Lamp Test switch on the Monitor and Control Unit. Verify that all plant LEDs are lit and the meter segments are illuminated while the switch is pressed.
- Place a test load across TB5 and TB6 in the output distribution module. Verify that the power modules can deliver output power by noting plant voltage and current on the meter located on the Monitor and Control Unit.
- Set the plant voltage using the VADJ potentiometer located on the Monitor and Control Unit (as needed).
- Remove the test load.

Note: The system load may be used instead of a test load to test the plant's capacity to deliver power.

Adding Power Modules to a Working Plant

Step N: The power module may be added with input power applied and the power unit switch in the ON position. To install the module, place it on the shelf and slide it toward the backplane until the mounting screw prevents any further backward motion. Using the 5mm Allen head wrench provided, seat the module by turning the mounting screw clockwise. If required, turn the power module on.

Installing Output Protection Fuses or Circuit Breakers

Step O: For installation in new plants:

- Verify that all power units are in standby.
- Install circuit breakers or fuses.
- Turn the power unit on.

Note: The alarm circuits in power modules are tested during power-up. The red alarm LED on the power units will light momentarily during turn-on to verify that the alarm circuits are operational.

Step P: Installing Output Distribution in Working Plants:

To install fuses for loads being added to a plant, or replacing blown fuses, simply install the fuse. In 74-type distribution modules, install the 74-type fuse first and then install the 70A alarm fuse.

To install circuit breakers for loads being added to the plant, *verify that the circuit breaker is off.* Install the breakers and turn them on.

Final Set-Up

Step Q: Replace all the removed covers. Insure that no alarm LEDs are lit on the Monitor and Control Unit.

