

"LINEAGE*" 2000
MICROPROCESSOR CONTROLLED SYSTEM BATTERY PLANT
DESCRIPTION

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E. Rectifier (J87436A)	14	1. GENERAL	
F. Rectifier (J87437A)	14	1.01 This practice describes the physical and functional characteristics of the LINEAGE 2000 Microprocessor Controlled System (MCS) battery plant (Fig. 1).	
G. Rectifier (J87438A)	14	1.02 Whenever this practice is reissued, the reason(s) for reissue will appear in this paragraph.	
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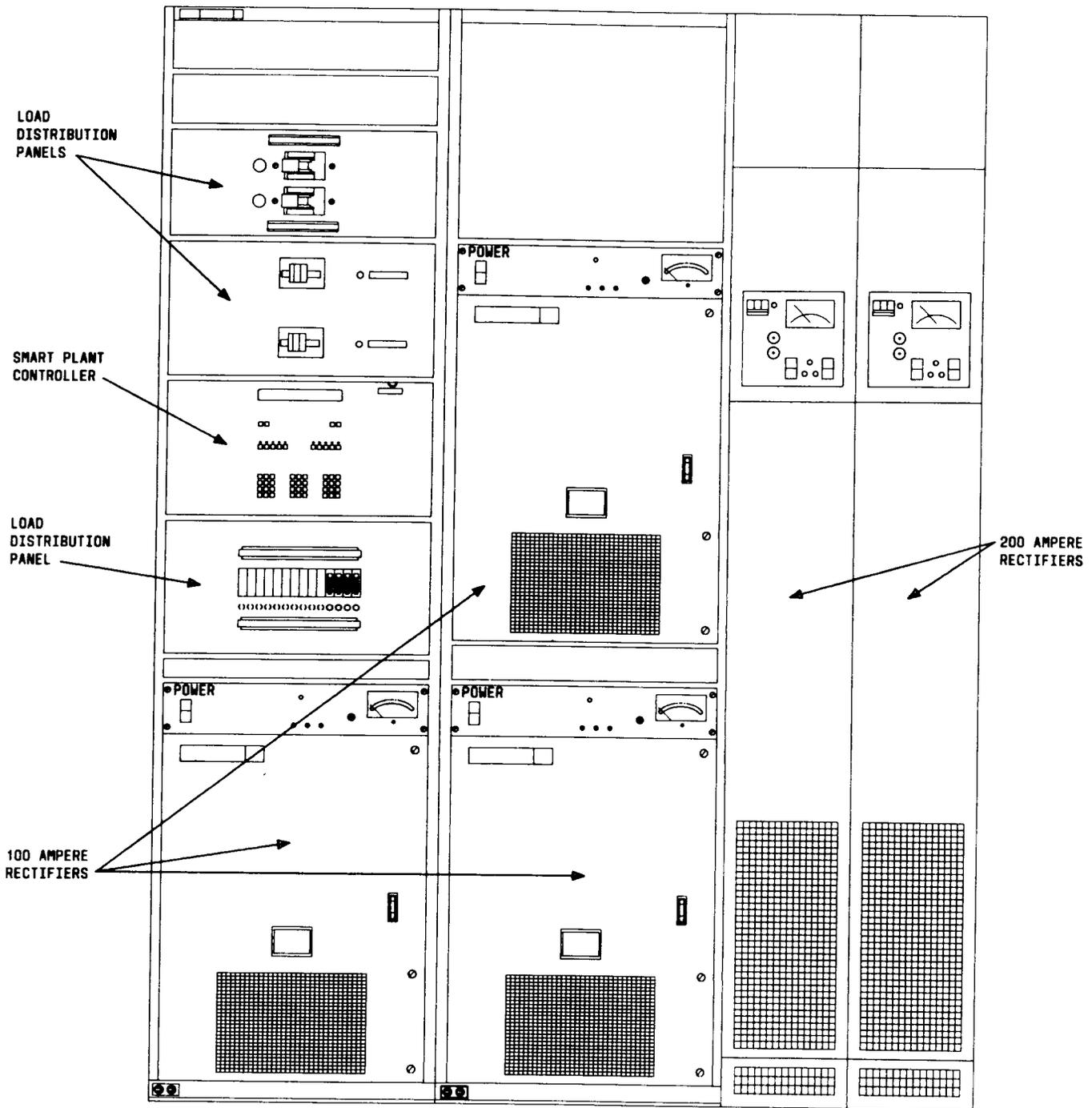


Fig. 1 — Typical Plant Application Using Smart Controller

1.03 The plant described in this practice is a 24- or 48-volt, positive or negative plant which provides power for the loads as well as float and recharge capability for the battery string(s). The plant can supply up to 3200 amperes of current (including charge/recharge current).

1.04 The plant is available as either an automatic microprocessor controlled smart plant or a conventional plant. A conventional plant may be upgraded to a smart plant at a later date.

1.05 This issue of the practice is based on the following circuit schematic drawings:

SCHEMATIC	TITLE
SD-82397-01, Issue 8B	Power Systems, Rectifier, 208/240-, 220/240-, or 480-Volt, 60-Hz Input; 24-Volt, 100-Ampere Output (J87436A)
SD-82398-01, Issue 8B	Power Systems, Rectifier, 208/240-, 220/240-, or 480-Volt, 60-Hz Input; 48-Volt, 100-Ampere Output (J87437A)
SD-82399-01, Issue 6D	Power Systems, Rectifier, 208/240-, 220/240-, or 480-Volt, 60-Hz Input; 24-Volt, 200-Ampere Output (J87438A)
SD-82400-01, Issue 8B	Power Systems, Rectifier, 208/240-, 220/240-, or 480-Volt, 60-Hz Input; 48-Volt, 200-Ampere Output (J87439A)
SD-82588-01, Issue 1	LINEAGE 2000 Controller, for 24- or 48-Volt Power Plants (J85501A)
SD-82603-01, Issue 1	LINEAGE 2000 Battery Plant, 24 or 48 Volts, 3200 Amperes Maximum (J85500A)

If this practice is used with equipment or apparatus that is associated with earlier or later issues of the drawings, refer to the SDs to determine the extent of the changes and the manner in which the practice may be affected.

2. PHYSICAL DESCRIPTION

A. Introduction

2.01 The power plant consists of one initial bay with optional supplementary bay(s), rectifiers, one initial battery string with optional supplementary string(s), and external discharge ground bars(s). The initial bay contains the plant control unit, optional discharge circuit breaker, fuse panel(s), and optional capacitor filter charger/modem panel. The initial bay may also be equipped with one 100-ampere rectifier in the lower part of the bay. Each supplementary bay may be equipped with one or two 100-ampere rectifier(s). The supplementary bays may also be equipped with additional discharge circuit breakers and fuses. Free standing, floor mounted 200-ampere rectifiers may be used instead of, or in combination with bay mounted 100-ampere rectifiers with the plant. The bays are 26 inches wide, 84 inches high, and are available 12 or 15 inches deep.

