

**ENERGY COMMUNICATIONS SERVICE ADJUNCT (ECSA)
FEATURE DOCUMENT
"DIMENSION*" PBX**

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INTRODUCTION

1. GENERAL INFORMATION

1.01 This section describes the Energy Communications Service Adjunct (ECSA) feature which is provided as a stand-alone system.

1.02 This section is being reissued for the following reasons:

- (a) To add the off-premises capability
- (b) To add a new customer alterable parameter called the fail-safe condition
- (c) To add the system start-up sequence
- (d) To add the improvements made to the shed estimates which are used by the PDSF algorithm
- (e) To add the following customization parameters to PDSF:
 - Safety band
 - Reaction minute
 - Predicator interval.

- (f) To add that the current time is automatically displayed in the upper right-hand corner of each operational procedure which frees function key F5
- (g) To add a capability to procedure F4 which allows the operator to copy one load's 8-day schedule to another load with the push of a function key
- (h) To add three alarms to procedure F3 for the alarming of printer failures
- (i) To add binary feedback
- (j) To add the capability of an external alarm
- (k) To add that the operating company can provide the common power supply and interface power relay.
- (l) To change the name of the relay on the LC562 from "relay contact" to the "load control relay".

Revision arrows are used to denote the more significant changes.

1.03 There are several terms used throughout this section which need to be defined. These terms and the applicable definitions are as follows:

- (a) **Balanced Load Group:** A group of loads that have the same total kilowatt (KW) value scheduled to be energy enabled at any given time. To be more precise, if the product of the measured consumption rate (ie, plate value) and the run factor (ie, percentage of time the load consumes energy compared to the time the load is energy enabled) for each load in the group is summed each minute, and if these totals for the group are the same for each minute in the hour, then the load group is balanced.
- (b) **Compatible Shed Patterns:** Shed patterns are compatible with the chosen normal pattern if the following condition exists. Any time within the hour when the normal pattern has the load off, the shed pattern also has the load off.
- (c) **Cycling a Load:** Any load that has its energy enabled/disabled at a specified rate (eg,

every 15 minutes the load is enabled or disabled depending on the previous state). Cycling is used to reduce the customer's energy consumption and/or demand.

- (d) **Demand Interval:** The length of time used by the power company in calculating a customer's demand (usually 5 to 30 minutes). For example, if the demand interval is 30 minutes and the customer consumes 2 kilowatt hours (KWHs) of energy during that period, the energy demand is 4 KWs (energy demand equals energy consumed during demand interval times the number of demand intervals in an hour). This value is usually 5, 15, or 30 minutes.

- (e) **ECSCA Console:** The terminal used to control the functions associated with the ECSCA feature.

◆(f) **Energy Consumption:** The quantity of energy used. This term is usually used to express the total amount of electrical energy that has been used in a given interval of time. It is usually expressed in units of KWH. However, other forms of energy such as natural gas (units of cubic feet or thermal units) and fuel oil (units of gallons) could also be implied. Sometimes consumption is used to refer to the **rate** at which electrical energy is being drawn, in which case it is expressed in units of KW, and in which case it would be called consumption rate rather than just consumption.◆

- (g) **Energy Demand:** The average rate at which a customer consumes electrical or non-electrical energy during a short period of time (demand interval). It is computed by taking the total consumption during the demand interval (expressed in KWH) and multiplying by the number of demand intervals which are contained in 1 hour. For example, if the demand interval is 15 minutes, and the total consumption in the last 15 minutes was 5000 KWH, then the current demand would be 20,000 KW.

- (h) **Energy Enabled/Disabled:** In most cases, a given load's control unit is wired in series with other control mechanisms for that load (ie, thermostats, pressure regulators, timers, etc). The term "energy enabled" means that the ECSCA feature is allowing a load to be on. This does not necessarily mean that the load is actually on, since it may be held off by other control mechanisms (eg,

thermostat or state inversion technique). The term "energy disabled" means that the ECSA feature is forcing a load to be off. In most cases, this would override other control mechanisms, and the load would actually be off (or at least some lower power state).

- (i) **Fixed Demand Interval:** A demand interval that is discrete in time, ie, the power company calculates the demand only once each demand interval, and these intervals do not overlap in time. ♦ This is one of two methods which the utility company can use for computing peak demands. (The other is the floating demand interval, defined below.) A fixed demand interval is sometimes called a fixed window. To be precise, when a fixed window is used, one demand interval does not start until the last one ends, and the times at which they start and stop are predetermined. For example, if the demand interval is 15 minutes, and the windows are synchronized at 5 minutes after the hour, then demand computations would be recorded four times per hour; once at 5 minutes after the hour, once at 20 minutes after the hour, once at 35 minutes after the hour, and once at 50 minutes after the hour. The results would be recorded for the entire month (or billing period) and the peak demand charge would be based on the maximum of these values. ♦
- (j) **Floating Demand Interval:** A demand interval that is continuous or nearly continuous in time, ie, the power company calculates demand several times each demand interval. For example, if the demand interval is 30 minutes and the power company calculates the demand once every minute, the floating demand interval is being used. ♦ A floating demand interval is sometimes called a floating window. To be more precise, when a floating window is used, a demand computation is done every minute. For example, if the demand interval is 15 minutes, then a demand computation is made each minute of the demand interval. Hence, 60 demand figures are recorded each hour (regardless of the demand interval), and again the peak demand charge is based on the largest one recorded during the billing period. ♦
- (k) **Load/Individual Load:** Any device that consumes energy while operating. Usually the term refers to an electrical load, but the customer can control nonelectrical loads by connecting special transducers to these loads. For example, natu-

ral gas can be controlled by a solenoid valve. (The customer's nonelectrical loads may normally be regulated by thermostats, which provide a convenient point of access for control of these loads.)

Note: A load may be many energy consuming devices connected in series.

- (l) **Modifier:** A method of deriving a shed pattern for individual loads by modifying the chosen preprogrammed normal cycling pattern. The normal cycling pattern is modified by specifying the number of minutes (ie, 00 to 55) which is added to the off time of each cycle in the normal cycle pattern. This lengthens the off time and shortens the on time. However, a modifier cannot exceed the on time of the cycle it is modifying.
- (m) **Peak Demand:** This is the highest calculated demand in KWs during a demand interval or during a billing period.
- (n) **Power Meter Interface:** An electrical interface between the customer's power meter(s) and the ECSA cabinet(s) which allows the ECSA software to calculate energy consumption and demand.
- (o) **Preprogrammed Cycling Pattern:** A cycling pattern stored in ECSA memory that may be used to control individual loads with the individual load cycling function (ILCF) and the peak demand shedding function (PDSF) (eg, 5 minutes on, 30 minutes off, 5 minutes on, 30 minutes off, etc).
- (p) **Priority Shedding:** Assigning loads to load groups such that the noncritical loads are shed first, and the critical loads are shed last.
- (q) **Load Control Relay:** An electromechanical switch within the ECSA cabinet(s) which is used by the ECSA feature to send control signals to the customer's loads which enable or disable the load assigned to this relay.
- ♦(r) **Restoring a Load:** When a load is restored from the shedding pattern to the normal pattern, it is not restored to the point of departure but to the point on the cycling pattern that corresponds to the wall clock time. ♦
- (s) **Shedding a Load:** Any load that has its energy turned off completely or cycled at a

rate which has less on time than its normal cycling rate in order to keep the customer's energy demand from exceeding a specified target value.

2. DEFINITION

2.01 ECSA: This feature provides the capability to control and monitor energy-consuming devices throughout a building complex. This feature is primarily designed to reduce customer's energy costs by minimizing energy consumption in areas where energy is not required under normal conditions, and by limiting a customer's energy consumption during peak demand periods. ♦ This feature is also capable of self diagnostics, monitoring the response of energy-consuming devices, enhancing security, and detecting alarm conditions within a building complex. The building complex may be on or off the customer's premise. ♦

DESCRIPTION

3. USER OPERATION

APPLICATIONS

3.01 The ECSA feature has two basic functions. These are:

(a) Any individual load may be controlled by the Individual Load Cycling Function (ILCF). ♦ The ILCF energy enables/disables loads via a schedule of preprogrammed cycling patterns to reduce the customer's energy costs. This is done by minimizing energy consumption in areas where energy is not required under normal conditions. The ILCF reduces consumption of electrical and nonelectrical forms of energy. Each load may have a different schedule for each day of the week plus one for holidays. Six multiple cycling rates may control an individual load on a time-of-day basis for each of these daily schedules. For example, in an office building at 7 am to 8 am on a Monday morning, specified offices may have the heating cycled at a desired rate because of the increase in heat due to the added body heat. At 3 pm to 5 pm a higher cycling rate may be desired to compensate for the loss of body heat. At 5 pm to 12 am the heating can be cycled at a lower rate again to conserve energy. This example of a daily schedule only used four of the six possible scheduling intervals.

(b) The Peak Demand Shedding Function (PDSF) is a sophisticated and flexible demand limit-

ing function. Large consumers of electricity are generally billed on the basis of both consumption and peak demand. The peak demand charges represent a large fraction of the electricity bill. A 50 percent share is not uncommon, and there is a trend for demand charges to make up an even larger fraction of the electricity bill. Therefore, the PDSF has the potential for saving customers substantial sums of money. ♦ All individual loads may be controlled by limiting the peak or maximum usage of electrical energy in the system by the PDSF. Thus, when the overall electrical demand of the customer's building(s) approaches a predetermined threshold, various loads may be cycled or turned off automatically to keep the peak demand below the threshold. The level of the threshold and the priority of loads to be cycled or turned off are determined by the customer.

3.02 ♦ The ECSA feature controls loads by sending load control relay closures over wiring to either the customer provided power relay or the operating company provided Interface Power Relay, which in turn controls directly the state of the load. ♦ This feature also gives the customer the ability to monitor the energy demand and consumption via an interface to the power company metering devices.

3.03 ♦ The ECSA feature allows the customer to choose the state (ie, energy enabled or disabled) that the load should be in during an ECSA system failure or power failure via the Fail Safe Condition.

3.04 The ECSA feature has the capability to monitor the response of loads controlled by the ILCF or PDSF. This capability is called Binary Feedback. Binary Feedback can also monitor loads not controlled by ECSA for energy enabled or disabled conditions. Binary Feedback has a wide range of application and can obtain feedback from any customer provided device that senses the desired condition and provides a relay closure to ECSA. Alarming can be provided for each load or application that is in an alarm condition.

3.05 The ECSA feature can control remote loads via the Off-Premises Capability. This capability provides the customers with multiple locations (eg, school districts, restaurant chains, grocery stores, banks, department stores, related businesses, etc) the ability to control off-premises loads as though they were on-premises loads from the ECSA

location. The user operations and administrations are identical to those needed for on-premises loads. Off-premises loads should only use the ILCF and/or Binary Feedback functions.♦

3.06 An important aspect of the ECSA feature is that the feature requires customer involvement. It is not intended to be a turn key type operation which can be set up initially, turned on, and left alone. The feature is designed to allow a great deal of operational changes through parameter selection via an ECSA console. When a system is installed, it must be tailored to that particular customer. After installation, operational changes are made to fine tune the performance of the system. New situations arise constantly, such as changing weather, occupancy, and times of usage of common areas and meeting rooms, which require parameter changes. Ease of entry to parameters which govern the feature's performance, rapid indication of the current status of the loads under control, ♦and demand/periodic printouts of ECSA parameters♦ are important attributes of this feature.

FUNCTIONS

3.07 There are four major functions which constitute the ECSA feature. These functions are:

- (a) ILCF
- (b) PDSF
- (c) Energy consumption and demand monitoring (ECDM).
- (d) ♦Binary Feedback.♦

A. Individual Load Cycling Function (ILCF)

3.08 The ILCF reduces the customer's energy consumption and/or demand by controlling the on time of individual loads (ie, by cycling or disabling the load's energy) with a flexible preprogrammed scheduling system.

3.09 This preprogrammed scheduling system gives the customer the ability to designate for each individual load a separate schedule for each day of the week (seven daily schedules, Monday through Sunday) as well as a schedule to be used on holidays (the so-called eighth daily schedule).

Note: This method of scheduling is also known as the 8-day clock.

3.10 The customer alterable parameters associated with the ILCF are as follows:

- (a) ILCF—Active/Inactive
- (b) The 8-day clock.

3.11 The ILCF parameter may be specified active or inactive.

- (a) **Active:** All individual loads have their energy cycled by the normal cycling pattern in the ILCF unless a peak demand is encountered (see the PDSF discussion).
- (b) **Inactive:** All individual loads remain in the energy enabled state and are not affected by the ILCF. If a peak demand is encountered, the loads may be cycled or disabled by the PDSF if it is active.

3.12 The 8-day clock parameter gives the customer the ability to designate for each individual load eight daily schedules (one for each day of the week and one for holidays).

3.13 Each daily schedule may have from one to six time intervals. A time interval is the period of time that a particular normal preprogrammed cycling pattern is desired to control an individual load under normal conditions. For each desired time interval, either a shed preprogrammed cycling pattern or a modifier (see paragraph 1.03) must be specified for the PDSF. (See Table A for a list of preprogrammed cycling patterns which can be used for normal and shed cycling patterns.)

Note: Cycling pattern 01A in Table A is a pattern with no off time and cycling pattern 24A is a pattern with no on time.