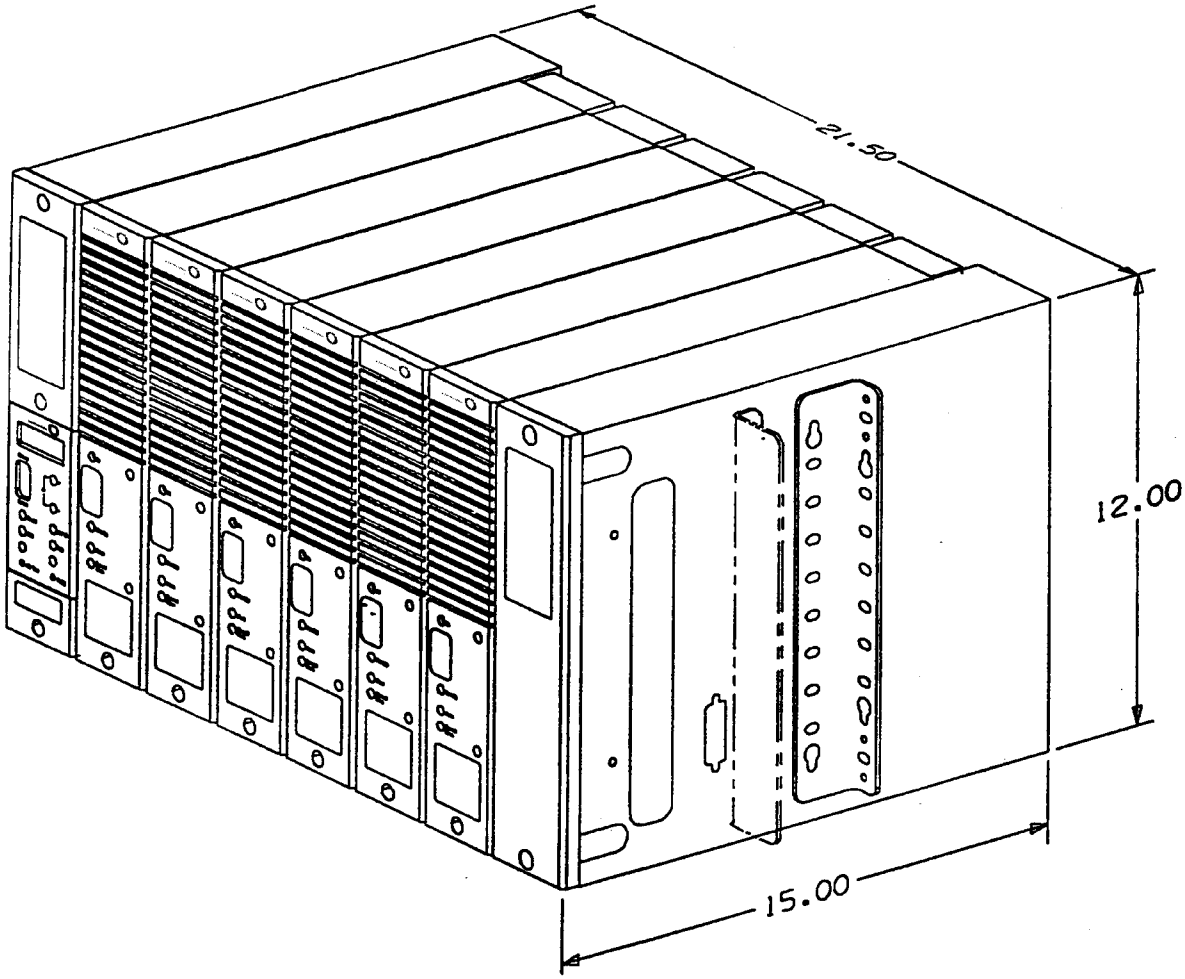

Figure 3-1: FPS DC/DC Converter Plant (Mounting Bracket Shown Reversed)