B. Plant Controller (Smart Plant)

2.02 The power plant controller for the smart plant (Fig. 2) measures 9 inches high, 26 inches wide, and 12 inches deep. The front panel contains a 40-character, single-line alphanumeric vacuum fluorescent display (VFD). Red membrane switch pads are used to access major alarm information. Yellow membrane switch pads are used to access minor alarm information. A blue membrane switch keypad (numeric keypad) is provided to enter rectifier or feeder number(s), to perform alarm cutoff (ACO), and to set the system 24-hour clock. Gray membrane switch pads are used to access various standard and optional plant feature functions.

C. Plant Controller (Conventional Plant)

2.03 The power plant controller for the conventional plant (Fig. 3) measures 9 inches high, 26 inches wide, and 12 inches deep. The front panel con-

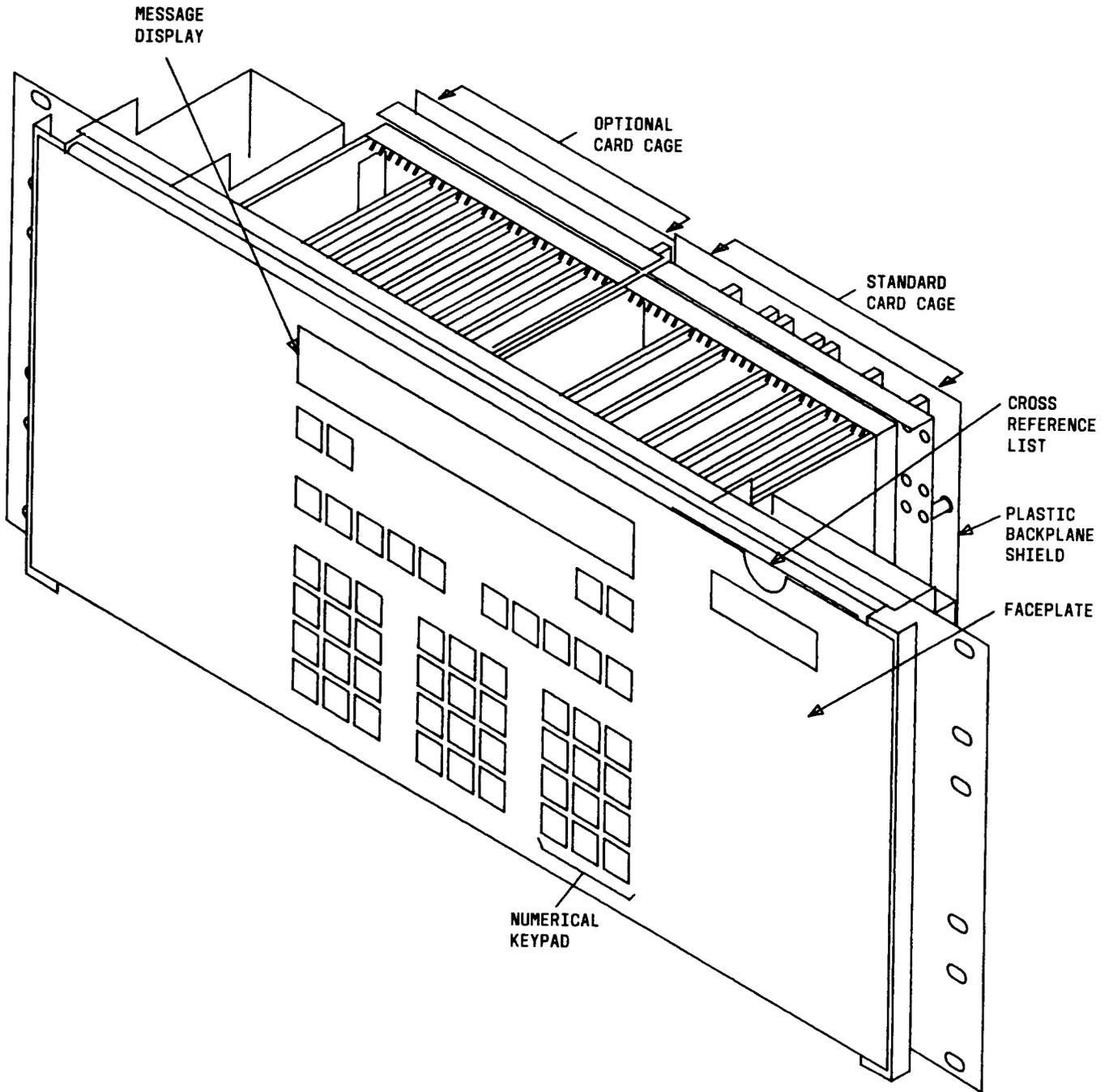


Fig. 2—Smart Plant Controller

tains the PLANT VOLTAGE and PLANT LOAD CURRENT analog meters. Test jacks [VM CAL (+) and (-)] are located on the front panel for PLANT VOLTAGE meter calibration. Alarm indicators give a visual indication of the cause of alarms.

D. Rectifier (J87436A and J87437A)

2.04 The J87436A and J87437A, 100-ampere rectifiers are designed to mount in a standard equipment bay. The rectifiers are designed to be serviced from the front. The rectifiers are 31 inches high, 12 inches deep, 21.25 inches wide, and can be mounted in a 26-inch relay rack. The circuits associated with

alarm, power control, voltage regulation, current limiting, voltage walk-in, restart, and plant interface are mounted on replaceable circuit packs (CPS SP1 and CPS SP2 in the conventional plant or CPS SP7 and CPS SP2 in the smart plant). Input and output power connections, filter capacitors, ac contactor, dc breaker, and printed circuit packs are accessible through a door in the front of the cabinet.

E. Rectifier (J87438A and J87439A)

2.05 The J87438A and J87439A, 200-ampere rectifiers are designed to stand alone and may be fastened directly to the floor. Multiple rectifier units