3.14 The patterns in Table A are completed in 60 minutes. The normal pattern for a time interval is repeated each hour on the hour (according to the internal ECSA clock which corresponds to the wall clock time) until the time interval is completed. Each time interval within a daily schedule cycles its normal pattern in this manner until the schedule for that day is completed or until a peak demand is encountered. If a peak is encountered, the load is then controlled by the PDSF (ie, if the PDSF is active and if this particular load is assigned to a load group). Therefore, under normal conditions, an individual

TABLE A

LIST OF PREPROGRAMMED CYCLING PATTERNS

PATTERN CODE	PATTERN PER ONE HOUR PERIOD (ON AND OFF TIME IN MINUTES)
01A)	ON
02A) 02B) 02C) 02D) 02E) 02F) 02G) 02H) 02I) 02J) 02K) 02L)	55 ON, 5 OFF 50 ON, 5 OFF, 5 ON 45 ON, 5 OFF, 10 ON 40 ON, 5 OFF, 15 ON 35 ON, 5 OFF, 20 ON 30 ON, 5 OFF, 25 ON 25 ON, 5 OFF, 30 ON 20 ON, 5 OFF, 35 ON 15 ON, 5 OFF, 40 ON 10 ON, 5 OFF, 45 ON 5 ON, 5 OFF, 50 ON 5 OFF, 55 ON
03A) 03B) 03C) 03D) 03E) 03F)	50 ON, 10 OFF 40 ON, 10 OFF, 10 ON 30 ON, 10 OFF, 20 ON 20 ON, 10 OFF, 30 ON 10 ON, 10 OFF, 40 ON 10 OFF, 50 ON
04A) 04B) 04C) 04D) 04E) 04F)	25 ON, 5 OFF, 25 ON, 5 OFF 20 ON, 5 OFF, 25 ON, 5 OFF, 5 ON 15 ON, 5 OFF, 25 ON, 5 OFF, 10 ON 10 ON, 5 OFF, 25 ON, 5 OFF, 15 ON 5 ON, 5 OFF, 25 ON, 5 OFF, 20 ON 5 OFF, 25 ON, 5 OFF, 25 ON
05A) 05B) 05C) 05D)	45 ON, 15 OFF 30 ON, 15 OFF, 15 ON 15 ON, 15 OFF, 30 ON 15 OFF, 45 ON
06A) 06B) 06C) 06D)	15 ON, 5 OFF, 15 ON, 5 OFF, 15 ON, 5 OFF 10 ON, 5 OFF, 15 ON, 5 OFF, 15 ON, 5 OFF, 5 ON 5 ON, 5 OFF, 15 ON, 5 OFF, 15 ON, 5 OFF, 10 ON 5 OFF, 15 ON, 5 OFF, 15 ON, 5 OFF, 15 ON
07A) 07B) 07C)	40 ON, 20 OFF 20 ON, 20 OFF, 20 ON 20 OFF, 40 ON
08A) 08B) 08C)	20 ON, 10 OFF, 20 ON, 10 OFF 10 ON, 10 OFF, 20 ON, 10 OFF, 10 ON 10 OFF, 20 ON, 10 OFF, 20 ON

TABLE A (Contd)

LIST OF PREPROGRAMMED CYCLING PATTERNS

PATTERN CODE	PATTERN PER ONE HOUR PERIOD (ON AND OFF TIME IN MINUTES)
09A) 09B) 09C)	10 ON, 5 OFF, 10 ON, 5 OFF, 10 ON, 5 OFF, 10 ON, 5 OFF 5 ON, 5 OFF, 10 ON, 5 OFF, 10 ON, 5 OFF, 10 ON, 5 OFF, 5 ON 5 OFF, 10 ON, 5 OFF, 10 ON, 5 OFF, 10 ON, 5 OFF, 10 ON
10A) 10B) 10C) 10D) 10E) 10F) 10G) 10H) 10I) 10J) 10K) 10L)	35 ON, 25 OFF 30 ON, 25 OFF, 5 ON 25 ON, 25 OFF, 10 ON 20 ON, 25 OFF, 15 ON 15 ON, 25 OFF, 20 ON 10 ON, 25 OFF, 25 ON 5 ON, 25 OFF, 30 ON 25 OFF, 35 ON 20 OFF, 35 ON, 5 OFF 15 OFF, 35 ON, 10 OFF 10 OFF, 35 ON, 15 OFF 5 OFF, 35 ON, 20 OFF
11A) 11B)	30 ON, 30 OFF 30 OFF, 30 ON
12A) 12B)	15 ON, 15 OFF, 15 ON, 15 OFF 15 OFF, 15 ON, 15 OFF, 15 ON
13A 13B	10 ON, 10 OFF, 10 ON, 10 OFF, 10 ON, 10 OFF 10 OFF, 10 ON, 10 OFF, 10 ON, 10 OFF, 10 ON
14A) 14B)	5 ON, 5 OFF, 5 ON, 5 OFF 5 OFF, 5 ON, 5 OFF, 5 ON
15A) 15B) 15C) 15D) 15E) 15F) 15G) 15H) 15I) 15J) 15K) 15L)	25 ON, 35 OFF 20 ON, 35 OFF, 5 ON 15 ON, 35 OFF, 10 ON 10 ON, 35 OFF, 15 ON 5 ON, 35 OFF, 20 ON 35 OFF, 25 ON 30 OFF, 25 ON, 5 OFF 25 OFF, 25 ON, 10 OFF 20 OFF, 25 ON, 15 OFF 15 OFF, 25 ON, 20 OFF 10 OFF, 25 ON, 25 OFF 5 OFF, 25 ON, 30 OFF
16A) 16B) 16C)	20 ON, 40 OFF 40 OFF, 20 ON 20 OFF, 20 ON, 20 OFF

TABLE A (Contd)

LIST OF PREPROGRAMMED CYCLING PATTERNS

PATTERN CODE	PATTERN PER ONE HOUR PERIOD (ON AND OFF TIME IN MINUTES)
17A) 17B) 17C)	10 ON, 20 OFF, 10 ON, 20 OFF 20 OFF, 10 ON, 20 OFF, 10 ON 10 OFF, 10 ON, 20 OFF, 10 ON, 10 OFF
18A) 18B) 18C)	5 ON, 10 OFF, 5 ON, 10 OFF, 5 ON, 10 OFF, 5 ON, 10 OFF 10 OFF, 5 ON, 10 OFF, 5 ON, 10 OFF, 5 ON, 10 OFF, 5 ON 5 OFF, 5 ON, 10 OFF, 5 ON, 10 OFF, 5 ON, 10 OFF, 5 ON, 5 OFF
19A) 19B) 19C) 19D)	15 ON, 45 OFF 45 OFF, 15 ON 30 OFF, 15 ON, 15 OFF 15 OFF, 15 ON, 30 OFF
20A) 20B) 20C) 20D)	5 ON, 15 OFF, 5 ON, 15 OFF, 5 ON, 15 OFF 15 OFF, 5 ON, 15 OFF, 5 ON, 15 OFF, 5 ON 10 OFF, 5 ON, 15 OFF, 5 ON, 15 OFF, 5 ON, 5 OFF 5 OFF, 5 ON, 15 OFF, 5 ON, 15 OFF, 5 ON, 10 OFF
21A) 21B) 21C) 21D) 21E) 21F)	10 ON, 50 OFF 50 OFF, 10 ON 40 OFF, 10 ON, 10 OFF 30 OFF, 10 ON, 20 OFF 20 OFF, 10 ON, 30 OFF 10 OFF, 10 ON, 40 OFF
22A) 22B) 22C) 22D) 22E) 22F)	5 ON, 25 OFF, 5 ON, 25 OFF 25 OFF, 5 ON, 25 OFF, 5 ON 20 OFF, 5 ON, 25 OFF, 5 ON, 5 OFF 15 OFF, 5 ON, 25 OFF, 5 ON, 10 OFF 10 OFF, 5 ON, 25 OFF, 5 ON, 15 OFF 5 OFF, 5 ON, 25 OFF, 5 ON, 20 OFF
23A) 23B) 23C) 23D) 23E) 23F) 23G) 23H) 23I) 23J) 23K) 23L)	5 ON, 55 OFF 55 OFF, 5 ON 50 OFF, 5 ON, 5 OFF 45 OFF, 5 ON, 10 OFF 40 OFF, 5 ON, 15 OFF 35 OFF, 5 ON, 20 OFF 30 OFF, 5 ON, 25 OFF 25 OFF, 5 ON, 30 OFF 20 OFF, 5 ON, 35 OFF 15 OFF, 5 ON, 40 OFF 10 OFF, 5 ON, 45 OFF 5 OFF, 5 ON, 50 OFF
24A)	OFF

load could change normal cycling patterns up to six times a day or per daily schedule. An example of normal and shed preprogrammed cycling patterns for three individual loads is shown in Fig. 1. This example has a 1-hour time interval from 5 pm to 6 pm. Note that the normal patterns of these loads are balanced (ie, only two out of three loads are on at any given time) if the KW value of each load is the same. Also, notice that the shed patterns have more off time than the normal patterns.

Preprogrammed Cycling Patterns

3.15 The pool of cycling patterns that is available for both the ILCF and the PDSF is shown in Table A. Observe the following characteristics of this list.

3.16 In this list, three characters are always used to specify a pattern, (two digits and a letter). There is a total of 116 patterns. There are 24 truly distinct patterns with multiple versions to allow load balancing. All versions of one original pattern have the same 2-digit number (but different letter) assigned.

3.17 The patterns are arranged in increasing order with respect to off time. This should make it easier for the ECSA operator to locate a desired normal cycling pattern and to insure the desired shed cycling pattern has more off time than the normal cycling pattern in each specified time interval.

B. Peak Demand Shedding Function (PDSF)

3.18 The PDSF reduces a customer's energy usage by attempting to limit the peak electrical demand to a specified value. The Energy Consumption and Demand Monitoring (ECDM) function monitors the building's total demand for electricity. When that demand approaches the specified value, the PDSF begins to shed customer-specified loads as needed, in an attempt to keep the demand from exceeding this specified target value. ♦ This is done if the designated minimum time between restore and shed has occurred. ♦ These loads must be assigned to load groups to be capable of being shed. Each load in the individual load group being shed automatically switches from the normal preprogrammed cycling pattern to the shedding preprogrammed cycling pattern, where the shedding cycling pattern has more off time than the normal cycling pattern (for an example, see Fig. 1). If a modifier is used for shedding, the

individual load group being shed automatically switches from the normal cycling pattern to the modified normal cycling pattern which has the designated additional off time in each cycle of the normal cycling pattern.

3.19 The individual load groups are shed in order of ascending group number (shed priority number). That is, when the PDSF function decides that a load group must be shed, it looks for the lowest numbered load group that has not already been shed, and starts that group's shed pattern(s). Thus, higher numbered load groups are not shed unless the reduction in demand caused by shedding lower numbered groups is not sufficient to keep the demand from exceeding the target value. ♦ Once the demand for energy has been leveled out and has dropped below the lower threshold level (ie, the target level minus the safety band), the PDSF algorithm decides if this lower threshold level is threatened to be exceeded. If not, load groups can be restored if the designated minimum time between shed and restore has been surpassed. ♦ When a load group is restored, the loads within that group return to being controlled by the ILCF and cycled by normal preprogrammed cycling pattern. Load groups are restored, highest priority (numbered) load group first, so that the total KW estimate for these load groups does not exceed the amount calculated to keep the demand below the lower threshold level.

3.20 The customer alterable parameters associated with the PDSF function are as follows:

- (a) Peak demand shedding function—active/inactive
- (b) Peak demand target level
- (c) Load group number (shed priority)
- (d) Shed estimates
- (e) Load number(s) assigned to group
- (f) Load KW consumption
- (g) Load run factor
- (h) Minimum time between shed and next restore
- (i) Minimum time between restore and next shed
- (j) Shed state for each load (shed cycling pattern or modifier)

LOAD GROUP #20

LD NO.	HRMN	NRM PATTERN	SHD PATTERN	HRMN
0013	1700	03B (40 ON, 10 OFF, 10 ON)	07A (40 ON, 20 OFF)	1800
0018	1700	10E (15 ON, 25 OFF, 20 ON)	15C (15 ON, 35 OFF, 10 ON)	1800
0022	1700	10J (15 OFF, 35 ON, 10 OFF)	15H (25 OFF, 25 ON, 10 OFF)	1800

LOAD 0013
(NORMAL
PATTERN)

LOAD 0013
(SHEDDING
PATTERN)

LOAD 0018
(NORMAL
PATTERN)

LOAD 0018
(SHEDDING
PATTERN)

LOAD 0022
(NORMAL
PATTERN)

LOAD 0022
(SHEDDING
PATTERN)

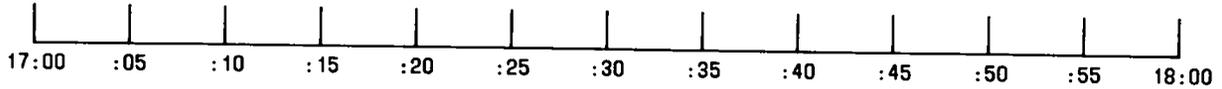


Fig. 1—Individual Load Cycling Example

- (k) Safety band
- (l) Reaction minute
- (m) Predictor interval
- (n) Start-up: highest numbered group shed
- (o) Floating demand interval.

3.21 The PDSF parameter may be specified active or inactive.

(a) **Active:** Individual loads that are assigned to load groups will have their loads switch from cycling at the normal pattern (ie, with ILCF active) or from an enabled state (ie, with ILCF inactive) to the shed pattern/modifier (specified in the daily schedule) when the PDSF algorithm decides it is time to shed the load group.

(b) **Inactive:** Individual loads are not affected by the PDSF.

3.22 The peak demand target level parameter specifies the demand level which the PDSF attempts to keep the property's peak demand from exceeding. The PDSF starts to shed load groups when the property's demand approaches this level, and it restores load groups when the demand falls sufficiently below this level.

3.23 The load group number (shed priority) parameter is used to identify a load group and is also used as the shed priority by the PDSF (lowest numbered load groups first). Individual loads desired to be shed should be assigned to a load group.