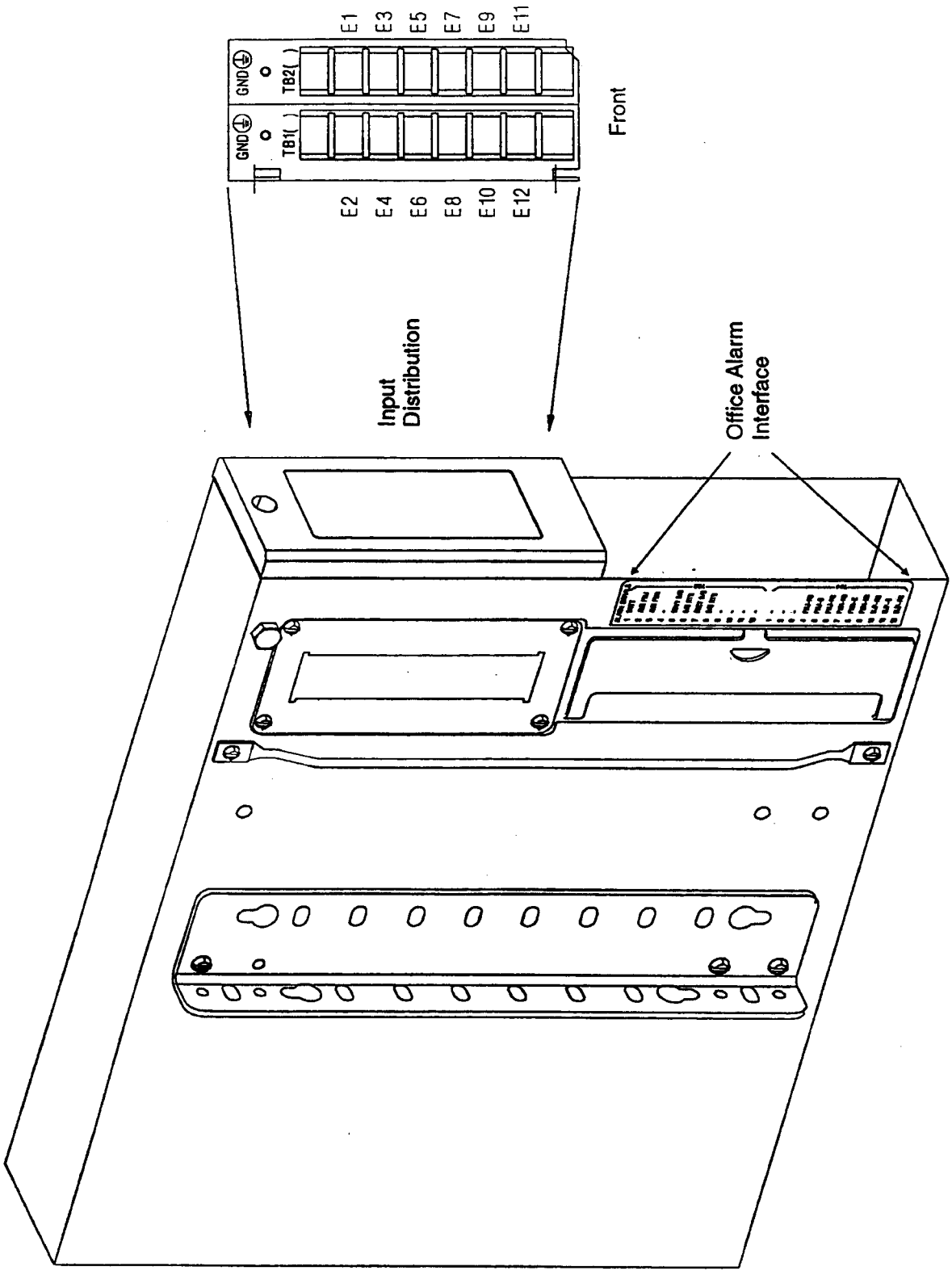

Figure 3-2: Input Distribution and Office Alarm Interface

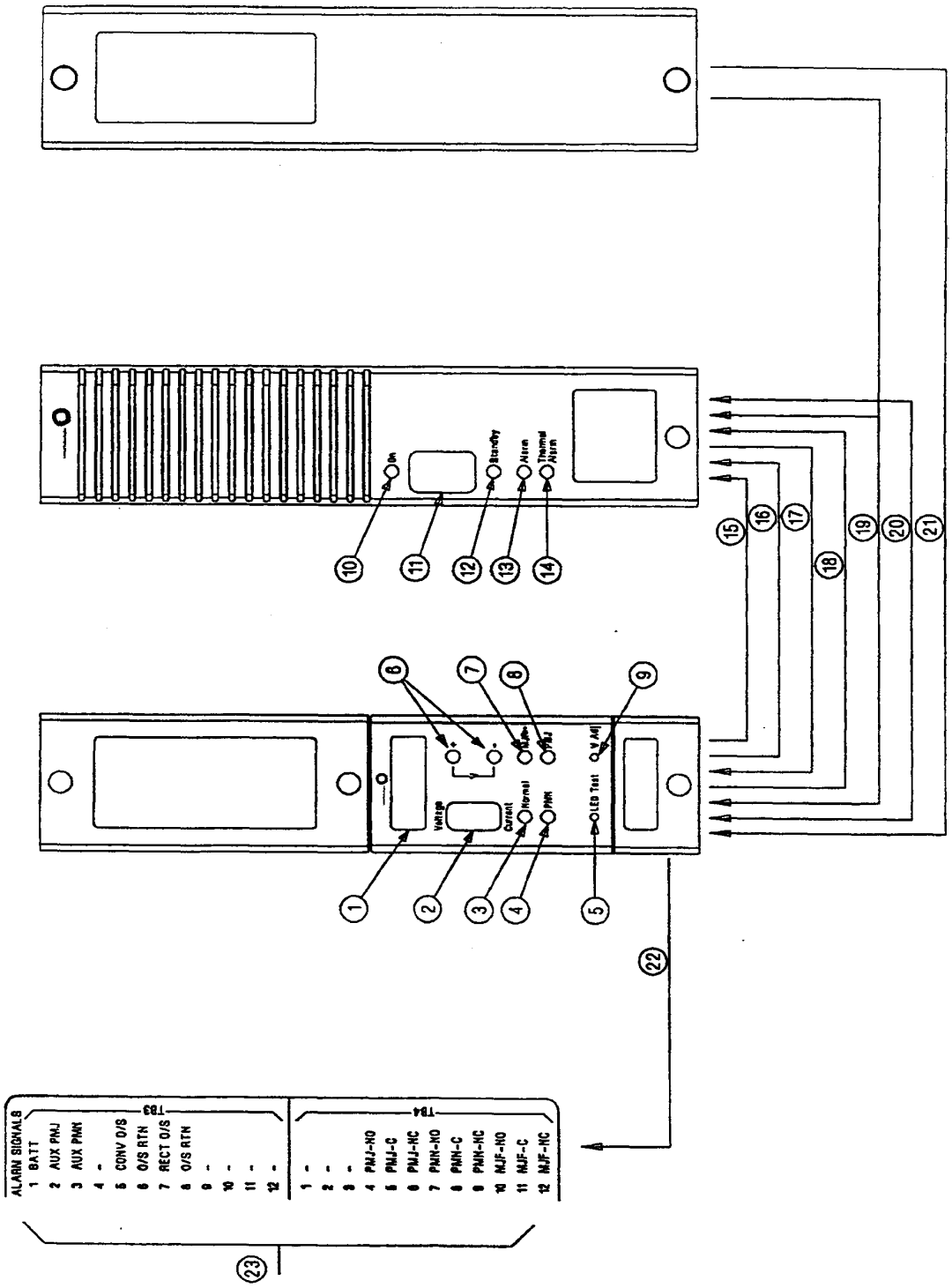

Figure 3-3: Alarm Interface

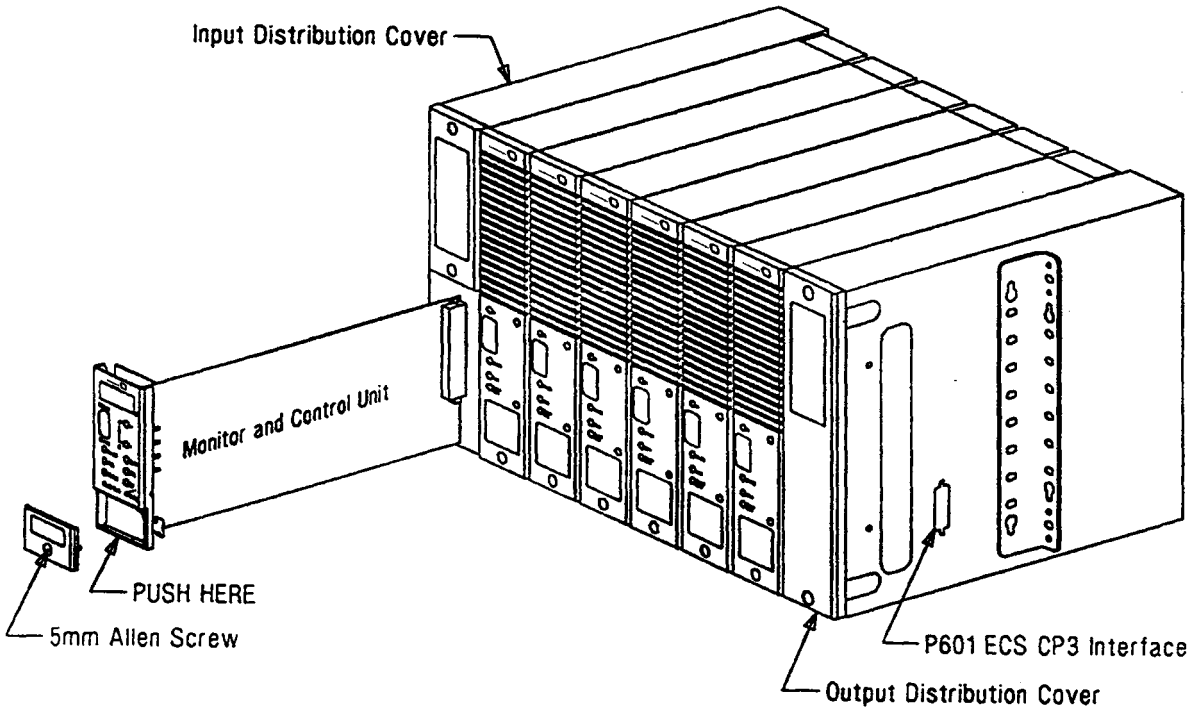

Figure 3-4: FPS DC/DC Converter Plant (Monitor and Control Unit Removed)

4 Displays, Controls, and Interface Signals

General

The following information provides a functional description of the displays, controls and interface signals associated with normal plant operations and maintenance procedures. The FPS series converter and the Monitor and Control Unit are shown in Figure 4-1. Each item identified by an index number is listed and described below.

Displays and Controls

The plant operational controls and status indicators are listed below and shown in Figure 4-1.

1. **Digital volt/ampere meter:** A three-digit, backlit, LCD meter which displays plant voltage or plant current for FPS Converter Plants and rectifier plant voltage and current for FPS Rectifier/Converter Plants.

2. **Meter select switch:** A two position switch used to select the plant output, volts or current, to be displayed on the plant meter.

3. **Normal:** This green LED lights while the plant converters are operating normally and are able to furnish power to the load. While in this operational mode, the converters can be switched to the standby mode by a control signal originated by the customer and routed to the converter through the Monitor and Control Unit (interface signals 15 and 22).