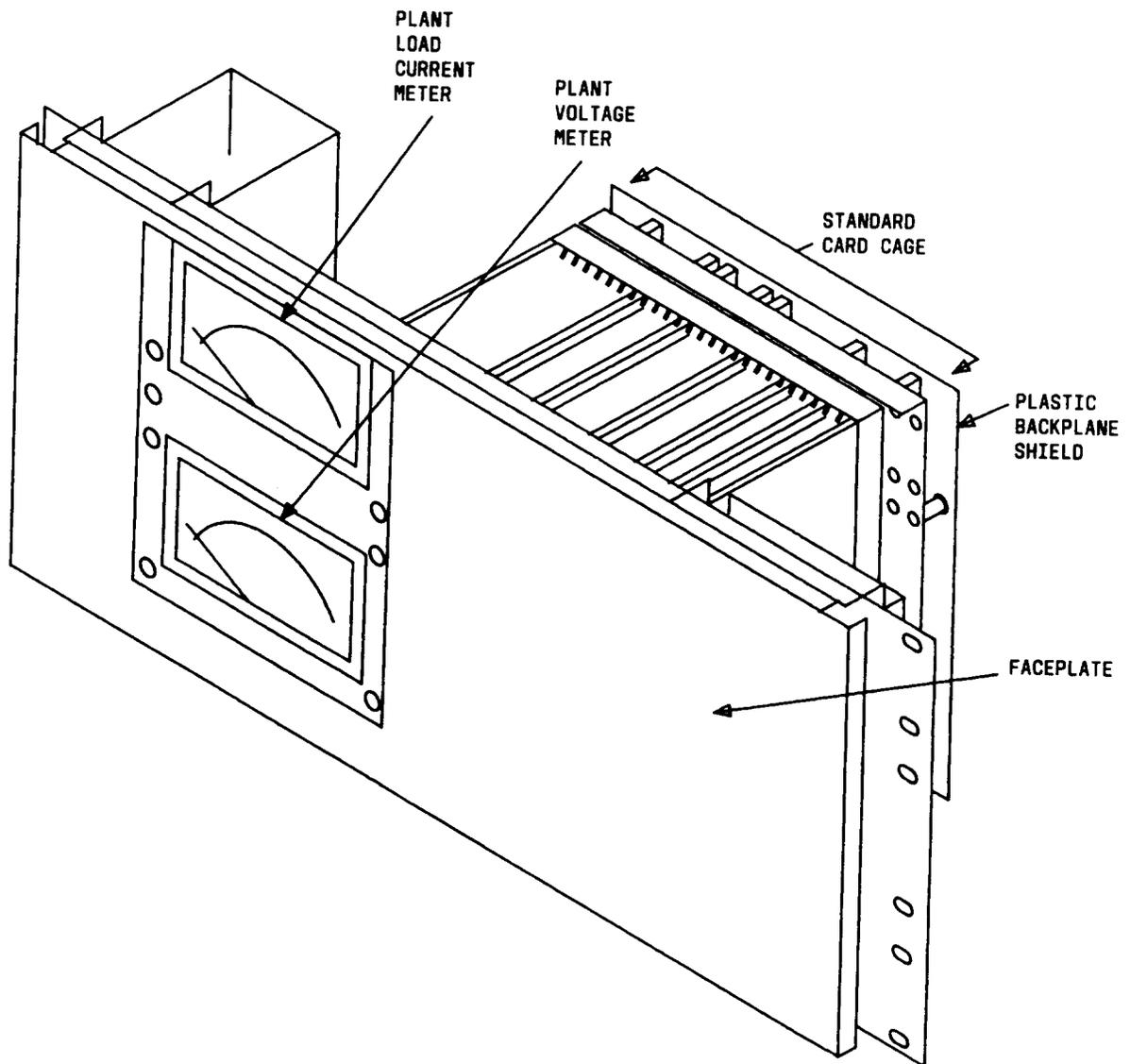


Fig. 3—Conventional Plant Controller

may be bolted side-to-side or back-to-back. The rectifiers are designed to be serviced and maintained from the front. The rectifiers are 84 inches high, 15 inches deep (16.38 inches deep including front doors), and 13 inches wide. The circuits associated with alarm, power control, voltage regulation, current limiting, voltage walk-in, restart, and plant interface are mounted on replaceable circuit packs (CPS SP1 and CPS SP2 in the conventional plant or CPS SP7 and CPS SP2 in the smart plant). Input and output power connections, filter capacitors, ac contactor, dc breaker, and printed circuit packs are accessible through a door in the front of the cabinet.

3. FUNCTIONAL DESCRIPTION

A. General

3.01 The plant is a 24- or 48-volt, positive or negative plant designed to provide power for the loads as well as battery float and recharge capability. Current output options range through 3200 amperes maximum (including spare rectifier, charge, and recharge capacity).

B. Smart Plant

3.02 The smart plant uses a microprocessor controller to monitor the plant current, voltage, alarm, status, sanity, etc. The controller determines load current, float, and recharge requirements. Individual rectifiers are monitored and checked continuously for rectifier data, status, output current, alarms, and malfunctions. Periodically the microprocessor runs a self-diagnostic test and a system test to detect malfunctions. Refer to Fig. 4 for the smart plant interface block diagram.

3.03 The front panel of the controller (Fig. 5) has a black polymer face and contains the following:

- A 40-character, single-line alphanumeric vacuum fluorescent message display
- Major alarm indicators/controls
- Minor alarm indicators/controls
- Specific system function controls

- Numeric keypad
- Rect and Feeder Assignment Cross Reference List.

The message display informs the operator in plain English, of test, current and voltage measurements, and trouble diagnostics. The major alarm controls access the reason(s) for major alarms. The reason(s) for major alarms appear on the message display. The minor alarm controls access the reason(s) for minor alarms. The reason(s) for minor alarms appear on the message display. The specific system function controls allow the operator to run tests on the plant and access plant operating data. The numeric keypad is used to set the system clock and to select the rectifier to be checked.

3.04 A maximum of 16 rectifiers may be controlled by the smart plant controller. If there are eight or less rectifiers, one ED-83008 (smart plant) rectifier signals circuit pack (CP4) is required. If 9 to 16 rectifiers are equipped in the plant, two ED-83008 (smart plant) rectifier signals circuit packs (CP4) are required.

3.05 *Plant Voltage Alarms and Shutdown Levels:* The plant is equipped with two low-voltage alarms and one high-voltage shutdown. The voltage alarms and shutdown are as follows.

- (a) ***Battery Dischrg:*** The plant issues a Battery Dischrg alarm if the battery voltage drops to 25.5 volts for a 24-volt plant or 51.25 volts for a 48-volt plant.
- (b) ***Low Voltage 2:*** The plant issues a Low Voltage 2 alarm if the battery voltage drops to 24 volts for a 24-volt plant or 48.25 volts for a 48-volt plant.
- (c) ***High Battery Voltage:*** The plant will shut down any rectifier(s) which drives the voltage high (26.75 volts for a 24-volt plant or 53 volts for a 48-volt plant).

3.06 *Plant Alarm Output:* The smart plant is equipped with alarm outputs in fours. Plant alarm outputs may be connected to local office audible alarms, local office visual alarms, status indicator (SI) leads, Electronic Switching System alarm scanners, and/or other locally selected alarm systems. When connecting alarm leads to the controller, contact protected relays are required.