3.24 The shed estimate parameter is not directly customer alterable. For each load group, the PDSF computes a shed estimate for each load within the group, and sums them to get a total group estimate. This is done separately for each day of the week, and so each group has eight shed estimates, (the eighth is for the holidays). For any load in a group, and for any of the eight days, the estimate is computed via the following equation:

$$E = P \times R \times I$$

Where E is the shed estimate, P is the plate value consumption rate, R is the run factor, and I is the incremental fraction of the hour which the shedding

cycling pattern holds the load off above the time which the normal cycling pattern holds it off. For example, if a load had a normal cycling pattern of 45 on 15 off, and a shedding pattern of 30 on 30 off, the incremental off time would be 1/4. Hence, if this same load had a plate value of 100 KW and a run factor of 100 percent, the estimate for that load would be:

$$E = 100KW \times 100\% \times .25 = 25KW$$

Since the 8-day clock allows up to six different scheduling intervals per day, the incremental off time can change with the time of day, and can take on any one of up to six values in any one day. The value used for I then is the maximum incremental off time in the six intervals. This shed estimate is used to display to the customer the highest expected decrease in electrical demand for that day which is seen when the load group is shed. The PDSF algorithm actually recalculates the shed estimate for each load group, each minute for shed, and restore decisions.

3.25 The load number parameter is not customer alterable, but is used by the customer to identify individual loads for control by the ILCF and to form individual load groups for control by the PDSF.

3.26 The load KW consumption parameter, entered by the ECSA operator, gives the rate at which a load consumes electrical energy when it is actually in an energy consuming state (corresponds to the plate value of the load) expressed in units of KW. Since shed estimates are only generated for loads that consume electrical energy, loads consuming other forms of energy cannot be shed. Only the meters designated as electrical meters are used by the PDSF. This is done at the Maintenance and Administration Panel (MAAP).

3.27 The load run factor parameter is a ratio of the time the load is actually consuming energy to the time that ECSA has the load energy enabled. This ratio is displayed as a percentage. For example, the load run factor for a fan that is on all the time is 100 percent; however, the load run factor for a heater with a thermostat may be 50 percent.

3.28 The minimum time between shed and next restore and the minimum time between restore and next shed parameters apply to all the load groups in the system. These parameters allow the customer to designate what the minimum time is be-

tween the initiation of shedding a load group and the initiation of restoring this load group and vice versa. These parameters help to protect critical individual loads from damage caused by enabling and disabling loads too frequently and thus reduces the possibility of damaging a load (such as a compressor or large electrical motor) by oscillating between shed and restore while the system demand hovers near the target level. While these parameters eliminate the possibility of frequent changes in states within short time intervals (ie, 5 or 10 minutes), the customer should be aware of the possibility of a change of state within a short time interval; eg, the load being in an on state, switching to an off state for 1 minute, and returning to an on state. This could damage some loads. Again, this could happen in the shed-to-restore/restore-to-shed condition, when alternating between the shed and normal schedules, or when the load is placed in an override state. These parameters nor the safety band parameter (explained in paragraph 3.31) can prevent this possibility.

3.29 The shed state for each load must be assigned for each normal pattern assigned in the 8-day clock. This parameter allows the ECSA operator to shed a load by using a shedding pattern chosen from Table A or by designating a modifier. If the load is to be capable of shedding during a time interval, the shed cycling pattern must have more total off time than the normal cycling pattern. If the load is not to be capable of shedding, then the shed cycling pattern specified should be the same as the specified normal pattern for that interval. If a modifier is used for shedding, then the normal cycling pattern is modified by adding an additional off time to the off time in a cycle of the chosen normal cycling pattern. If the load is not to be capable of shedding, then the modifier should have no additional off time specified. The normal cycling pattern is then repeated (ie, not affected by the PDSF). Again, if the PDSF is not active or the load is not assigned to a load group, the load cannot be shed.

Note: The modifier method for scheduling shed patterns is more flexible and easier to use than choosing a shed pattern from Table A. For more details, see the OPERATING PROCEDURE F4—ILCF and Peak Demand Shedding procedure.

3.30 The safety band parameter is a customer alterable parameter sometimes referred to as a dead band. A safety band basically entails that shed

decisions be made when the predicted demand exceeds target, but restore decisions are not made until the restore would not cause the predicted demand to exceed some predetermined level which is lower than the target. The safety band (or dead band) then is the band between the target level and this predetermined level which is below the target level. This restore level thus is dependent on the target level and the safety band. Without a safety band, shed decisions are made whenever the predicted demand exceeds the target, and restorations are made as soon as the restorations would not cause the predicted demand to exceed the target. This leaves open the possibility that certain loads could be shed 1 minute, restored the next, then shed again the following minute, and so on. The purpose of the safety band then is to help prevent the PDSF algorithm from oscillating between shed and restore decisions. In order to designate this level to a value which maximizes efficiency of the PDSF, the customer needs to have some previous record of demand (which may be accessed by the utility company) or use a trial and error method. Because of interactions with the reaction minute, predictor interval, the shed, and next restore constraints, special care should be taken to ensure that the safety band implementation allows the PDSF to react as the customer desires (see the description on the PDSF algorithm for more detailed information).

3.31 The reaction minute parameter allows the customer to balance the two risks inherent with the PDSF. Each minute the PDSF algorithm predicts what consumption levels will be experienced in the future minutes and a decision is made as to whether loads should be shed or restored, and if so, how many. Because there is no way to predict the future with certainty, there will always be the risks of making the following type of errors.

- (1) If no loads are shed, it is possible that consumption in subsequent minutes will be higher than predicted, causing the target to be exceeded.
- (2) If loads are shed, it is possible that consumption in future minutes will be lower than predicted by a wide enough margin so that the target would not have been exceeded even if the shed had not been implemented.

Both types of errors have associated costs. A type-1 error may result in a higher peak demand charge by the power company, and a type-2 error may result in

unnecessary curtailment in operation of the user's business or loss of comfort. These costs vary from one installation to the next.

3.32 The reaction minute parameter allows the customer to balance these risks by being able to designate how many minutes into the demand interval ECSA will wait before making a shed or restore decision. For example, a customer with a 15-minute fixed demand interval and relatively low costs for type-1 errors and high costs for type-2 errors, might not want to consider shedding until the tenth minute has begun. Another customer with the same 15-minute window but relatively high costs for type-1 errors and low cost for type-2 errors might want to shed any time (ie, within this 15-minute demand interval) that the predicted demand exceeds the target. Hence, the first customer would enter 10, and the second would enter 1 for the reaction minute parameter. For a discussion on how this parameter affects the floating demand interval which is the actual demand interval used by ECSA, see the PDSF Algorithm description.

3.33 The predictor interval parameter is a customer alterable parameter which allows the customer to specify the number of minutes of past consumption (ie, 1 through 10) which are to be used to predict the future consumption within a demand interval. The past consumption is averaged over the number of minutes designated and this average is the consumption used for each minute in the window. An adjustment is made to the predicted consumption to account for the possibility that loads may be shed during the predictor interval. The predictor interval should be chosen in accordance with the customer's trend in demand so that the predicted consumption is as accurate as possible. A customer with continuous trends in demand should use a longer predictor interval. For example, a factory's assembly line would have conveyor belts and equipment running nearly continuously. A customer with fluctuating trends in demand should use a shorter predictor interval. For example, a steel company often sees a large (ie, in megawatts) inductive furnace kick in only to turn back off within 2 minutes. The customer should also consider the rate at which the power meter pulses. Some power companies (especially in the East) have power meters which pulse very slowly (less than ten times per minute). In such a case a 1 minute predictor interval would have large round off errors, thus a longer predictor interval should be used. For details and a description on how this pa-

rameter applies to a floating demand interval (which is the type of demand interval used by ECSA), see the description of the PDSF algorithm.

3.34 The start-up : highest numbered group shed parameter allows the customer to choose the highest load group that will shed when the system is brought up after a power failure or upon system installation.♦

3.35 The demand interval parameter is the length of time the power company uses to calculate the demand for electrical energy. The power company may use either a floating demand interval or a fixed demand interval. The floating demand interval usually equals or exceeds the fixed demand interval in its ability to detect peak demands. Therefore, ECSA uses the floating demand interval for the most critical look at the customer's highest demand per billing period. The operation of PDSF intends to prevent the calculated floating demand from exceeding the demand target level. The peak demand recorded by the ECSA system should check closely with those on the electric bill if the power company uses the floating demand interval. Since the demand timing of ECSA is not synchronized with the demand timing of the power company, the minutes (for calculating demand) may start and stop up to 30 seconds apart. This can cause a small discrepancy between peak demands on your bill and those recorded by ECSA.

PDSF Algorithm

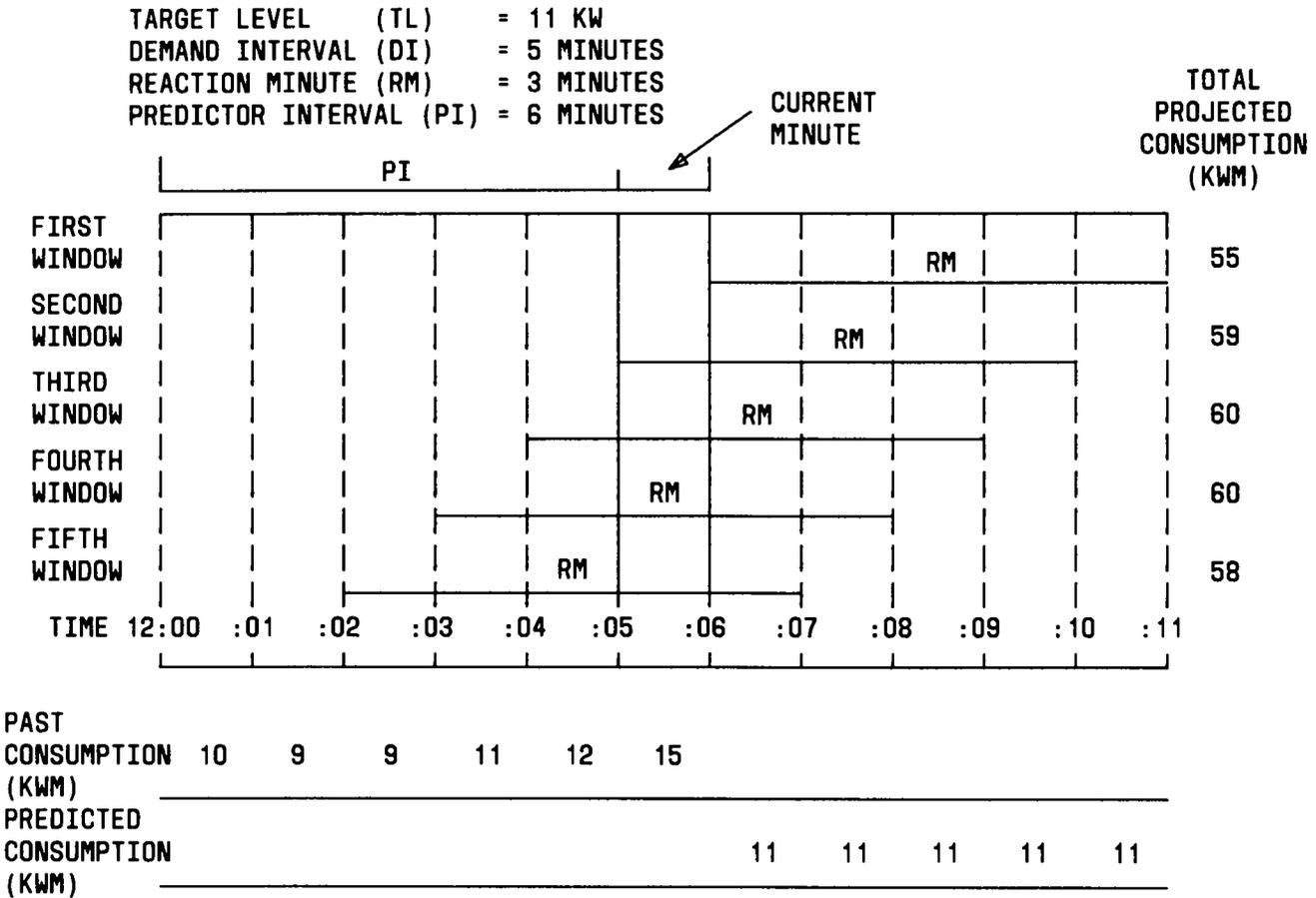
3.36 ♦The PDSF algorithm is quite complex and a basic description is presented in order to define the PDSF operation more precisely, thus helping the user to optimize the PDSF's performance.

3.37 The PDSF algorithm is used basically to decide if load groups should be shed or restored, and if so, how many for the current minute. Each minute, the algorithm uses the floating demand interval to determine the current demand. The floating demand interval is made up of multiple fixed demand intervals. The number of fixed demand intervals used is equal to the number of minutes in the demand interval. The first fixed demand interval (or window) starts at the end of the current minute and thus has no past consumption. The second window starts at the beginning of the current minute and thus has 1 minute of past or known consumption. Each proceeding window has an additional minute of past consumption. The last window has one 1 minute of which

the consumption is not known. An example of a floating demand interval with a demand interval of 5 minutes is shown in Fig. 2.

consumption which has occurred thus far in the window (ie, up to the end of the current minute) and does its best to predict how much more consumption will occur in the remainder of the window by using the predictor interval. The total consumption

3.38 For each window, the algorithm looks at the



NOTE:

1. THE MAXIMUM ALLOWABLE CONSUMPTION PER WINDOW IS EQUAL TO: TL X DI = 11 KW X 5 MINUTES = 55 KWM.
2. SINCE THE TOTAL PROJECTED CONSUMPTION OF THE FOURTH AND FIFTH WINDOW IS HIGHER THAN THE MAXIMUM ALLOWABLE CONSUMPTION THE AMOUNTS SHED FOR THESE WINDOWS ARE:

$$\text{FOURTH WINDOW} = \frac{60 \text{ KWM} - 55 \text{ KWM}}{2\text{M}} = 2.5 \text{ KW}$$

$$\text{FIFTH WINDOW} = \frac{58 \text{ KWM} - 55 \text{ KWM}}{1\text{M}} = 3 \text{ KW}$$

3. CONCLUSION: THIS CURRENT MINUTE WILL SHED 3 KW.

Fig. 2—Current Minute Demand Computation Example

(KWHs) within the window is divided by the number of minutes in the predictor interval (thus KW minutes) and this average (sometimes called the predictor) is used for the future minutes within each window. The total projected consumption (KWM) is calculated for each window as shown in Fig. 2.