4. **Power Minor alarm (PMN):** A yellow LED which lights to signify one or more of the following conditions: one converter alarm (13) or one converter in Standby (12).

5. **LED Test:** When depressed, this momentary closure switch lights all plant status LEDs and all segments on the plant meter.

6. **Voltage test jacks:** Test jacks are provided to measure the plant output voltage in FPS Converter Plants and the plant rectifier output voltage in FPS Rectifier/Converter Plants.

7. **Major Fuse alarm (MJF):** A red LED which lights to signify that an output distribution fuse or circuit breaker has operated while exposed to excessive current. Manual operation of the circuit breakers typically does not cause an MJF alarm.

8. **Power Major alarm (PMJ):** A red LED which lights to signify one or more of the following conditions: two or more converter alarms (13), two or more converters in Standby (12), or a major fuse alarm (7).

9. **Voltage Adjustment (V Adj):** A screwdriver adjustable, recessed potentiometer which adjusts the plant output voltage for FPS Converter Plants and the plant rectifier output voltage for FPS Rectifier/Converter Plants.

10. **On:** This green LED lights while the converter is operating normally and is able to furnish power to the load. While in this operational mode, the converter can be switched to the standby mode under local control (11) or by a control signal originated by the customer and routed to the converter through the Monitor and Control Unit.

11. **Power On/Standby switch:** This two-position switch determines the operation status of the converter.

12. **Standby:** This yellow LED lights while the converter is in the standby mode. In this mode, the converter control and alarm circuits are powered; however, the power circuits are inhibited to prevent the converter from producing output power. To switch the converter from Standby to On, both the local and remote control signals must be switched to the power On state.

13. **Alarm:** This red LED lights to indicate that the converter has shut down due to an output undervoltage condition, a thermal alarm, or an operated internal fuse.

14. **Thermal Alarm:** This red LED lights when the converter shuts down due to inadequate air flow indicating possible intake air blockage, fan failure or inlet air temperature above 122 degrees Fahrenheit (50 degrees Celsius).

Interface Signals

This section describes the interface signals between FPS series converters, the Monitor and Control Unit, and the Output Distribution Unit.

15. **On/Standby Control:** A plant Monitor and Control Unit originated signal which controls the operational status of the converter. When the signal is present, the converter is forced into the standby mode.