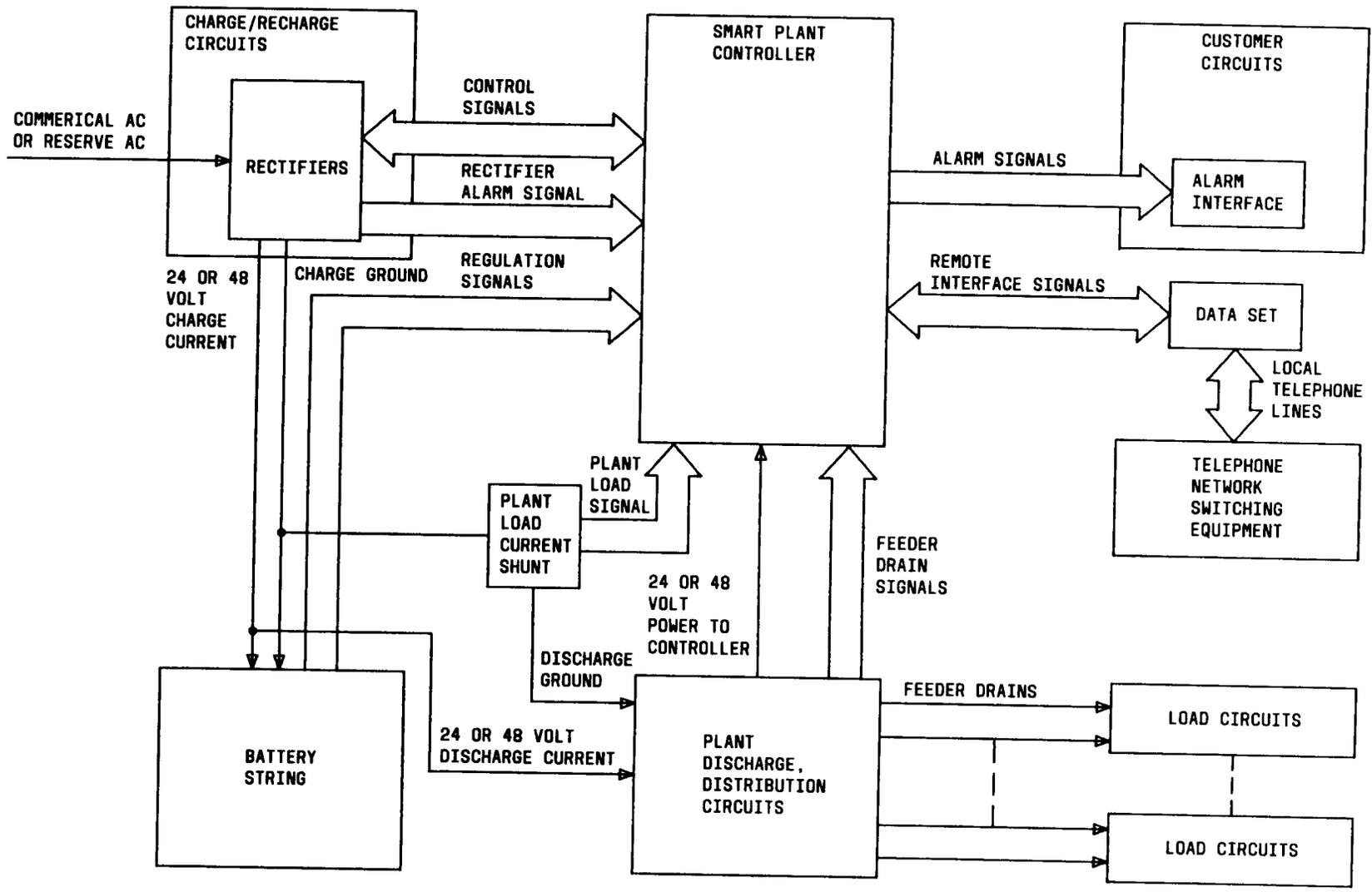


Fig. 4—Smart Plant Interface Block Diagram

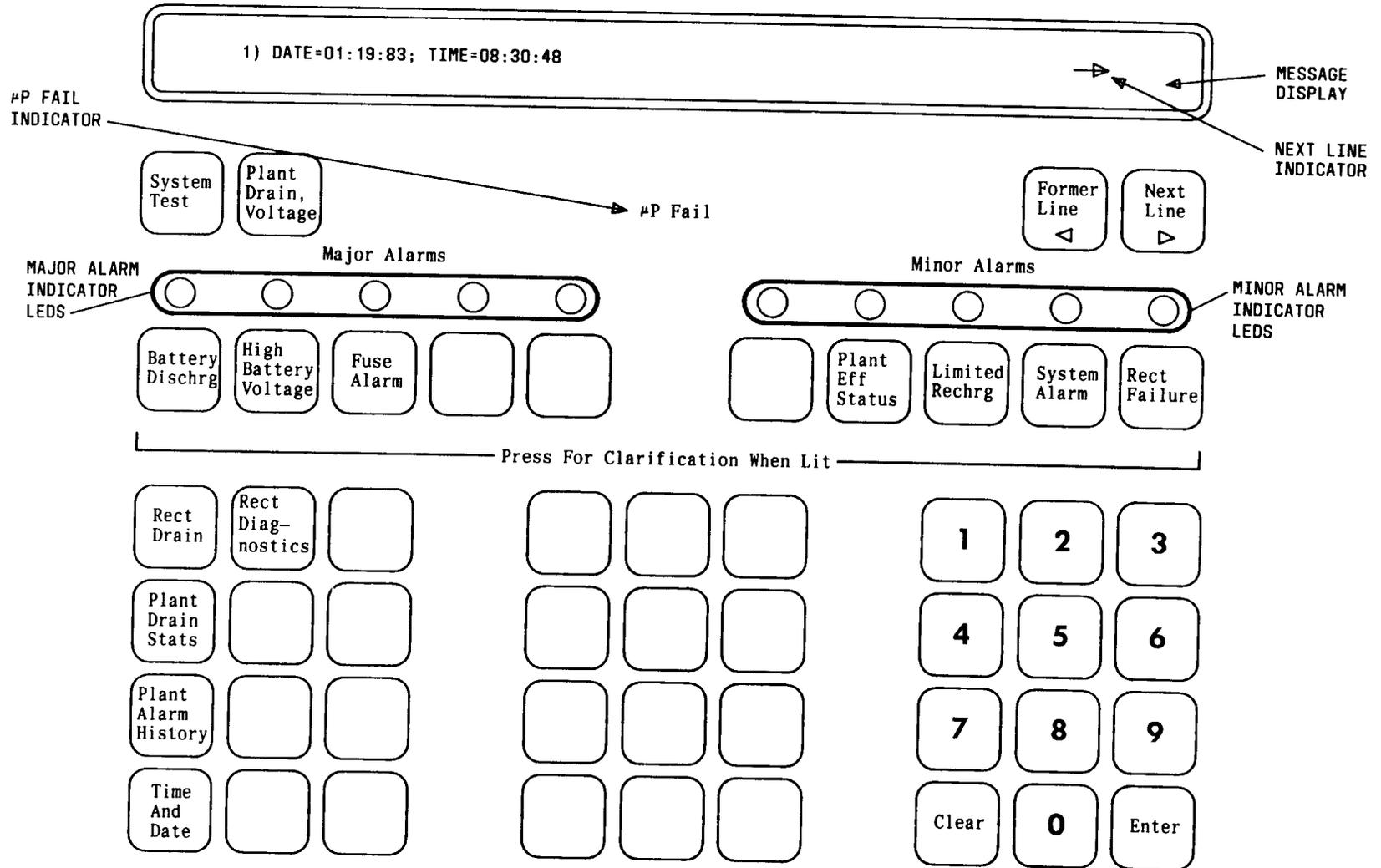


Fig. 5—Smart Plant Controller Controls

3.07 Plant Efficiency Algorithm: The smart plant compares the actual current requirement (the current drain for the loads plus recharge current for the battery), with the number, capacity, and types of rectifiers on line. The controller then turns off any rectifier(s) (the least efficient first), not needed to supply the load. When the load current increases, the controller turns on rectifier(s) (the most efficient first), to meet the demand. As a fail safe system, should the microprocessor system ever fail, the efficiency algorithm turnoff signal is removed and rectifiers (turned off by the smart plant controller), automatically turn on. In addition, each rectifier is turned on at least once a month. The plant efficiency algorithm may be disabled by operating EFF DIS switch (S1) on the ED-83009 PLANT SIGNAL circuit pack (CP5). All rectifier turnoff signals will be removed as long as the plant efficiency is disabled.