3.39 In determining an accurate predictor, the algorithm also takes into account the amount shed each minute of the predictor interval. Each minute the system recalculates the shed estimates for each load group and sums the total consumption saved by the load groups currently being shed. If this amount is above zero, the amount saved by shedding for that minute is added to the past consumption for that minute. These totals are used for the past consumption and the total projected consumption for each window is calculated as before.

3.40 Each window's total projected consumption is used by the algorithm to determine the amount to be shed or restored for the current minute. This is the case if the reaction minute is equal to zero. If the reaction minute is not equal to zero, the algorithm does not consider a window's total projected consumption unless the reaction minute's consumption is known. Thus in Fig. 2, only the fourth and fifth windows are considered by the algorithm to make shed and restore decisions.

3.41 After the total projected consumption is calculated, the algorithm then calculates how much is needed to be shed or restored for each window. This is done by comparing the total projected consumption for the window (in terms of KWM) to the maximum consumption which may occur in a window without exceeding the target (which is the target in KW times the demand interval in minutes). If the projected consumption is higher, the difference (again in KWM) is divided by the number of future minutes in the window, and the result (in KW) is the amount to be shed for that window (as shown in Fig. 2). If the projected consumption is lower, the algorithm must implement the safety band.

3.42 Recall that the purpose of a safety band is to avoid oscillations. The cause of oscillations is the fact that predictions of consumption in future minutes are imperfect, and must inevitably contain some amount of error. A safety band is incorporated to provide some margin for that error. Clearly the total error contained in the projected consumption for a window depends largely on how much of that

window has already happened (for which there should be no error) versus how many minutes must have their consumptions predicted. Hence, it makes sense to incorporate the safety band only for the minutes which must be predicted. Implementation of this approach is similar to the one outlined previously for shedding, except that the maximum allowable consumption (for the restore decisions) would be different for each window. For any window, the maximum allowable consumption would be the sum of two products. The first would be the number of minutes which have already passed in the window under consideration times the target. The second would be the product of the number of minutes remaining in the window and the restore level (ie, the target level minus the safety band). Thus, if the total projected consumption is lower than the maximum allowable consumption, the difference (again in KWM) is divided by the number of minutes left in this window and the result (in KW) is the amount to be restored for the window.

3.43 Of the windows that satisfy the reaction minute parameter, the algorithm first looks for the window which sheds the most. This is the amount need to be shed for the current minute (as shown in Fig. 2). If there are no windows with amounts to be shed, the algorithm finds the window that restores the least number of KWs. This is the amount needed to be restored for the current minute.

3.44 Before the algorithm can shed load groups for the current minute, it must have surpassed the minimum time between restore and next shed parameter. Likewise, before it can restore load groups, the current minute must have surpassed the minimum time between shed and next restore parameters. Also, before the algorithm can shed, the amount to be shed for that current minute must be greater than the shed estimate (calculated each minute) of the first or next higher load group. Likewise, before it can restore, the amount to be restored for that current minute must be greater than the shed estimate (calculated each minute) of the next lower load group.¶

Factors to Consider When Using the PDSF Function

3.45 The PDSF is the most complex of the ECSA functions. Factors which should help the customer obtain optimum performance from the PDSF function are as follows:

- (a) As previously discussed, the load group KW estimates are used to decide how many load

groups should be shed (or restored) in any 1-minute period. The closer the KW estimates are to the actual power reduction (caused by shedding the load groups), the better the PDSF algorithm operates (keep the demand below the target level without shedding more load groups than necessary). The power consumption and run factor parameters specified for loads within a group should be as accurate as possible.

- (b) Load groups should be made as small as possible (small KW estimate) while maintaining balance within the group.
- (c) To allow flexibility, priority ranks should not be assigned in tight sequential order. It is suggested that groups be initially given priority ranks (ie, load group numbers) which are multiples of five or ten to allow for simpler additions and rearrangement.
- (d) It is possible that loads used for PDSF will occasionally be turned off for periods as short as 1 minute. The probability of these occurrences depends on the number of times the groups are shed and restored, but in general, this will rarely happen.
- (e) The ECSA system should be as near balanced as possible.
- (f) For best performance of the PDSF, the "minimum time between shed and next restore" and "minimum time between restore and next shed" parameters should be set to zero. However, this increases the possibility of oscillating between shed and restore decisions in short time intervals which may damage some loads.
- ◆(g) The possibility of damaging a load due to oscillating between shed and restore depends largely on the nature of the loads being controlled. A higher potential for damage would naturally indicate that a larger safety band should be considered. The possibility of oscillations depends, to some extent, on the shed and restore constraints. The more binding these constraints are reduces the necessity for a large safety band. The possibility of oscillations also depends on the accuracy of the shed estimates. Less accurate estimates increase the likelihood that a shed decision is reversed (ie, a quick restoration) because the impact on demand is not what the algorithm had expect-

ed. Hence, if a particular installation includes a large number of factors which make it difficult to assess shed estimates (ie, large loads with controls external to ECSA), a larger safety band would be required for PDSF optimization.◆

Balancing the ECSA System

3.46 In optimizing the ILCF's and PDSF's ability to reduce energy consumption and eliminate peak demands from reaching the target level, the importance of balancing the system in both the normal and shed condition cannot be stressed too much. Balancing the system also lowers the customer's power rates by lowering the energy value of the peak demands.

3.47 To balance the system, the following steps should be taken:

- (1) Balance the loads (whether they are in a group or not) within the system for each day of the week by adjusting the normal patterns per daily schedule whenever possible. Normal patterns should be chosen so that the peak demand is lowered considerably and to ensure only a few peak demands occur during the month. This lowers the target level value, thus lowering the customer's power rate. Normal patterns should also be chosen for maximum energy savings.
- (2) Loads desired to be shed should be placed in groups first on the basis of each load's priority. The second consideration for developing load groups should be on the basis of each load's energy consumption and shedding schedule for each day of the week. For example, a load with an energy consumption rate of 1000 KW and which has a shedding pattern of 14A might be grouped with two loads that each have a consumption rate of 500 KW and with a shed pattern of 14B. The closer each load groups is to being balanced, the closer the system (all load groups) is to being balanced in the shed condition. If the customer chooses to assign one individual load per group, a balanced system would then require balancing between load groups of consecutive priorities using the shed schedules. Load groups should be made as small as possible because a small KW estimate allows the PDSF to shed only the desired amount; however, if a load group has only a single load, the system will not come close to being balanced until two or three of such load groups are shed. If a load group

has loads with daily shed schedules of "continually off" (ie, 24A), the group is balanced for that day in the shed condition.

Note: It should be stressed that the time at which the peak demand normally occurs for a customer is the period of time that balancing in the shed condition is most important.

- (3) A decision should be made at this point to decide which condition (shed or normal), if balanced to a finer degree, is most profitable.
- (4) The final step in optimizing ECSA is to balance to a finer degree loads in their normal condition or load groups in their shed condition or both. Again, this is accomplished by rearranging loads between groups and/or changing daily schedules. The ECSA operator should realize that balancing the system is a continuing process because of the many variables which may change daily schedules or the number of loads in the system.

System Start-Up

3.48 Commercial power failures can contribute to causing large peak demand charges for users of energy management systems (like the ECSA). For example, often a power failure causes the temperature in an air-conditioned building to rise. When power is restored, the air conditioners run continuously until the temperature is brought back down. This continuous running of the air-conditioning system can cause a peak demand for which customers with ratchet clauses could have to pay for the next year or two. Similar situations can occur after any system failure, or even upon bringing the system up just after installation. A start-up peak demand such as this would wipe-out the benefits of the meticulous demand limiting gained by the PDSF for that year or two. The ECSA system is designed to prevent these start-up peak demands.

3.49 Upon system start-ups, load groups are sequentially started up from lowest to highest priority number. Loads in the designated load groups are controlled by their shed schedules, loads not in a designated group or not in a group are controlled by their normal schedules. The customer can designate these load groups via the START UP: HIGHEST NUMBERED GROUP SHED parameter. This load group and lower numbered load groups are controlled

by their shed schedules. Higher numbered load groups are controlled by their normal schedules upon system start-up. The PDSF algorithm cannot make shed nor restore decisions for 5 minutes, or the predictor interval length plus 1 minute, whichever is longer. The reason for waiting 1 minute longer than the predictor interval length is as follows. The first minute during which the power meter interfaces become active (upon system start-up) is likely to be an incomplete minute. That is, the system may come up in the middle of the minute. Hence, the consumption data collected during that minute is likely to indicate a consumption rate smaller than what is actually being experienced and is inappropriate to use as the basis for prediction.

C. Energy Consumption and Demand Monitoring (ECDM)

3.50 The ECDM function allows the customer to monitor the building's electrical energy consumption, demand, and help to optimize the performance of the ECSA. The following information is displayed by the ECDM function:

- (a) Time and date of display.
- (b) Total consumption for the system since last cleared, and time and date it was cleared.
- (c) Highest floating demand for the system since last cleared, and time and date it was last cleared.
- (d) Present floating (current) demand and peak demand target level.
- (e) The load group number of the highest load group now shed, if any.
- (f) The total number of loads which currently have their energy disabled by any of the ECSA functions.
- (g) A current history of the floating demand and highest load group shed in 5-minute increments during the past 50 minutes.
- (h) Current energy demand for each nonelectric or electric power meter. (The nonelectric current demand information is not used for the PDSF nor for any other ECSA function. The designation of which meters are used for measuring electric

power consumption are administered by craft personnel via the MAAP.) This demand reading is not an actual but an average rate of consumption based on the demand interval (ie, 5, 15, or 30 minutes).

3.51 The ECDM function also continuously displays the information on the total consumption and highest demand for each power meter (since last cleared) and can be printed automatically at a specified rate (5 to 60 minutes) on the TELETYPE* Model 4310 printer. This report is called the periodic status report (see ECSA PRINTED INFORMATION). The ECSA keeps a running total of consumption and demand for the system and for each power meter. The customer may print or print and clear this running total each billing period or any interval the customer chooses. The ECSA also keeps a daily total of consumption and demand for the system and for each power meter (since last cleared). This total is also updated once every minute but is printed and cleared every 24 hours. This is called the Daily Status Report. These reports can be used in a number of ways such as fine tuning the PDSF, monitoring system performance, or validating the customer's electrical, gas, etc, power bill. The floating window is one of two methods that the utility company can use for computing demand (the other is the fixed demand interval). The ECSA uses the floating demand interval to assure the detection and calculation of the highest demand in any period of time. So that the peak demand calculated by the power company is never higher than the peak demand calculated by ECSA.

3.52 The total number of loads disabled by the ECSA feature is a useful parameter to an experienced ECSA operator. The operator is able to use this data to quickly determine the health of the ECSA. Given factors such as time of day, outside temperature, building occupancy, etc, the experienced operator is able to surmise a reasonable value for this item. If the displayed value is considerably different from the expected value, the ECSA operator should look at the system operation more closely to determine if it is working properly.

D. Binary Feedback

3.53 Binary Feedback is a function of ECSA that is used to monitor the response of sense

points. The sense points can either be assigned to an ECSA controlled load or just assigned as a stand alone. Binary Feedback has many applications and can obtain feedback from any customer provided device that senses the desired condition and provides a dry contact closure to the ECSA sense point when the condition exists. Some examples of sensors are: a sail switch that senses if a pressure threshold has been exceeded or a temperature sensor that detects if a temperature threshold has been exceeded. Many such devices are generally available and find standard application in the controls industry.

3.54 If a sense point is assigned to an ECSA controlled load, Binary Feedback can be used to monitor the response of the load and compare it to the state the load should be in according to the ILCF or PDSF. If there is ever a difference between the normal schedule (ie, during normal conditions) or the shed schedule (ie, during shedding conditions) and the actual state of the load, an alarm can be displayed/sounded to the ECSA operator.

3.55 If a sense point is assigned as a stand alone, Binary Feedback could be used to detect abnormal conditions or to monitor a load or device not controlled by ECSA. If it is used to monitor loads or devices not controlled by ECSA, then its purpose may be to determine when different units are being used and how many are energy enabled or disabled (eg, factory production machines). Binary Feedback could be used to monitor for a certain condition such as an emergency condition within the building (eg, fire, smoke, gas, etc) or an emergency condition relating to a load (eg, dangerous temperatures, blown fuses, overload conditions, etc). Binary Feedback could also be used to monitor for a security breach condition (eg, door opening or closing, movements, sounds, windows breaking, etc). The following information is displayed by Binary Feedback.

- (a) Sense point number
- (b) Alarm type (0, 1, or 2)
- (c) Sensor status (closed or open)
- (d) Load number
- (e) Load status (ON or OFF)
- (f) Delay (seconds).

3.56 The sense point number parameter is the number of the sense point assigned to an

*Registered trademark of Teletype.

ECSA controlled load or to the ECSA system. A separate numbering scheme is provided for sense points.

3.57 The alarm type parameter is the type of alarming desired for each sense point. A sense point may be assigned alarm type 0-no alarms, 1-asterisk displayed or 2-asterisk and alarm message displayed.

3.58 The sensor status parameter indicates the current state (ie, open or closed) of the sense point. If the sense point is assigned to a load, the sensor status should verify the loads daily schedule; if it does not, an alarm can be displayed/sounded. If the sense point is assigned as a stand alone, the sensor status could be used to detect an emergency or security breach condition; or, it could monitor a load not controlled by ECSA.

3.59 The load number parameter and the following two parameters are displayed only if the sense point is assigned to a load number via the MAAP. The functions of the load number and load status parameters have been previously discussed.