16. **Output Voltage Adjust**: A plant Monitor and Control Unit originated control voltage which sets the converter output voltage to the desired value within the converter operating voltage range. For controllerless operation, the converter output is internally adjusted to the nominal voltage.

17. **Output Current Monitor:** A signal provided to the plant Monitor and Control Unit proportional to the converter output current.

18. **LED Test:** A plant Monitor and Control Unit originated signal which tests the converter status LEDs. When the signal is present all LEDs illuminate.

19. **Alarm Return (AR):** A signal path between the Monitor and Control Unit and both rectifiers and converters in FPS power plants that provides a common return path for signals 18, 20, and 21.

20. **Converter Alarm:** A signal to the Monitor and Control Unit indicating low rectifier output voltage resulting from a converter failure or excess load.

21. **Distribution Alarm:** Signal path between the distribution module and the Monitor and Control Unit. When the signal is present the MJF alarm lights.

22. **Signal interface:** Signal path between the Monitor and Control Unit and the customer interface panel (TB3 and TB4).

23. **Office Alarms:** The office alarm tie-points and control signal access points listed below are available to facilitate monitor and control of the FPS plant.

- **TB3-1 BATT:** Supplies battery voltage to the Monitor and Control Unit from an outside source.
- **TB3-2 AUX-PMJ:** Closure to BATT through a 4.7K resistor occurs when the Monitor and Control Unit issues a PMJ.
- **TB3-3 AUX-PMN:** Closure to BATT through a 4.7K resistor occurs when the Monitor and Control Unit issues a PMN.
- **TB3-5, 6 CONV O/S, O/S RTN:** Closure between tie-points 5 and 6, supplied by the user, causes all installed converters to go into the Standby mode.
- **TB3-7, 8 RECT O/S, O/S RTN:** Closure between tie-points 7 and 8, supplied by the user, causes all installed rectifiers to go into the Standby mode.
- **TB4-4, 5, 6 PMJ-NO, PMJ-C, PMJ-NC:** Open between NO and C and closure between NC and C occur when the Monitor and Control Unit issues a PMJ.
- **TB4-7, 8, 9 PMN-NO, PMN-C, PMN-NC:** Open between NO and C and closure between NC and C occur when the Monitor and Control Unit issues a PMN.
- **TB4-10, 11, 12 MJF-NO, MJF-C, MJF-NC:** Open between NO and C and closure between NC and C occur when the Monitor and Control Unit issues a MJF.