3.08 Peg Count Output: The smart plant controller will interface with the Engineering Administrative Data Acquisition System (EADAS) to provide peg count. The controller sends 1000 pulses per hour (pph) at full load, 500 pph at half load, etc. The controller averages the load every minute and sends 16.6 pulses per minute (ppm) at full load, and 8.3 ppm at half load, etc. The contact will be closed for 1 second and opened for 2.6 seconds at full load. The contact will be closed for 1 second and opened for 6.2 seconds at half load, etc.

3.09 Rectifier Interface and Addressing:
The smart plant is interfaced with the rectifiers by the CPS SP7 circuit pack in each rectifier.

3.10 Rectifier Monitoring: The smart plant monitors each individual rectifier for the following:

- OUTPUT CIRCUIT BREAKER ON or OFF
- POWER switch ON or OFF
- Rectifier fuse operated (blown)
- Rectifier current drain
- Rectifier alarm
- Rectifier shutdown

- Type of rectifier
- Rectifier turned down by efficiency algorithm
- Phase failure (3-phase) or loss of AC (single-phase).

3.11 Accessing Smart Plant Information: To access information from the smart plant, press and release the desired switch and observe the message display for data and/or instructions. If two switches are pressed at the same time, or if a second switch is pressed before the audible feedback (beep) occurs, a microprocessor lockup may occur.

3.12 The proper procedure to access information from the smart plant is as follows:

- (1) Press and release the desired switch.
- (2) Wait for the audible feedback (beep).
- (3) Observe the message to appear on the message display.

3.13 Plant Control and Routine Switches:
The plant control and routine switches do not activate alarms. The functions of the plant control and routine switches are:

- **Numeric Keypad**—Set time (24-hour clock) and date, perform alarm cutoff (ACO), and specify rectifier or feeder to be checked.
- **System Test**—Self test of the smart controller hardware.
- **Plant Drain, Voltage**—Display plant load current and voltage (normal default display).
- **Next Line**—View next line of a multiline message (the prompt for a multiline message is an arrow on the right side of the message display).
- **Former Line**—View preceding line of a multiline message.
- **Rect Drain**—Display individual rectifier current.

- **Plant Drain Stats**—Display plant hourly average and peak load current statistics.
- **Plant Alarm History**—Display short-term memory of alarms.
- **Time and Date**—Check the processor real time and date (24-hour clock).
- **Rect Diagnostics**—Display detailed diagnostics information on selected rectifiers. May allow manual restarting of rectifier that has failed.

3.14 Major Alarm Indicators and Controls:

The following controls and switches are used during major alarm conditions:

- **Battery Discharge**—Display status of batteries
- **High Battery Voltage**—Identify presence and source of high-voltage condition
- **Fuse Alarm**—Identify blown or operated major alarm plant fuses or circuit breakers.

3.15 Minor Alarm Indicators and Controls:

The following controls and switches are used during minor alarm conditions:

- **Plant Eff Status**—Check enable/disable status of rectifier efficiency algorithm, and a list of rectifiers turned down by the efficiency algorithm
- **Limited Recharge**—Display diagnostic message relating to rectifier recharge capacity
- **System Alarm**—Display minor alarm system information and provides a minor alarm cutoff (ACO) feature for certain alarms
- **Rect Failure**—Identify the rectifier(s) that has failed and prompts the use of Rect Diagnostics switch.

3.16 Microprocessor Failure: The following devices are used when a microprocessor system failure occurs:

- **μ P Fail Indicator**—Lights if the microprocessor fails.
- **RESET Switch**—Resets the microprocessor system after a failure. Located on the MC-80013-A1 Central Processor Unit (CPU) circuit pack.

C. Smart Plant Options

3.17 General: The smart plant controller may be upgraded by installing option circuit packs in the smart plant controller optional card cage. When optional circuit packs are installed, new keypad inserts are placed in the controller faceplate (if necessary), to identify switches to be used to access the new option.

3.18 Remote Interface Option: The MC-80013-B1 remote interface (Option T) circuit pack (CP8) and data set (modem) (Option M) provides access to power plant data, status, major alarms, minor alarms, and diagnostic messages from remote terminals anywhere in the world (Fig. 6).

3.19 The remote interface system consists of:

- A MC-80013-B1 remote interface circuit pack (CP8) plugged into the smart plant controller optional card cage
- Connections from the smart controller optional card cage to a data set (modem) (Option M) in the initial bay
- Connections from the data set to the local telephone switching network via the local telephone lines
- An American Standard Code for Information Interchange (ASCII) terminal and data set (not supplied with remote interface option) at the location accessing the plant
- A 982 DF bus terminating pad installed at top position of plug P7 on optional backplane.