3.60 The delay time parameter is assigned via the MAAP. The delay time is the time that ECSA waits after a command to change the state of the load is sent to the load before expecting the sense point to detect the new loads state. The delay time can be from 000 to 300 seconds (ie, 0 to 5 minutes). It is assigned in 5-second intervals. The delay time is useful when equipment controlled by the ECSA is turned on and there is a natural delay in sensing the effects caused by the equipment. For example, a natural time lag exists between the time a large air handler is started and a sail switch detects air moving in the ductwork.♦

E. Other Customer Alterable Parameters

3.61 There are several ECSA parameters that the customer can administer which are not directly associated with any of the particular ECSA functions. These parameters are:

- (a) ECSA—active/inactive
- (b) Energy communications system on override—active/inactive
- (c) Loads with on override active
- (d) Loads with off override active

- (e) Power meter KWH per pulse factor
- (f) Power meter alarm—active/inactive
- (g) System date and time
- (h) Holiday dates
- (i) ♦Fail-safe conditions.♦

3.62 The ECSA parameter may be specified active or inactive.

- (a) **Active:** All ECSA functions operate normally.
- (b) **Inactive:** All ECSA functions are deactivated and all individual loads are enabled. This parameter takes precedence over all overrides. This state is referred to as the ECSA inactive override in the load status table (see OPERATING PROCEDURE F7—Load Status). Power meter readings are not taken when ECSA is inactive.

3.63 The energy communications system on override parameter may be specified active or inactive.

- (a) **Active:** All loads are enabled. This takes precedence over the load override parameters and all ECSA functions.
- (b) **Inactive:** System on override has no effect on the ECSA functions.

3.64 The loads with on override active parameter can force any load to have its energy enabled. If a load is included in the load on override list, the load's energy is enabled and the load is not affected by any of the ECSA functions.

3.65 The loads with off override active parameter can force any load to have its energy disabled. If a load is included in the load off override list, the load's energy is disabled and the load is not affected by any of the ECSA functions except that the system on override and load on override take precedence and force the energy to the load to be enabled.

Note: The customer may wish to provide a manual override which would have precedence over all the ECSA functions and all ECSA over-

rides for various reasons. Some loads may need to have the option of a manual override for emergency conditions. Other loads may have this override for convenience. For example, an employee working overtime may need the lights or factory machines to operate but the ECSA operator has gone home and no one knows the ECSA security code.

3.66 The power meter KWH per pulse factor parameter must be specified for each power meter that the customer wishes to monitor. This factor is the number of KWH represented by each pulse received from the power meter. This parameter is used to calculate the total consumption and highest demand for the system and for each power meter. It is also used to calculate the current demand for the system and each power meter. This parameter may be obtained from the power company. This parameter may represent nonelectrical power also [eg, British thermal units (BTUs)].

3.67 The power meter alarm parameter may be specified active or inactive.

(a) **Active:** An alarm message is displayed to the ECSA operator indicating that there was no power meter pulse received from that meter for one demand interval.

(b) **Inactive:** No alarm messages are displayed to the ECSA operator. This option is provided for power meters that usually do not send pulses for long periods of time and would cause alarm messages to be displayed constantly.

3.68 The ECSA system date and time parameter allows the ECSA operator to set or reset the system date and time when the system is first installed, for example.

3.69 The holiday dates parameter allows the ECSA operator to choose the dates (ie, month and day) for which the holiday schedule (eighth daily schedule) is activated. If more holiday schedules are desired, past holiday dates can be overwritten.

3.70 ♦The fail-safe condition allows the customer to designate for each load what state (ie, enabled or disabled) the load is to be in if a power failure occurs and ECSA powers down, but the load's power is not affected (eg, an off-premise load). This customer alterable parameter can be designated ON or OFF.

(a) **ON:** When a power failure occurs, the load is energy enabled, assuming that the correct relays and connections are made to the load.

(b) **OFF:** When a power failure occurs, the load is energy disabled, assuming that the correct relays and connections are made to the load (this is the default for each load when assigned to the system).♦

ECSA SYSTEM CONFIGURATION

3.71 ♦A simplified block diagram of the ECSA hardware configuration is shown in Fig. 3. The ECSA feature is provided via a stand-alone system. The ECSA feature is provided in one or two cabinets depending on the size of the system (see LIMITATIONS, Part 6). This feature has its own hardware, within its own cabinet(s), powered by its own power supply(s) and controlled by its own processor. The major and minor alarm leads from the alarm panel are the only connections between a remote system or alarm and the ECSA system. These leads, for example, may be connected to a red and green light-emitting diode (LED) and mounted next to the cathode ray tube (CRT). The ECSA cabinet(s) is 560 millimeters (mm) (22 inches) deep by 800 mm (31-1/2 inches) wide by 1207 mm (47-1/2 inches) high. For details on the ECSA cabinet(s) and carrier(s) see the ECSA System Description (Section 554-106-100).♦

ON-PREMISES CAPABILITY

3.72 The ECSA feature which consists of the ILCF, PDSF, ECDM, and Binary Feedback functions are provided to on-premises loads via the following hardware.

(a) Load control relay—LC562

(b) Power meter interface/sense point—LC563

A. Load Control Relay (LC562)

3.73 The load control relay is the circuit by which ECSA controls customer loads. Technically, the load control relay is a dry "make" (normally open) contact and these contact closures control either an inverting relay leading to a power relay or the power relay directly. The power or inverting relay can be provided by the customer or the operating company. The operating company provided power relay is called the Interface Power Relay. The power

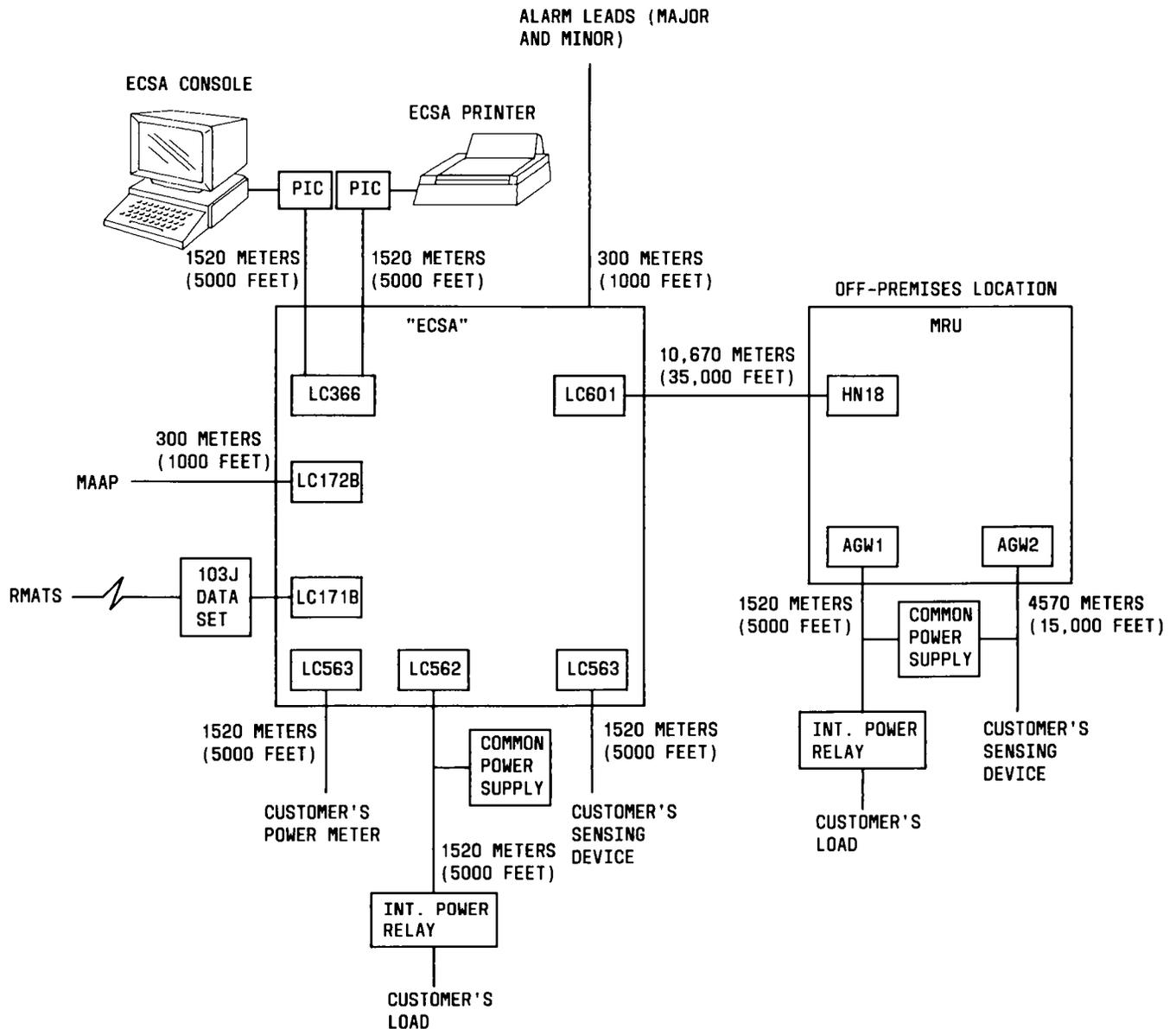


Fig. 3—ECSA Hardware Configuration

relay controls directly the state of the load. It is the customer's responsibility to wire from the load control relay connections to the load which is to be controlled. There are 16 load control relays on an LC562 circuit pack.

B. Power Meter Interface/Sense Point (LC563)

3.74 The power meter interface (PMI) is the circuit by which the ECSA feature monitors the customer's electrical energy consumption and demand.

A maximum of 16 PMIs can be administered. The LC563 circuit pack has 16 PMI circuits. The PMIs may be assigned to electrical power meters or non-electrical meters (eg, gas or water). Most power companies provide a power meter pulsing relay from their power meter(s). Each relay pulse (a contact open/close cycle) represents a fixed amount of energy consumption (electrical and nonelectrical) during a very short period of time (this is the KWH per pulse factor). The PMI enables the ECSA software to count these meter pulses and in turn calculate the build-

ing's total electrical energy consumption and demand for the system and also calculates the energy consumption and demand for each power meter assigned to ECSA. If the power company does not provide these meter pulses, the customer will have to install a power meter pulsing relay capable of providing the meter pulses. The PDSF and ECDM functions require the use of a PMI circuit. Again, wiring from the cross-connect field to the power meter pulsing relay can be provided by the customer or optionally provided by the operating company.

3.75 The sense point is the circuit by which the ECSA feature monitors the customer's sensing device. The sense point acts as a buffer circuit interface between ECSA and the sensing device. A sense point senses the contact closure from the sensing device and thus allows ECSA to provide the Binary Feedback function. It is the customer's responsibility to wire the sensing device to the demarcation point which is connected to the cross-connect field. Wiring may optionally be provided by the operating company. There are 16 sense points on an LC563 circuit pack.

OFF-PREMISES CAPABILITY

3.76 With this capability, the ECSA system controls and obtains feedback from off-premises loads via the ILCF and Binary Feedback functions. The PDSF and the ECDM cannot be used with an off-premises load. However, the same applicable operating procedures and printed reports are used for on- and off-premises loads. The system operates the same and responds the same for on- and off-premises loads. The only other difference is that the Off-Premises Capability allows ECSA to control up to 64 loads at a remote location with the use of *one* private line. This capability requires only hardware Limitations (Part 6), Installation/Addition/Deletion (Part 9), and Hardware Requirements (Part 10). The system configuration for the Off-Premises Capability is shown in Fig. 3.

3.77 The ECSA Off-Premises Capability hardware includes the following items.

- (a) Remote Controller (LC601)
- (b) Master Remote Unit (MRU)
- (c) Remote Interface Board (HN18)
- (d) Remote Load Control Relay (AGW1)

(e) Remote Sense Point (AGW2).

A. Remote Controller (LC601)

3.78 This board fits into a cabinet carrier slot which is connected via a private line to the Master Remote Unit (MRU). The private line connection between the Remote Controller and the MRU can be provided by the customer or optionally provided by the operating company. The Remote Controller replaces four Load Control Boards (LC562s). This opens 64 equipment locations for off-premises loads. The Remote Controller acts as a buffer circuit for the MRU, keeping the MRU transparent to the ECSA processor. Included in the LC601 is the hardware to provide the 300 baud FSK (Frequency Shift Keying) full duplex data channel required to interface to the MRU. A wire pair for the LC601 is brought out to the cross-connect field.

B. Master Remote Unit

3.79 The MRU is the control unit that sends the contact closures generated by the Individual Load Cycling Function (ILCF) to the inverting relay and/or the power relay which directly control the actual state of the off-premises loads. The MRU can also be used to transmit the contact closer from a customer provided sensing device to the Remote Controller for the Binary Feedback function. The wiring between the MRU cross-connect field and the off-premises customer provided sensing device can be provided by the customer or optionally provided by the operating company. The MRU comes with one Remote Interface Board (HN18). The MRU has eight slots of which some combination of Remote Load Control Boards (AGW1) and Remote Sense Point Boards (AGW2) are placed. The MRU can be located on- or off-premises. If the MRU is located off-premises a private line is required to connect between the Remote Controller and the MRU. However, if the MRU is located on-premises the LC601 is connected to the MRU via in-house 26-gauge wire or a nonloaded, twisted wire pair (24-gauge wire).

3.80 The MRU has the same physical dimensions as a Peripheral Interface Circuit (PIC). The MRU measurements are 292 mm (11.5 inches) wide, 89 mm (3.5 inches) high, and 279 mm (11.0 inches) deep. The MRU weighs approximately 6.8 kilograms (kg) (15 pounds) and is configured for desk mounting. The MRU has a standard modular telephone plug on it which is used to connect the data channel from the LC601 to the MRU.

C. Remote Interface Board (HN18)

3.81 This board contains the receive/transmitter circuitry for the 300 baud data link. The Remote Master Interface Board receives the control signals transmitted by the Control Board for the ILCF, and in turn, orders the addressed relay mounted on the Remote Load Control Board(s) to the proper condition (ie, open or closed). The Remote Master Interface Board can also receive contact closures from the Remote Sense Point Board and transmit them to the Control Board. In addition, the connectors to interface to the AGW1 boards, AGW2 boards, and cross-connect field are located on the HN18. A combined sum of eight AGW1 and AGW2 boards may be plugged into the HN18 board.