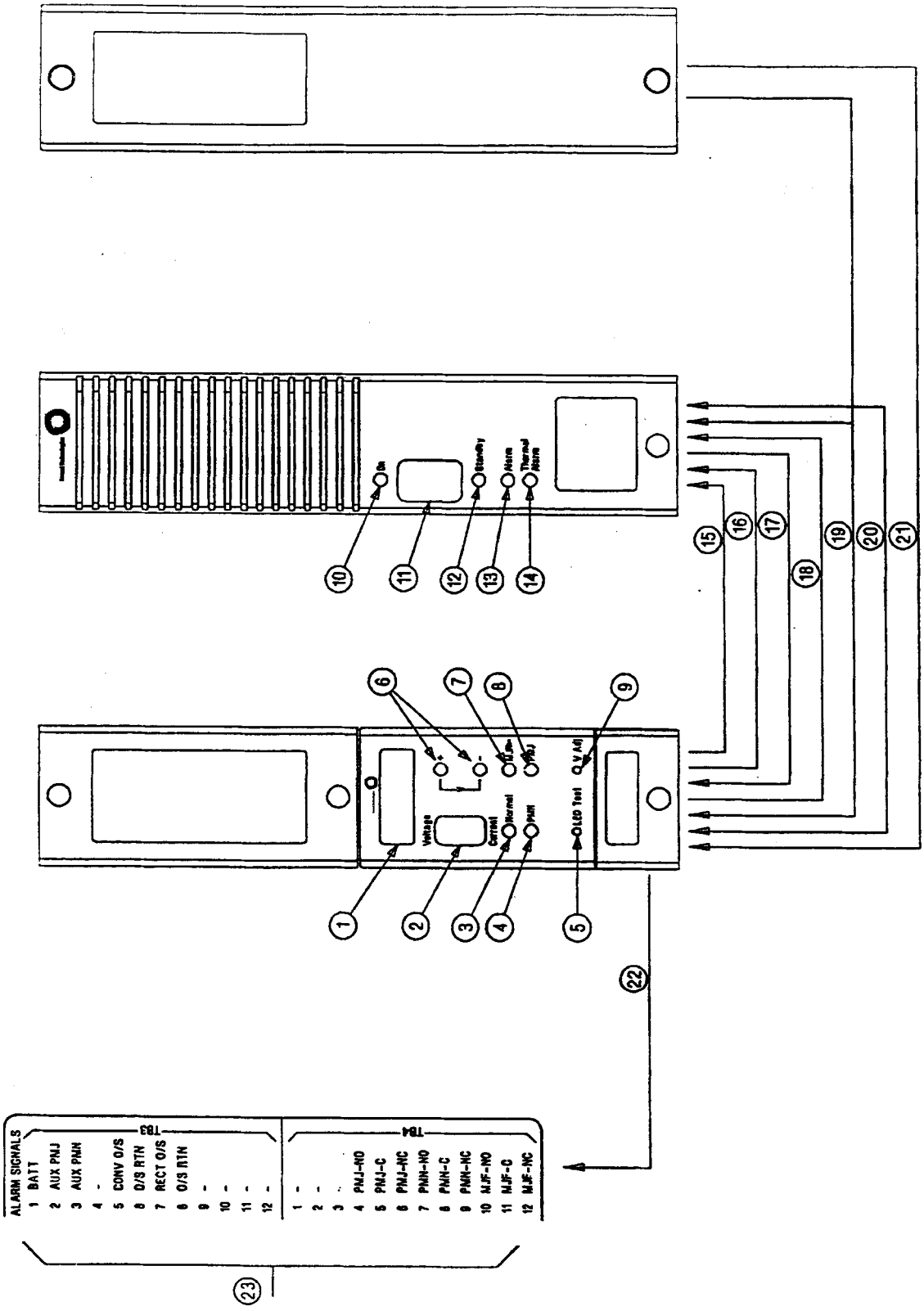

Figure 4-1: Functional Description

5 Ordering Information

The tables below, taken from drawing J-85500K-1, provide ordering information for FPS system growth and/or spare parts.

Table 5-A: J85500K-1 Apparatus Codes

Comcode	Code	Description	Circuit Option
106676299	693AA	24Vdc to 48Vdc Converter	B
106938764	115B	Monitor and Control Unit (24V in conv)	Z

Table 5-B: J85500K-1 Spare Parts

Comcode	Description	Circuit Option
106676299	693AA Converter	3 per service area
106938764	115B Monitor and Control Unit	1 per service area
405006222	1/4A (AXI with SAX Safety Cover, SAN-O)	2 per system
406976894	1/2A (AXI with SAX Safety Cover, SAN-O)	2 per system
405673146	1-1/3A (AXI with SAX Safety Cover, SAN-O)	2 per system

Table 5-B: J85500K-1 Spare Parts

Comcode	Description	Circuit Option
405181983	2A (AXI with SAX Safety Cover, SAN-O)	2 per system
406976985	3A (AXI with SAX Safety Cover, SAN-O)	2 per system
406159061	5A (AXI with SAX Safety Cover, SAN-O)	2 per system
405725433	7-1/2A (AXI with SAX Safety Cover, SAN-O)	2 per system
406159236	10A (AXI with SAX Safety Cover, SAN-O)	2 per system
406976886	1-1/4A (74A) Fuse	2 per system
406976910	3A (74B) Fuse	2 per system
406976977	5A (74C) Fuse	2 per system
406977017	7-1/2A (74J) Fuse	2 per system
406976993	10A (74D) Fuse	2 per system
406977009	15A (74E) Fuse	2 per system
406977538	20A (74F) Fuse	2 per system
406977520	1/2A (70G) Alarm Fuse,	4 per system
847017548	Module Fan Assembly	6 per service area