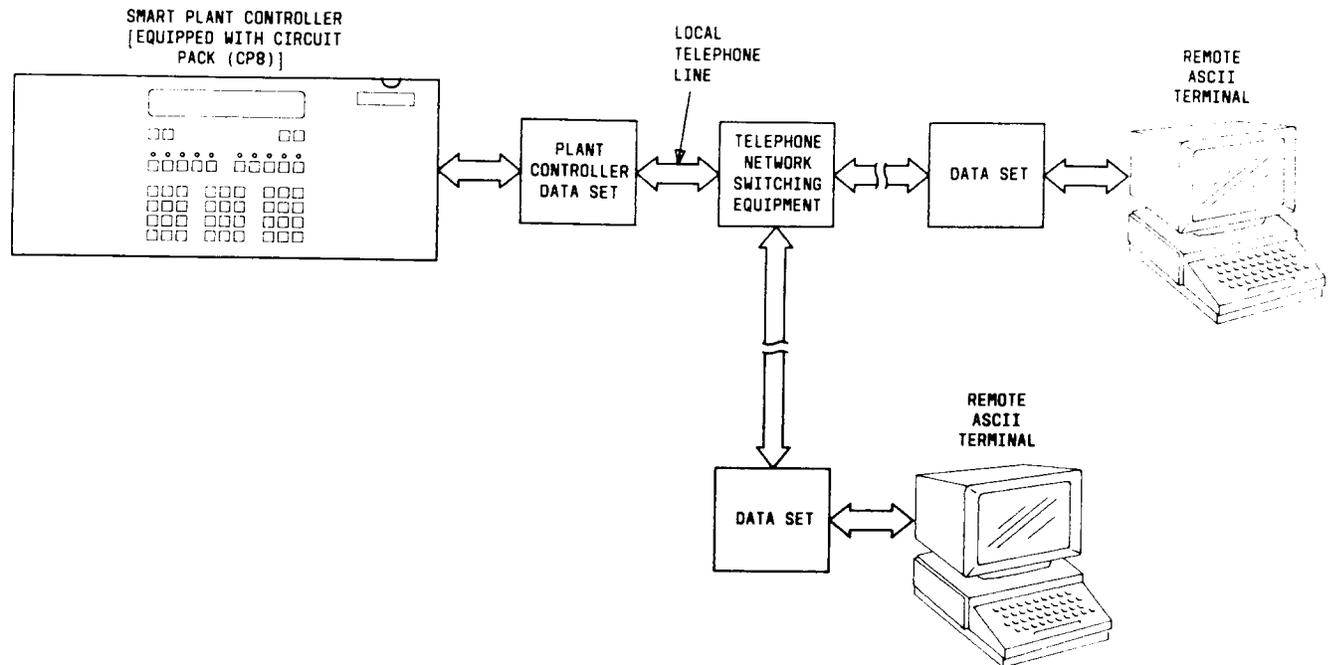


Fig. 6—Smart Plant Remote Interface

3.20 To interface with the plant, perform the following:

- Establish a data link and login at the terminal.
- Enter password.
- Type MENU for list of commands (Fig. 7).
- Enter desired command.

D. Conventional Plant

3.21 **General:** The conventional plant uses a connectorized plant control unit. The plant voltage and current are displayed on analog voltage and current meters on the front panel. (See Fig. 3.) Refer to Fig. 8 for the conventional plant interface block diagram. The conventional plant controller alarm sensing, rectifier shutdown, rectifier restart, and alarm sending circuits are located on either two or three plug-in circuit packs. The one or two ED-83017 rectifier circuit packs (CP11) interface the rectifiers to the ED-83006 auxiliary circuit pack which interfaces to the office alarm, the plant fuse alarm bus,

and the battery voltage sense point (on the battery charge bus).

3.22 Discharge fuse and circuit breaker panels are monitored for operated fuses and tripped circuit breakers. Plant control and REG fuses are monitored for operated fuses.

3.23 Each ED-83017 (conventional plant) rectifier signals circuit pack (CP11) monitors alarms for up to eight rectifiers. If 9 to 16 rectifiers are used, two ED-83017 rectifier signals circuit packs are required. The circuit packs monitor the Rectifier Failure Alarm (RFA), Circuit Breaker, and Low Output Alarm (LOA) signals for alarms. The circuit pack(s) receive shutdown signals from rectifiers, the plant controller waits approximately 5 seconds, and then issues a rectifier restart signal for approximately 5 minutes.

3.24 **Plant Voltage Alarms and Shutdown Levels:** The plant is equipped with two low-voltage alarms and one high-voltage shutdown. The voltage alarms and shutdown are as follows.

- (a) **Battery Dischrg:** The plant issues a Battery Dischrg alarm if the battery voltage

ENTER PASSWORD

TYPE 'MENU' FOR LIST OF COMMANDS

THERE ARE NO ALARMS PRESENT

MENU

-----MENU-----

```
ALMS      : LISTS ACTIVE ALARMS
VI        : GIVES BATT VOLTAGE & PLANT DRAIN
BD        : GIVES STATUS OF BATT DISCHARGE ALARM
HV        : GIVES STATUS OF HIGH VOLTAGE ALARM
FAJ       : GIVES STATUS OF MAJOR FUSES OR BREAKERS
EFF       : GIVES STATUS OF EFFICIENCY DISABLE ALARM
LIMR     : GIVES STATUS OF LIMITED RECHARGE ALARM
MN       : GIVES STATUS OF MINOR SYSTEM ALARMS
RECT     : GIVES STATUS OF RECTIFIERS
LOADST   : PRINTS LOAD STATISTICS
RCTDR    : PRINTS RECTIFIER DRAINS
.         :
.         :
.         :
MENU     : PRINTS LIST OF POSSIBLE COMMANDS
```

Fig. 7—Typical Smart Plant Remote Interface Menu

drops to 25.5 volts for a 24-volt plant or 51.25 volts for a 48-volt plant.

(b) **Low Voltage 2:** The plant issues a Low Voltage 2 alarm if the battery voltage drops to 24 volts for a 24-volt plant or 48.25 volts for a 48-volt plant.

(c) **High Battery Voltage:** The plant will shut down any rectifier(s) which drives the voltage high (26.75 volts for a 24-volt plant or 53 volts for a 48-volt plant).

3.25 Alarm Indicators: Alarm indicators provided on the conventional plant controller are as follows.

(a) **Major Alarm Indicators:** The three major alarm indicators (red indicators LEDs) are:

- HIGH VOLTS
- BAT DISCH
- FUSE ALARM MAJOR.

(b) **Minor Alarm Indicators:** The two minor alarm indicators (yellow indicator LEDs) are:

- RECT FAIL
- FUSE ALARM MINOR.

3.26 Plant Voltage Meter Calibration: Two test jacks [VM CAL (+) and (-)] are located on the panel to measure plant battery bus voltage and calibrate the PLANT VOLTAGE meter.

3.27 Rectifier Interface and Addressing: The conventional plant controller is interfaced to the CPS SP1 circuit pack in each rectifier. The CPS SP1 circuit pack receives signals from the plant controller to shut down and restart the rectifier. The CPS SP1 circuit pack transmits signals to the plant controller in the event of a rectifier alarm.

3.28 Upgrading Conventional Plant to Smart Plant: The conventional plant controller may be equipped with smart plant components. The following components are required to upgrade a conventional basic plant to a smart plant.