D. Remote Load Control Relay (AGW1)

3.82 This relay provides a "make" (normally open) contact rated at 25VA, just as if the dry contact closures were coming from an LC562 circuit pack. The wiring between the MRU cross-connect field and the off-premises inverting relay and/or power relay can be provided by the customer or optionally provided by the operating company. The Remote Load Control Board provides control for eight loads. There is a maximum of eight AGW1 boards per MRU, thus providing a maximum of 64 off-premises loads that ECSA can control via an MRU. The design of the AGW1 is such that in the event of the loss of the data channel from the ECSA to the MRU these relays return to the open state.

E. Remote Sense Point (AGW2)

3.83 The function of the Remote Sense Point is to act as a buffer circuit interface between ECSA and the sensing device. A remote sense point collects the contact closures from the off-premises sensing device and thus allows ECSA to provide the Binary Feedback function to remote locations. It is the customer's option to wire the sensing device to the MRU cross-connect field which has the connections to each remote sense point. The AGW2 Remote Sense Point Board permits the interface to eight binary sense points using an operating company provided -24 volt source to detect contact closures. One Common Power Supply is required at each MRU location equipped with AGW2 boards to provide this -24 volt source. There is a maximum of eight Remote Sense Point Boards (AGW2s) per MRU, thus providing a maximum of 64 sensing devices that ECSA can monitor via an MRU.⚡

PERIPHERAL HARDWARE

3.84 The following ECSA peripheral hardware is common to both on- and off-premises operations.

- (a) ECSA Console
- (b) ECSA Printer
- (c) ⚡Interface Power Relay
- (d) Common Power Supply.⚡

A. ECSA Console

3.85 The ECSA console is a general trade cathode ray tube (CRT) terminal. The ECSA console is used to administer (display/or modify) the ECSA parameters, to observe the ECSA functional operation, and to request printed ECSA reports. Only one ECSA console can be administered per system via the MAAP. However, two additional consoles can be used if configured in a daisy chain arrangement [see Note 2 following the System Status (Base) Procedure description for operation of two or three consoles].

3.86 The ECSA console is an ADDS REGENT 40 console which consists of an alphanumeric keyboard for input, and a CRT display for output (see Fig. 4). The keyboard is displayed in Fig. 5. It consists of a standard typewriter set of keys plus a convenient numeric pad on the right, a special set of function keys on the top left (F1 through F8) and a set of cursor control keys on the top right.

3.87 This CRT can display up to 1920 characters arranged in 24 rows and 80 columns. Characters can be displayed in any combination of four display modes. These display modes are:

- Normal video (white characters on black)
- Reversed video (black characters on white)
- Half intensity (white part is dimmer)
- Blinking (characters flash on and off).

These display modes are used to help feed back information to the console operator.

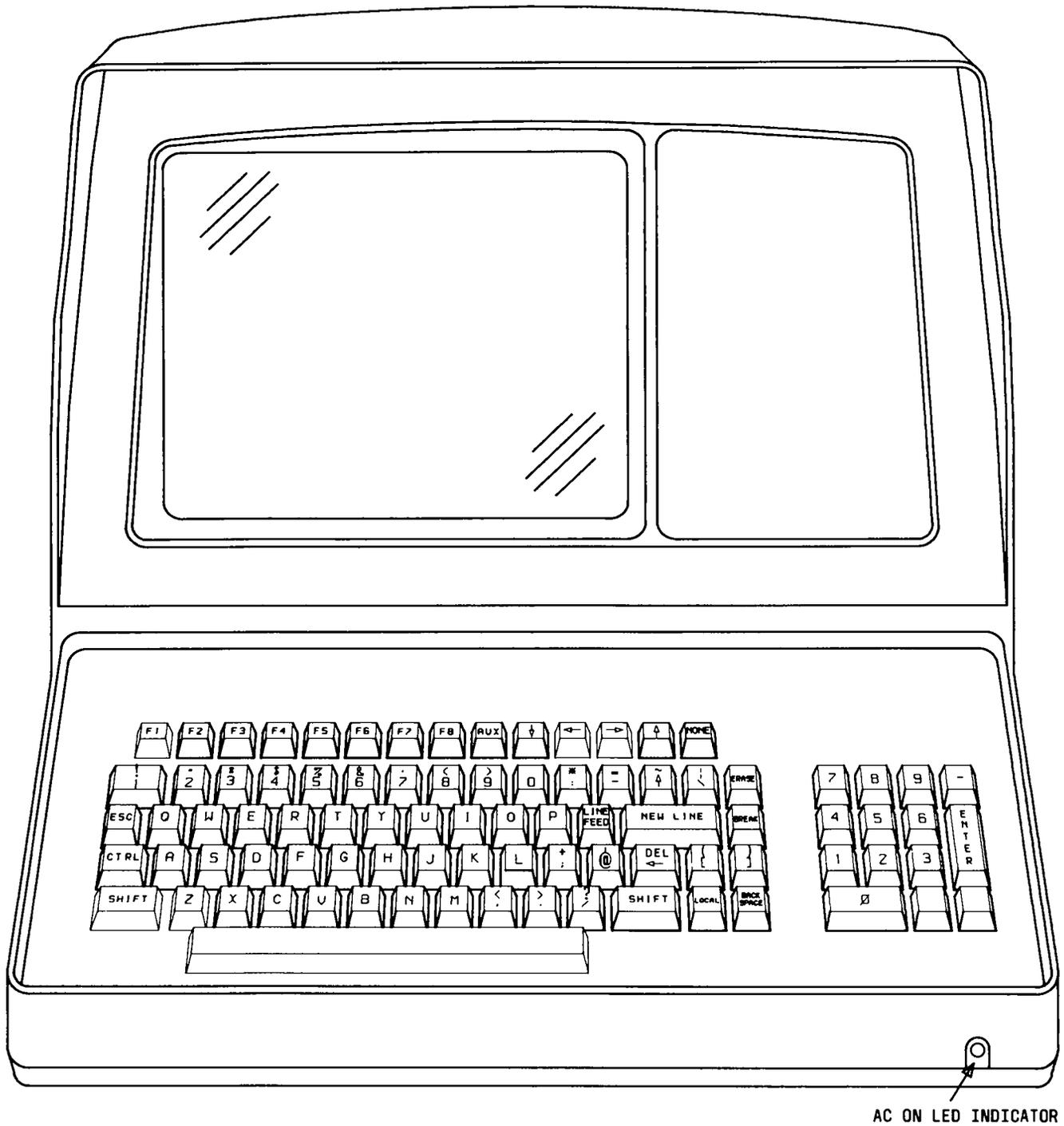
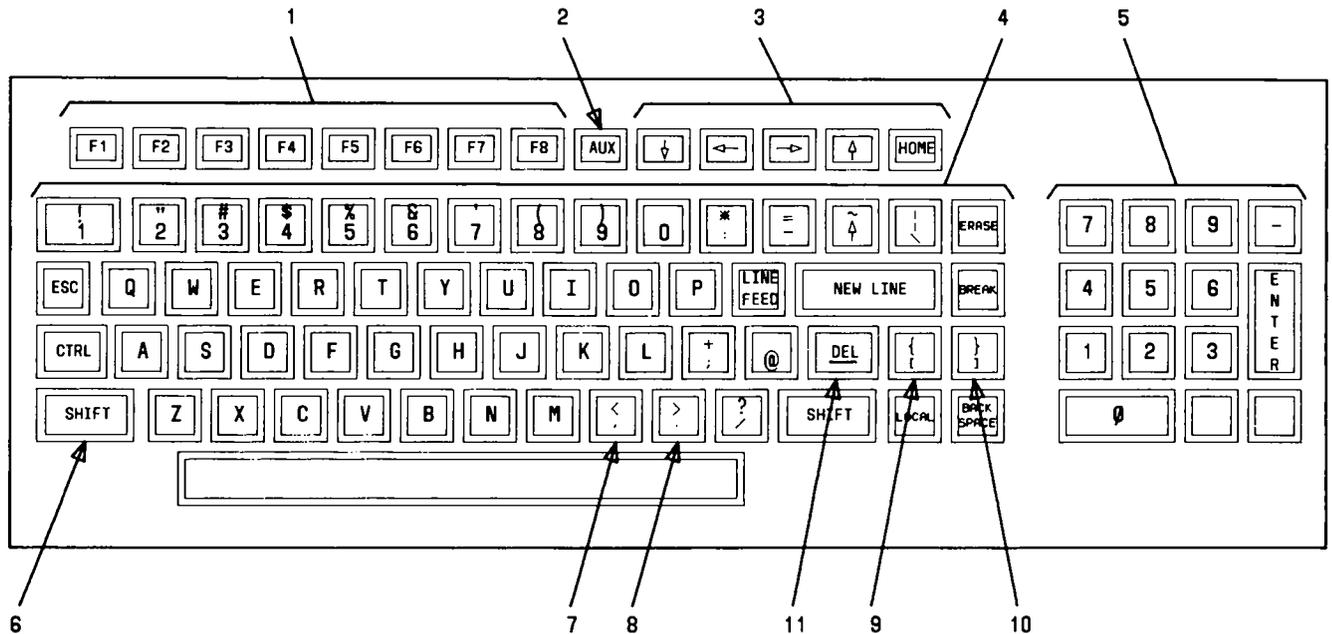


Fig. 4—ADDS REGENT 40 Console



1. THESE KEYS ARE FUNCTION KEYS FOR CONTROLLING THE CRT DISPLAYS
2. THE AUXILIARY KEY - THIS KEY IS NOT USED
3. THESE ARE THE CURSOR CONTROL KEYS
4. THE MAJOR KEYBOARD KEYS
5. THE PAD - THE NUMBERS ARE DUPLICATED ON THE KEYBOARD
6. SHIFT KEY - WHEN PRESSED SIMULTANEOUSLY WITH ANY KEY F2 THROUGH F8, ALLOWS YOU TO JUMP DIRECTLY FROM ONE PARAMETER DISPLAY TO ANOTHER.
7. THIS KEY (NO SHIFT REQUIRED) MOVES THE CURSOR TO THE LEFT AND UPWARD TO THE BEGINNING OF THE PREVIOUS DATA FIELD.
8. THIS KEY (NO SHIFT REQUIRED) MOVES THE CURSOR TO THE RIGHT AND DOWNWARD TO THE NEXT DATA FIELD.
9. THIS KEY (LONG TAB BACKWARD) MOVES THE CURSOR BACKWARD TO THE FIRST DATA FIELD OF THE PREVIOUS LINE.
10. THIS KEY (LONG TAB FORWARD) MOVES THE CURSOR FORWARD TO THE NEXT DATA FIELD OF THE NEXT LINE.
11. THIS KEY (DEL) MOVES THE CURSOR TO THE LEFT MOST DATA FIELD OF THE CURRENT LINE.

Fig. 5—ADDS REGENT 40 Console Keyboard

B. ECSA Printer

3.88 The ECSA printer is the TELETYPE 4310 printer; however, any RS232 compatible wide carriage printer capable of printing an 80-character line may be used. The physical size of the ECSA printer(s) is 15.25 centimeters (cm) (6 inches) in height, 51 cm (20 inches) in width and 66 cm (26 inches) in depth.

3.89 The ECSA printer(s) is used to obtain hard-copy information associated with the ECSA feature. The four ECSA printer functions are as follows:

- The ECSA demand reports
- The ECSA daily status report
- The ECSA periodic status report
- The ECSA automatic alarm report.

3.90 The customer has the option to direct each of these printouts to any ECSA printer (ie, except the ECSA automatic alarm report which is printed on the ECSA demand report printer), or the customer may choose to deactivate any or all of the printer functions by not assigning a printer to that function. In most cases, the customer has dedicated a single printer to ECSA and located that printer next to the ECSA console. The customer may dedicate two or three printers to ECSA if the printouts are to be kept separated. A maximum of three printers are allowed. A complete description of the ECSA printer functions is given in the discussion on ECSA PRINTED INFORMATION.

C. Interface Power Relay

3.91 The Interface Power Relay is provided as an option to customers to reduce the effort required on their part to provide the low control voltage to high voltage interface. The Interface Power Relay's coil is energized by the contact closure provided by the LC562 Load Control circuit pack or AGW1 Remote Load Control Board. Power from the Common Power Supply is superimposed on the Interface Relays coils at the cross-connect field.

3.92 The Interface Relay Unit includes an enclosure with removable cover, an octal base relay socket, low voltage screw terminal strip, high voltage

screw terminal strip, and a sealed octal base plug-in relay. The relay is current sensitive and requires 7.2 milliamps to operate with a maximum continuous 3-watt coil rating. The contacts rated at 120V with a maximum of 10 amps. This unit's dimensions are 75 mm (3 inches) deep by 76 mm (3 inches) wide by 127 mm (5 inches) high. This is a single poll double throw (SPDT) relay.

D. Common Power Supply

3.93 A Common Power Supply is required whenever the customer elects to use the interface power relay. In addition, this power supply is always required when AGW2 boards are used at a MRU location (see Fig. 3). The Common Power Supply is rated at 24 VDC, 2.4 amps and can power up to 216 relays. This power supply is equipped with a 1.8 meter (6 feet) power cord. This power supply's dimensions are 101 mm (4 inches) deep by 203 mm (8 inches) wide by 304 mm (12 inches) high.♦

OPERATING PROCEDURES

3.94 The ECSA console is the primary human interface to the ECSA feature. The ECSA console is used for the following functions:

- (a) ECSA parameter administration
 - Display present parameter value
 - Display ECSA alarms
 - Add and/or modify parameter values
- (b) Monitor system operation
- (c) Initiate printed reports.