Table 5-C: J85500K-1 Miscellaneous Equipment

Comcode	Description	Circuit Option
406746313	3A (KS-23616 L20) Plug-in Circuit Breaker	AA
406746321	5A (KS-23616 L21) Plug-in Circuit Breaker	AB
406746339	10A (KS-23616 L22) Plug-in Circuit Breaker	AC
406746347	15A (KS-23616 L23) Plug-in Circuit Breaker	AD
406746354	20A (KS-23616 L24) Plug-in Circuit Breaker	AE
406746362	30A (KS-23616 L25) Plug-in Circuit Breaker	AF
405006222	1/4A (AXI with SAX Safety Cover, SAN-O)	AG
406976894	1/2A (AXI with SAX Safety Cover, SAN-O)	AH
405673146	1-1/3A (AXI with SAX Safety Cover, SAN-O)	AI
405181983	2A (AXI with SAX Safety Cover, SAN-O)	AJ
406976985	3A (AXI with SAX Safety Cover, SAN-O)	AK
406159061	5A (AXI with SAX Safety Cover, SAN-O)	AL
405725433	7-1/2A (AXI with SAX Safety Cover, SAN-O)	AM
406159236	10A (AXI with SAX Safety Cover, SAN-O)	AN
406976886	1-1/4A (74A) Fuse	AO
406976910	3A (74B) Fuse	AP
406976977	5A (74C) Fuse	AQ
406977017	7-1/2A (74J) Fuse	AR

Table 5-C: J85500K-1 Miscellaneous Equipment

Comcode	Description	Circuit Option
406976993	10A (74D) Fuse	AS
406977009	15A (74E) Fuse	AT
406977538	20A (74F) Fuse	AU
406977520	1/2A (70G) Alarm Fuse	
847059797	Cable Assembly Power Shelf to ECS CP3	
847198637	Cable Assembly VR to BBU Power	
107044471	115B Product Manual	
107006215	693AA Product Manual	
107100851	Plant Product Manual	
846801819	Product Manual Binder	

6 Product Warranty

A. Seller warrants to Customer only, that:

1. As of the date title to Products passes, Seller will have the right to sell, transfer, and assign such Products and the title conveyed by Seller shall be good;
2. Upon shipment, Seller's Manufactured Products will be free from defects in material and workmanship, and will conform to Seller's specifications or any other agreed-upon specification referenced in the order for such Product;
3. With respect to Vendor items, Seller, to the extent permitted, does hereby assign to Customer the warranties given to Seller by its vendor of such Vendor Items, such assignment to be effective upon Customer's acceptance of such Vendor Items. With respect to Vendor items recommended by Seller in its specifications for which the vendor's warranty cannot be assigned to Customer, or if assigned, less than Sixty (60) days remain of the vendor's warranty or warranty period when the Vendor's items are shipped to Customer or when Seller submits its notice of completion of installation if installed by Seller, Seller warrants that such Vendor's Items will be free from defects in material and workmanship on the date of shipment to Customer. In such an event, the applicable Warranty Period will be sixty (60) days.

B. The Warranty Period listed below is applicable to Seller's Manufactured Products furnished pursuant to this Agreement, unless otherwise stated:

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.

THE FOREGOING WARRANTIES ARE EXCLUSIVE AND ARE IN LIEU OF ALL OTHER EXPRESS AND IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CUSTOMER'S SOLE AND EXCLUSIVE REMEDY SHALL BE SELLER'S OBLIGATION TO REPAIR, REPLACE, CREDIT, OR REFUND AS SET FORTH ABOVE IN THIS WARRANTY.