- One ED-83005 display circuit module (CP1)
- One ED-83006 auxiliary circuit pack (CP2) (also used in conventional plant)
- One MC-80013-A1 central processor unit (CPU) circuit pack (CP3)
- One or two ED-83008 (smart plant) rectifier signal circuit pack (CP4) (two required for 9 to 16 rectifiers)
- One ED-83009 plant signal circuit pack (CP5)

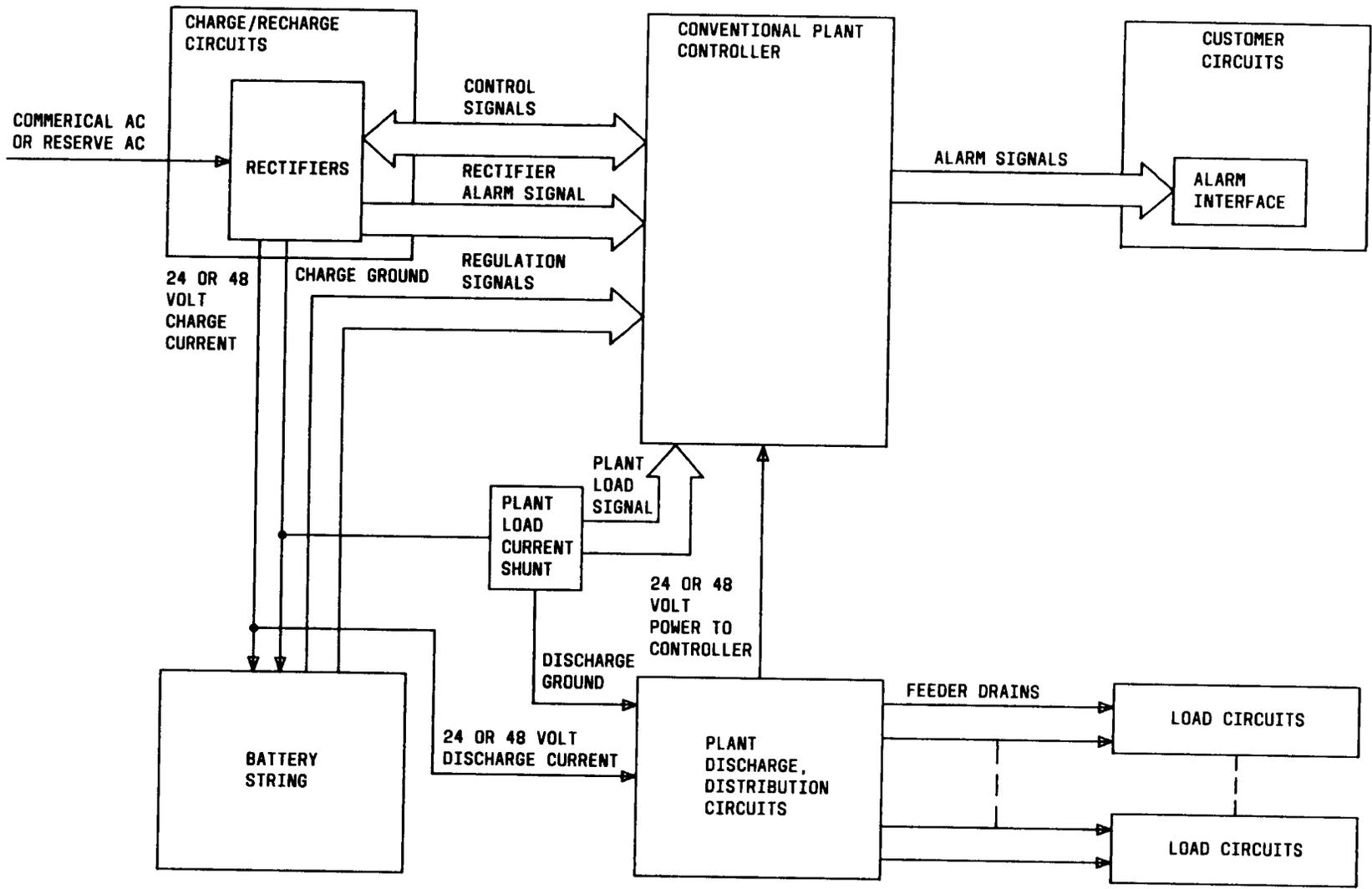


Fig. 8—Conventional Plant Interface Block Diagram

- One 24-volt or one 48-volt converter circuit pack [ED-83010 (CP6) or ED-83011 (CP7)]
- Smart plant control panel
- One CPS SP7 circuit pack to replace the CPS SP1 circuit pack in each rectifier in the plant, with a connection between the rectifier shunt and the CPS SP7 circuit pack
- Plant interface cables to connect the CPS SP7 circuit pack in each rectifier to the smart plant controller.

E. Rectifier (J87436A)

3.29 The J87436A, List 1, rectifier operates from 208/240 volts, 3-phase, 60 \pm 3 Hz input. The J87436A, List 2, rectifier operates from 480 volts, 3-phase, 60 \pm 3 Hz input. The J87436A, List 3, is required in addition to List 1 or List 2 to provide output circuit breaker capability. Lists 1 and 2 rectifiers provide positive or negative 24 volts direct current at 100 amperes output.

F. Rectifier (J87437A)

3.30 The J87437A, List 1, rectifier operates from 208/240 volts, 3-phase, 60 \pm 3 Hz input. The J87437A, List 2, rectifier operates from 480 volts, 3-phase, 60 \pm 3 Hz input. The J87437A, List 3, is required in addition to List 1 or List 2 to provide output circuit breaker capability. The J87437A rectifier provides positive or negative 48 volts direct current at 100 amperes output.

G. Rectifier (J87438A)

3.31 The J87438A, List 1, rectifier operates from 208/240 volts, 3-phase, 60 \pm 3 Hz input. The J87438A, List 2, rectifier operates from 480 volts, 3-phase, 60 \pm 3 Hz input. Lists 1 and 2 rectifiers provide positive or negative 24 volts direct current at 200 amperes output.

H. Rectifier (J87439A)

3.32 The J87439A, List 1, rectifier operates from 208/240 volts, 3-phase, 60 \pm 3 Hz input. The J87439A, List 2, rectifier operates from 480 volts, 3-phase, 60 \pm 3 Hz input. Lists 1 and 2 rectifiers provide positive or negative 48 volts direct current at 200 amperes output.

I. Plant Battery Bus Bars and Shunt

3.33 General: The first battery string in the plant is equipped with bus bars and shunt which may be upgraded as necessary (Fig. 9). The plant voltage is sensed on the standard battery bus bar and provides the regulation voltage for each individual rectifier as well as the plant controller. The plant load current is measured across the shunt connecting the charge ground bus to the discharge ground bus.

3.34 Standard Bus Bars: The standard bus bars handle a plant load of 1300-amperes (or less). Up to four battery strings (including the initial battery) and eight or less rectifiers may be paralleled using the standard bus bars.

3.35 Optional Bus Bars: Adding the optional bus bars enables the plant to deliver up to 2600 amperes of current. The optional bus bars may also be necessary to provide additional terminating positions for a plant load less than 1300 amperes if faster recharge or longer reserve time is required. Up to four additional battery strings and eight additional rectifiers may be paralleled when the optional bus bars are added.

3.36 Ground Bus Shorting Plate: The ground bus shorting plate (Fig. 9) is used to short the charge ground bus to the discharge ground bus when changing the large shunts rated at 1200 amperes or more.

3.37 Shunts: The plant load current is measured by a shunt between the charge ground bus and the discharge ground bus. The plant load shunt is available in six sizes: 400, 600, 800, 1200, 2000, and 2600 amperes. The plant load shunt should closely match the actual plant load so that more accurate current measurements are possible for the smart plant efficiency algorithm. The amount of energy saved may be reduced if the plant load shunt is severely oversized. The plant load current is sensed at the two terminals located on the side of the shunt.