3.95 In general, the ECSA console is operated in an editing mode. This means that the system fills the display screen with formatted data. A security code must be entered if the screen data is to be changed. The operator then positions the cursor (a small blinking box on the display) over the white fields (ie, fields that are customer alterable shown in boxes in the following figures) and enters new data or modifies existing data on the display. When the operator is finished and satisfied that all the data which has been entered is correct, the operator depresses one of the special function keys and the system records the new data into its memory. Since the

console can only display 24 lines at one time, it is impossible to display all the ECSA data simultaneously. Therefore, the ECSA data is segmented into logical units that can be displayed in 24 lines or less. A logical unit of data is called a procedure. In some cases, the data contained in a procedure cannot be displayed in 24 lines. In these cases, the data for that procedure is broken into smaller units called pages.

3.96 There are nine ECSA console procedures which allow the operator to control and/or monitor the ECSA system. The system status (base) procedure gives the operator a minute-by-minute status of the ECSA system's operation and allows the operator to call any of the other eight console procedures. Five of the procedures allow the operator to display and/or modify the parameters associated with the ECSA system and the three ECSA functions. The remaining procedures are used to display load states, display ECSA alarms, and to initiate printer reports. The nine console procedures are numbered "0 through 8" as follows:

- (0) System status (base) procedure
- (1) Energy communications alarm procedures
- (2) System parameters procedure
- (3) Binary feedback procedure
- (4) The ILCF and peak demand shedding parameters procedure
- (5) Peak demand load shedding parameters procedure
- (6) Load override parameters procedure
- (7) Load status display procedure
- (8) Printer parameters and reports procedure.

Note: It is recommended that the ECSA console be turned off when not being used.

A. System Status (Base) Procedure

3.97 The ECSA console displays the base procedure unless the operator is actively involved in one of the other seven procedures. An example of the base procedure display is shown in Fig. 6. The base procedure display consists of three distinct parts. The top

part of the screen displays the current status of the ECSA system. This information is displayed and updated once every minute, so long as the ECSA feature is declared active.

3.98 The first line of the status display gives the date and time of the last update. The next two lines give the total electrical energy consumption and highest demand and the date and time this data was last cleared (set to zero). These data items can be printed, or printed and cleared using the Printer Parameters and Reports Procedure (see procedure F8). The next lines tell the operator at a glance how close the building's current demand is to the peak demand target level; and if load shedding is in progress, how well it is performing, and how close it is to shedding the highest available priority load group.

3.99 The next line, TOTAL NUMBER OF LOADS NOW OFF, constitutes a system heartbeat. An experienced operator is able to use this data item to quickly determine the health of the ECSA system. If this value is significantly different from what the operator considers normal, further action can be taken to assure that the system is functioning properly.

3.100 The 50-MINUTE HISTORY OF DEMAND and HIGHEST LOAD GROUP NOW SHED give the operator an in-depth look at the operation of the PDSF. In hard-copy form, this information is used to aid the system operator in adjusting the PDSF parameters and to verify the highest demand on the electric bill.

3.101 The INDIVIDUAL METER CURRENT DEMAND gives the current energy demand for each power meter (measured in KW). ***Demand is not the actual consumption of energy but is the average rate of consumption during the demand interval.*** It is computed by taking the total consumption during the demand interval and multiplying by the number of demand intervals in an hour. This information is displayed and updated once every minute and gives the ECSA operator information which can be used to monitor and optimize the PDSF. This display has the capability to designate some of the 16 meters to be used for purposes other than measuring electric power consumption (eg, keeping a current demand of water and gas consumption along with the electric power demand). The designation of which meters are used for measuring electric power consumption is administered by craft personnel

```

SYSTEM STATUS
□ 10/05/82 11:28

TOTAL CONSUMPTION SINCE 10/05/82 10:53 IS: 00017820 KWH
HIGHEST DEMAND SINCE 10/05/82 10:54 IS: 26320 KW
CURRENT DEMAND: 26320 KW PEAK DEMAND TARGET: 20000 KW
HIGHEST LOAD GROUP NOW SHED: 001
TOTAL NUMBER OF LOADS NOW OFF: 0001

HISTORY OF DEMAND AND HIGHEST LOAD GROUP SHED
TIME          00:00 00:00 10:50 10:55 11:00 11:05 11:10 11:15 11:20 11:25
DEMAND (KW)   00000 00000 26320 26320 26320 26320 26320 26320 26320 26320
HIGST.GRP.SHED --- --- --- --- --- --- --- --- 001 001

INDIVIDUAL METER CURRENT DEMAND
01-12720 02-63600 03-00000 04-63600 05-32436 06-00000 07-00000 08-00000
09-00000 10-00000 11-00000 12-00000 13-00000 14-00000 15-00000 16-00000

THE FOLLOWING PROCEDURES CAN BE CALLED BY PRESSING THE INDICATED KEY:
F1-EC ALARMS DISPLAY           F5-PEAK DEMAND LOAD SHEDDING PARMS.
F2-SYSTEM PARAMETERS          F6-LOAD OVERRIDE PARAMETERS
F3-BINARY FEEDBACK            F7-LOAD STATUS DISPLAY
F4-INDIVIDUAL LOAD SCHEDULING PARMS. F8-PRINTER PARAMETERS AND REPORTS
MESSAGE: EC ALARM(S)

..... CARRIER SEND

```

Fig. 6—Typical System Status (Base Procedure) Display

through the MAAP. No other administration besides the KWH/pulse factor in the F2—System Parameters procedure is required to allow the electric and nonelectric meters to be monitored. If, for example, nine meters are desired to be treated as electric power meters and the other seven are desired to be gas meters, then only the first nine meters on this display are totaled to construct the numbers which appear on the following lines in the base procedure display:

- TOTAL CONSUMPTION SINCE (date and time) IS: xxxxxxxx KWH
- HIGHEST DEMAND SINCE (date and time) IS: xxxxxx KW
- CURRENT DEMAND: xxxxxx KW.

The same applies to the DEMAND line of the HISTORY OF DEMAND AND HIGHEST LOAD GROUP SHED display. The input from the remaining nonelectric meters is not added into the totals which this feature looks at to make peak demand shedding decisions. Therefore, if there are no power meters treated as electric power meters, then the PDSF is deactivated.

3.102 The bottom part of the screen defines the eight other operational ECSA procedures which the operator may call. These procedures are called by depressing the function key (F1 through F8) which is indicated for that procedure. After the operator has entered one of the eight procedures, there are two ways in which the operator may enter other procedures. Normally, the operator exits a procedure

by depressing the function key F8 and returning to the base procedure. The operator may then enter any of the other procedures by depressing the appropriate function key. However, if the operator knows the function number of the procedure to be entered, the operator may enter it directly from any other procedure by holding down the shift key while depressing the function key corresponding to the procedure. For example, if the operator wants to enter the Load Status Procedure from any other procedure, the operator can do so by depressing shift and F7 simultaneously.

Note 1: For a periodic printout of this procedure, see the Periodic Status Report in the ECSA PRINTED INFORMATION description.

Note 2: If two or three ECSA consoles are configured in a daisy chain arrangement, then only one console can interact with the system at a given time. The remaining consoles are mirror images of the console that has control of the data channel. The first console to depress a function button from the base procedure has control. When the controlling console times out or returns manually to the base procedure, the remaining console(s) can access the data channel by depressing a function button.

Common Functions

3.103 The definition of the function keys is different for each of the operational procedures (ie, the base procedure and F1 through F8). However, there are three definitions of the function keys which are common to the eight operational procedures (F1 through F8) with the exception of the F1—ECSA Alarms and the F5—Peak Demand Load Shedding Parameters procedures. These function keys are:

F6—Record New Parameters

F7—Restart Procedure

F8—Exit Procedure.

3.104 The function key F6 is used to record new parameters into the system's memory. Parameter changes made by editing data displayed on the CRT screen or by deleting data using one of the function keys is not recorded until function key F6 is depressed.

3.105 The function key F7 is used to restart the current procedure. Depressing F7 has the

same affect as calling that procedure from the base procedure. The most likely uses of F7 are to abort erroneous parameter changes before they are recorded, and to redisplay formatted data after it has been recorded, when many parameter changes are made at once. The function key F8 is used to return to the base procedure when the operator is finished using one of the operational procedures. The operator should remember to return to the base procedure so that the system status information is displayed. However, if the operator forgets to return to the base procedure, there is a time-out provision that automatically returns the console to the base procedure.

Note: If the operator is executing one of the operational procedures and has not depressed a key on the ECSA console for a period of 5 to 6 minutes, the system automatically returns to the base procedure. When this occurs, the current procedure is aborted and parameter changes that have not been recorded must be reentered.

3.106 ♦Another common function of procedures F1 through F8 is the current system time-of-day which is displayed continuously in the upper right-hand portion of the current screen. The time is incremented each minute in accordance with time-of-day clock. The base procedure has the current time of day shown on the first line in the upper left-hand corner.♦

B. F1—Energy Communications Alarms Procedure

3.107 This procedure is entered from the base procedure by depressing function key F1. This procedure is used to display alarms which are detected by the ECSA on-line maintenance software. The first time an alarm occurs, a flashing message NEW EC ALARMS is displayed in the message area of the base procedure, and an audible beep is sounded. If the ECSA operator goes to another procedure after this message is displayed and then returns to the base procedure [without fixing the alarm(s) and/or clearing it and if no other alarms have occurred], the message EC ALARM(S) is displayed. No audible beep is sounded, and the word NEW is dropped ♦and the message EC ALARM(S) does not flash.♦

3.108 If there are not alarms in the system, depressing F1 from the base procedure results in the flashing message NO ALARM(S) appearing as a message and this procedure not being displayed. If there are alarms in the system, depressing F1 dis-

plays a screen similar to the sample shown in Fig. 7. There are eight different types of alarms, each of which produces a different message. These messages are:

- (a) SYSTEM CLOCK NEEDS UPDATING
- (b) POWER METER XX-NO PULSES RECEIVED
- (c) LOAD XXXX FAILED.
- (d) ◆PRINTER XX-EITHER OUT OF PAPER OR TURNED OFF
- (e) PRINTER XX-PIC FAILED OR BACKED UP, OR LC366 FAILED
- (f) PRINTER XX-OUT OF SERVICE

- (g) SENSE POINT XXX INDICATES LOAD XXXX IS IN THE WRONG STATE
- (h) SENSE POINT XXX CLOSED.◆

3.109 The SYSTEM CLOCK NEEDS UPDATING alarm can appear only once since there is no unit number associated with it. The remaining alarm types can appear several times, once for each unit that fails. Each alarm message is preceded by the date and time that the alarms occurs. The first alarm message always appears at the same position on the CRT screen, ie, on the first line. The other seven types of alarms are displayed in reversed order from when they were received (newest alarm message at the top). The system can hold in memory 42 alarm messages of these types. The ECSA operator can display

ENERGY COMMUNICATIONS ALARMS **08:46**

10/01 12:32 SYSTEM CLOCK NEEDS UPDATING

10/01 14:28 LOAD 0009 - FAILED
 10/01 14:09 LOAD 0108 - FAILED
 10/01 13:51 POWER METER 09 - NO PULSES RECEIVED
 10/01 13:32 LOAD 0099 - FAILED

F1-DISPLAY MORE ALARMS
 F2-PRINT ALL ALARMS
 F3-CLEAR ALARM AT CURSOR
 F4-

F5-
 F6-CLEAR ALL EC ALARMS
 F7-RESTART PROCEDURE
 F8-EXIT-PROCEDURE

MESSAGE:

CARRIER

SEND

Fig. 7—F1—Typical ECSA Alarms Display

up to 34 alarms by using the paging capability. When the number of alarms in memory reaches 35, a print-out of the alarms is initiated automatically; and, the printed alarms are cleared from memory. The reason for initiating the print when 35 alarms are stored (rather than 42) is to anticipate the case where the printer is busy when the first attempt is made to initiate the alarm print, and more alarms come in before the printer becomes free again. This makes it very improbable for alarms to be lost (ie, overwritten) before they are either seen on the screen or a record made of them which facilitates ECSA maintenance.

Note 1: An automatic print has probably been initiated if the ECSA operator finds an empty list of alarms when displayed/printed where there were recently many alarms. This is true if the operator has not previously cleared the alarms.

Note 2: If the system clock alarm occurs, the automatic printout is activated when memory reaches 36 alarms and the system clock alarm is printed.

Note 3: The automatic printing of alarms does not occur while the ECSA operator is in the F1—ECSA Alarms procedure.

3.110 The SYSTEM CLOCK NEEDS UPDATING alarm occurs whenever the ECSA time-of-day clock is invalid and the ECSA feature is active. ♦The time-of-day clock is invalid when both the hardware and software clocks have powered down. ♦This alarm usually occurs after a system power failure where the battery-backed clock synchronizer has failed. When the synchronizer does fail, it causes this alarm to be displayed to the ECSA operator and it also causes the “Minor” and “515 Other” alarm lamps to light on the alarm panel of the ECSA cabinet (see Note). When ECSA’s power is returned, the alarm occurs. The ECSA operator or craft personnel can update the time and date through use of procedure F2—System Parameters procedure or the MAAP.

Note: Whenever the “Minor” or “Major” alarm panel lamps light, the corresponding leads leaving ECSA are enabled.

3.111 The POWER METER XX-NO PULSES RECEIVED alarm occurs whenever pulses have not been received from a power meter for a length of

time equal to the floating demand interval. This alarm occurs only if the power meter alarm detection parameter has been declared ACTIVE (see Systems Parameters Procedure). This alarm indicates that there is a fault in the power meter interface, there is a fault in the customer’s power meter, or simply that no energy has been consumed by loads connected to the power meter in question. If the customer thinks that the power meter is sending pulses properly, the customer should notify craft personnel of the problem. The customer should realize that if a power meter alarm occurs, the PDSF and ECDM functions may not function properly. If this alarm occurs, a “Minor” and a “Power Meter” alarm lamp light on ECSA’s alarm panel.