3.38 Changing Small Type Shunts: The small 400-, 600-, and 800-ampere shunts require half the mounting area on the end of the ground bus bars. When both the existing and replacement shunts are one of the small shunt values, the replacement shunt is mounted above or below the existing shunt to prevent interruption of power when the replacement is

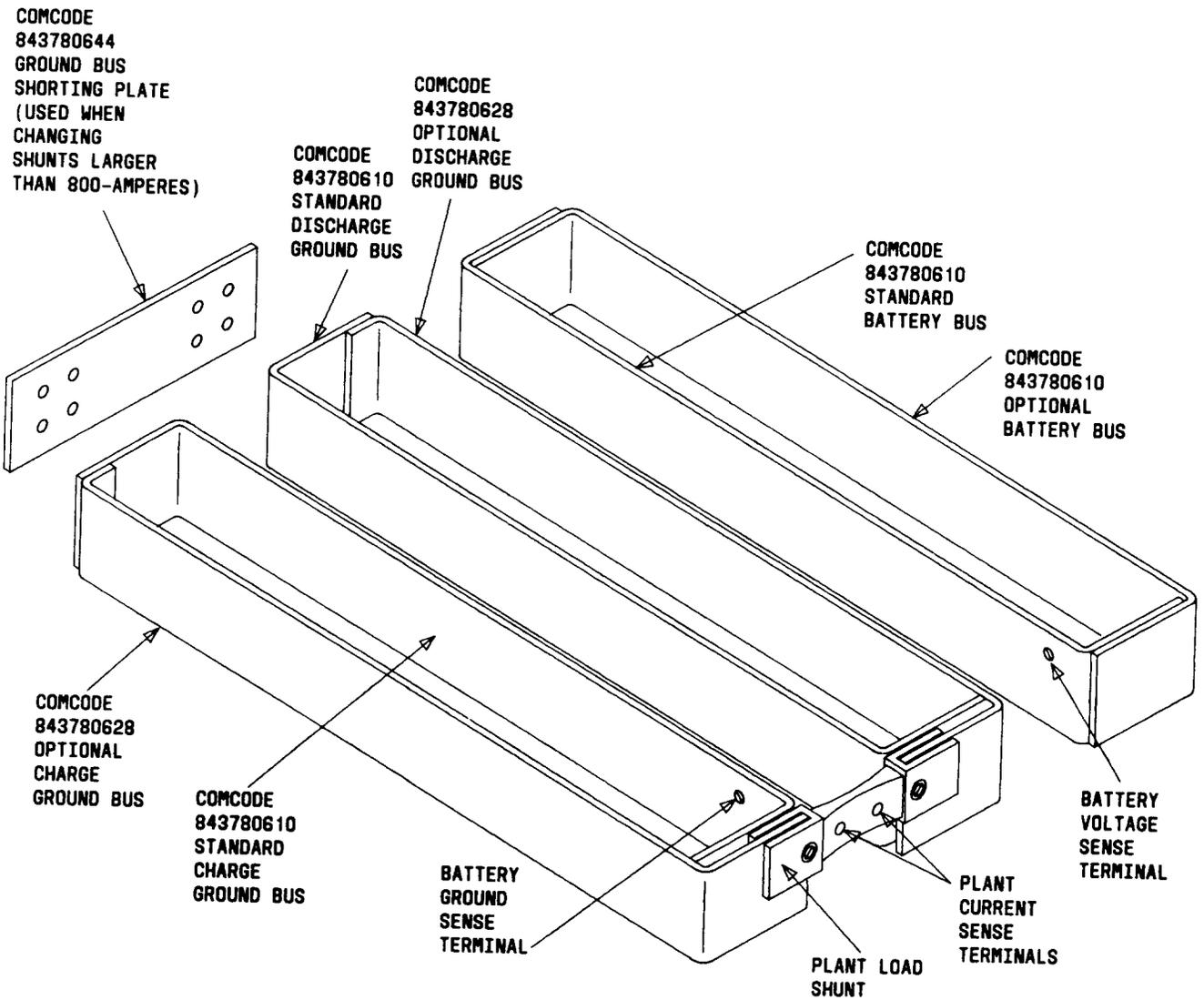


Fig. 9—Plant Bus Bars and Shunt

made. The procedure for changing these small types of shunts follows:

- (1) Disable efficiency algorithm (smart plant only).
- (2) Disconnect plant current sense leads from the existing small type shunt.
- (3) Install the new small type shunt.
- (4) Remove the existing small type shunt.
- (5) Reprogram shunt jumpers on controller back-plane.
- (6) Connect plant current sense leads to the new small type shunt.
- (7) Enable efficiency algorithm (smart plant only).
- (8) Verify revised shunt size by the System Test switch (smart plant only).

3.39 Changing Large Type Shunts: The large 1200-, 2000-, and 2600-ampere shunts require the full mounting area on the end of the ground bus bars. When shunt replacement involves the large types of shunts (either replacement or existing), the ground bus shorting plate(s) must be used to prevent interruption of power when the replacement is made. The procedure for changing these large types of shunts follows:

- (1) Disable efficiency algorithm (smart plant only).
- (2) Disconnect plant current sense leads from existing shunt.
- (3) Install ground bus shorting plate(s). (One for loads less than 1300 amperes; two for loads greater than 1300 amperes.)
- (4) Remove existing shunt.
- (5) Install new shunt.
- (6) Remove ground bus shorting plate(s). (One for loads less than 1300 amperes; two for loads greater than 1300 amperes.)

- (7) Reprogram shunt jumpers on controller back-plane.
- (8) Connect plant current sense leads to shunt.
- (9) Enable efficiency algorithm (smart plant only).
- (10) Verify revised shunt size by the System Test switch (smart plant only).

J. Plant Discharge Circuit Breakers and Fuses

3.40 The plant is equipped with circuit breakers and fuses sized per plant loads. The circuit breakers and fuse panels are constantly monitored by the plant controller for operated circuit breakers and blown fuses. To prevent fuses and circuit breakers from operating due to high inrush, and to protect connected equipment, the plant may be equipped with a filter charger circuit (Option S).

K. Battery Equipment (J85504A and J85504B)

3.41 A battery string comprised of KS-20472, L1, or KS-15544, L508, cells (12 individual cells for a 24-volt battery or 24 cells for a 48-volt battery) is connected in parallel with the rectifiers. Normally the plant rectifiers supply current to power the loads plus charge and recharge current to float the battery. When a commercial power failure occurs, the battery supplies current to power the loads. When either commercial or ac reserve power is restored, the rectifiers resume powering the loads and recharge the battery.

4. MAINTENANCE AIDS

- 4.01** Routine, acceptance, and trouble-clearing procedures are contained in Task Oriented Practice (TOP) 167-790-100.
- 4.02** A detailed description of the plant controller is contained in Practice 167-790-101.
- 4.03** A detailed description of the plant rectifiers is contained in Practice 169-790-103.