3.112 ♦**Caution: If the LOAD XXXX FAILED” alarm occurs, it should be noted that off-premise loads (ie, loads controlled via the MRU) cannot be distinguished from on-premise loads via the ECSA console nor the Remote Maintenance, Administration, and Traffic System (RMATS). Consider this before sending maintenance personnel to an ECSA location.**♦

3.113 The LOAD XXXX FAILED alarm indicates that a faulty load control relay has been detected and craft personnel should be notified so that the faulty unit can be repaired or replaced. ♦The Load Control Board and the Remote Control Board send maintenance signals to the ECSA processor which indicates the current state of the load control relay (ie, open or closed). This information is compared to the state the relay is scheduled to be in and if there is a difference the “LOAD XXXX FAILED” alarm is activated. ♦If the operator receives this alarm message, the operator may want to employ a “system on”, “load”, or a customer provided manual override to prevent a faulty load control relay from placing the load into an unwanted state (enabled or disabled). If this alarm occurs, a “Minor” and a “Load” alarm lamp light on ECSA’s alarm panel.

3.114 ♦The next three alarm messages indicate malfunctions with the assigned ECSA printer(s). The “XX” represents the printer number (ie, 01 through 03). The PRINTER XX-EITHER OUT OF PAPER OR TURNED OFF alarm indicates that the printer has been out of paper or turned off for approximately 30 seconds. The PRINTER XX-PIC FAILED OR BACKED UP, OR LC366 FAILED alarm indicates that there has not been a complete

connection between ECSA and the printer (due to the PIC being backed up, the PIC failed, the LC366 failed, or the printer is turned off) for approximately 15 seconds. This alarm generates a "Minor" and "Other" (Procedure 515) system alarm on the alarm panel. The PRINTER XX-OUT OF SERVICE indicates that the printer has failed for approximately 8 hours. This alarm generates a "Major" and "Other" (Procedure 515) system alarm on the alarm panel.

3.115 The last two alarms message indicate that an alarm condition has been detected by the Binary Feedback function. The alarm conditions for Binary Feedback are described in the F3-Binary Feedback procedure description.◆

3.116 After the ECSA console operator has entered the Energy Communications Alarms procedures and noted the displayed alarm message(s) on the initial screen, the operator may page through the remaining alarm messages by depressing function key F1. Function key F2 is used to print all alarm message(s) in memory. The operator has the capability to clear individual alarms or all alarms. In most cases, the operator should not clear the alarm(s) until the cause of the alarm(s) is corrected. If an alarm is cleared and its cause is not corrected, the alarm occurs again. After the cause of an alarm(s) has been corrected, the operator can clear the alarm message(s) individually by positioning the cursor on the alarm message line desired to be cleared and depressing function key F3. The operator can clear all the alarm messages from the screen(s) and the system by depressing function key F6. If all the alarms are not cleared, the system reminds the operator of this by displaying the nonblinking message EC ALARMS(S); or if a new alarm occurs, the blinking NEW EC ALARM(S) is displayed.

Note: If the ECSA feature is made inactive or the cabinet is unplugged, no alarms are initiated (major, minor, or other).

External Alarming

3.117 ◆If the NEW EC ALARM message is displayed at the bottom of the base procedure, the customer can also have an external alarm initiated. The purpose of this external alarm is to alert a person not at the ECSA console (eg, maintenance person) when the ECSA console is unattended and a NEW EC ALARM occurs. This is done by sending a pulse lasting from .5 seconds to 1 second long to a

load control relay that is assigned as an external alarm load via the MAAP. This load control relay is interfaced to a customer provided latching relay which would catch and stay on until it is manually released. The latching relay would control the customer provided alarming device. The alarming device could be audible (eg, buzzer or siren), or visual (eg, flashing blue light), or anything the customer might desire. If another ECSA alarm occurs before the timer of .5 to 1 second has elapsed, the timer is not reset but continues to time-out. Therefore, if several alarms happen at approximately the same time (ie, within 1 second of each other), the external alarm is turned on only once.◆

C. F2—System Parameters Procedure

3.118 This procedure is entered from the base procedure by depressing function key F2. After depressing F2, a display appears on the face of the CRT similar to the example shown in Fig. 8. The first line gives the name of the current procedure.

3.119 The ECSA security code is always entered on the second line of any operational procedure. The security code is a 4-digit number which is unique to the ECSA feature. The security code must be entered once before any new parameters can be recorded with that procedure. Line 3 of this procedure allows the operator to change the security code. In the event that the operator forgets the ECSA security code, it can be displayed by craft personnel using the MAAP.

3.120 The fourth line is used to set or reset the system date and time parameters. When the system date or time is changed, all ECSA printers print "TIME CHANGE" and the new date and time.

3.121 The fifth line gives the state of the ECSA feature. ◆If the ECSA feature is made inactive, all loads are forced to an energy enabled state.◆

3.122 The sixth line displays the length of time the power company uses to calculate demand. This is a display only field. This parameter is set in procedure F5.

3.123 The next six lines define the power meter parameters. The ECSA can support up to 16 power meters per installation. There is a MAAP procedure that assigns a power meter number (1 to 16) to each physical power meter that the customer has

SYSTEM PARAMETERS 08:55

ENTER SECURITY CODE HERE: XXXX

CHANGE SECURITY CODE TO: []

SYSTEM DATE AND TIME: 10 / 28 / 1982 [MO/DA/YEAR], 10:27 [HR:MN]

ENERGY COMMUNICATIONS FEATURE IS: A [A=ACTIVE, I=INACTIVE]

THE DEMAND INTERVAL IS: 15 MIN.

POWER METER PARAMETERS [ALM DETECTION: A=ACTIVE, I=INACTIVE]

NO.	KWH/PULSE	ALM									
01	010 . 000	A	02	050 . 000	A	03	000 . 000	I	04	050 . 000	A
05	025 . 500	I	06	000 . 000	I	07	100 . 000	A	08	000 . 000	I
09	000 . 000	I	10	000 . 000	I	11	000 . 000	I	12	000 . 000	I
13	000 . 000	I	14	000 . 000	I	15	000 . 000	I	16	000 . 000	I

HOLIDAY DATES

MO.	DAY																						
01	/	01	02	/	14	04	/	20	05	/	26	07	/	04	09	/	07	11	/	25	11	/	26
12	/	25	12	/	31		/			/			/			/			/			/	

F1-
F2-PRINT PARAMETERS REPORT
F3-
F4-
MESSAGE: [.....]

F5-
F6-RECORD NEW PARAMETERS
F7-RESTART PROCEDURE
F8-EXIT PROCEDURE

[.....] CARRIER SEND

Fig. 8—F2—Typical System Parameters Display

(see Part 9). For each power meter, the customer must specify the KWH per power meter pulse constant and whether or not the alarm associated with that power meter is active. The KWH/pulse constant tells the system the number of KWH consumed for each make/break cycle of the relay (see Notes 1 and 2). The power meter alarm (ALM) displays NEW EC ALARM on the bottom of the screen in the event that no power meter pulses have been received from that meter for one demand interval of time. The operator can deactivate any power meter alarm if it is normal not to receive pulses from a given meter for long periods of time. Just as with the demand interval specifications, the operator must specify a KWH/pulse constant and alarm state for each power meter number that has been assigned, before the PDSF or ECDM functions can function correctly.

Note 1: The power meters may be used for purposes other than measuring electrical power. In such cases, the KWH/pulse constant represents a nonelectrical power unit (eg, British thermal units (BTUs)/pulse or cubic feet/pulse).

Note 2: The KWH/pulse constant has two parameter fields (see Fig. 8). The first field is used for the KWH per pulse unit and the second field to the right of the decimal point is used to enter any fractional portion of the value for the KWH per pulse constant.

3.124 The next four lines define the dates which are controlled by the holiday schedule (see procedure F4, eighth daily schedule). If more than 16

holidays are desired a year, then additional dates may be written over past holiday dates.

3.125 The function keys which are defined for this procedure are F2 and F6 through F8. Function key F2 is used in many of the parameter procedures to initiate the parameters report associated with the current procedure. The parameters report for this procedure can be printed on the demand report printer (see procedure F8—Printed Parameters and Reports). The common function keys F6 through F8 have been previously described under Common Functions.

D. F3—Binary Feedback

3.126 This procedure allows the operator to interrogate the current binary feedback status of

any or all sense points and display the information on the screen of the CRT or on any of the ECSA printers. This procedure is entered from the base procedure by depressing function key F3. After depressing this key, a display appears on the screen similar to that shown in Fig. 9.

3.127 The first two lines give the name of the procedure and the location to enter the security code. The next line has the only customer alterable parameter for this procedure. This parameter is the range of sense point numbers that are to be displayed. The system displays the binary feedback status starting at the lower bound sense point and point through the upper bound sense point. If the lower and upper bounds are changed or entered without recording them (ie, via function key F6), they pertain only

09:26

BINARY FEEDBACK

ENTER SECURITY CODE HERE:

SENSOR STATUS DISPLAYED (OR PRINTED) FOR SENSOR NUMBERS TO

ALARM TYPES: 0-NO ALARM 1-ASTERISK ON SCREEN 2-ASTERISK PLUS EC ALARM

SENSE ALM SENSOR* LOAD LOAD DELAY	SENSE ALM SENSOR* LOAD LOAD DELAY
POINT TYP STATUS NUM. STAT (SEC)	POINT TYP STATUS NUM. STAT (SEC)

F1-DISPLAY BINARY FEEDBACK STATUS	F5-
F2-PRINT BINARY FEEDBACK STATUS REPORT	F6-RECORD NEW PARAMETERS
F3-	F7-RESTART PROCEDURE
F4-STOP PRINTING REPORT	F8-EXIT PROCEDURE

MESSAGE:

Fig. 9—F3—Typical Binary Feedback Display (Initial Display)

to the current display. If these values are recorded, they become permanent.

3.128 The operator can display each sense point's binary feedback status over the specified range on the CRT screen by depressing function key F1 (see Fig. 10), or this information can be printed on the assigned printer by depressing function key F2. Depressing function key F4 stops and ends the print-out. With the ECSA console, if the specified range exceeds the 10-line display area, the display stops when the screen is filled. The next page of sense points can then be displayed by depressing F1 again. This process can be repeated until all the sense points have been displayed.

3.129 *Caution: The customer should be aware that it takes approximately 10*

to 15 seconds from the time one of the alarm conditions mentioned in the following paragraph is sensed by the customers sensing device to the time the alarm is actually displayed on the console.

3.130 The next line defines the alarm types. The alarm type for each sense point is assigned via the MAAP. The alarm types are displayed on this procedure as either a 0, 1, or 2. The following is an explanation of each alarm type.

- (a) **0—NO ALARM:** Alarm type 0 is assigned to sense points that do not require an alarm to be displayed.
- (b) **1—ASTERISK ON SCREEN:** This alarm type is assigned to sense points that require

BINARY FEEDBACK
09:26

ENTER SECURITY CODE HERE:

SENSOR STATUS DISPLAYED (OR PRINTED) FOR SENSOR NUMBERS TO

ALARM TYPES: 0—NO ALARM 1—ASTERISK ON SCREEN 2—ASTERISK PLUS EC ALARM

SENSE POINT	ALM TYP	SENSOR* STATUS	LOAD NUM.	LOAD STAT	DELAY (SEC)	SENSE POINT	ALM TYP	SENSOR* STATUS	LOAD NUM.	LOAD STAT	DELAY (SEC)
001	2	OPEN *	0017	ON	005	002	2	OPEN *	0037	OFF	000
003	2	CLOSED	0021	ON	030	004	0	OPEN	----	---	---
005	1	CLOSED	0035	ON	030	006	1	CLOSED*	0075	OFF	015
007	0	OPEN	----	---	---	008	2	OPEN	----	---	---
009	2	CLOSED*	0050	OFF	000	010	1	CLOSED	0101	ON	010
011	0	OPEN	0052	OFF	000	012	1	CLOSED	0087	ON	030
013	1	OPEN	0056	OFF	015	014	2	CLOSED*	----	---	---
015	1	OPEN	----	---	---	016	0	OPEN	0045	ON	000
017	2	CLOSED*	----	---	---	018	2	OPEN *	0093	ON	060
019	0	CLOSED	0061	ON	000	020	0	CLOSED	----	---	---

F1-DISPLAY BINARY FEEDBACK STATUS

F2-PRINT BINARY FEEDBACK STATUS REPORT

F3-

F4-STOP PRINTING REPORT

F5-

F6-RECORD NEW PARAMETERS

F7-RESTART PROCEDURE

F8-EXIT PROCEDURE

MESSAGE:

Fig. 10—F3—Typical Binary Feedback Display (After F1 Is Depressed)

only an alarm to be displayed on this operating procedure. With this alarm type, an asterisk is displayed for the load number and/or sense point that is in one of the following alarm conditions. The delay time is not considered with this alarm type.

- If the sense point is assigned to a load, the sensor status should be closed for loads that are scheduled ON and open for loads that are scheduled OFF. If at any time this does not hold true, the load is in an alarm condition. For example, a load controlled by ECSA is ON (energy enabled) according to the load's status, however, the sense point which is assigned to this load indicates the load is OFF (open sensor status). This is an alarm condition. Thus, binary feedback verifies that the loads schedule actually takes places.
 - If the sense point is assigned as a stand alone, Binary Feedback is used to detect customer desired conditions or to monitor a load not controlled by ECSA. If it is used to detect a customer desired condition (eg, emergency or security breach condition), the sensor status is open under normal conditions and closed under abnormal conditions which is the alarm condition (see Fig. 10, sense point 17). If Binary Feedback is used to monitor a load not controlled by ECSA, the customer can wire the sense point to detect the alarm condition desired (ie, the load would set off an alarm if it is ON or OFF depending on the sensing device and other hardware used).
- (c) **2—ASTERISK PLUS EC ALARM:** This alarm type is assigned to sense points that requires not only an alarm to be displayed on this operating procedure but also an alarm to be displayed on the F1—Energy Communications Alarms procedure. The alarm on this procedure is an asterisk which is displayed for the load number and/or sense point that is in one of the two alarm conditions previously discussed for alarm type one. However, with this alarm type, the ECSA system must wait for the delay time to expire before expecting the sense point to have the correct status. For each of these conditions, the associated EC alarm is:

- **SENSE POINT XXX INDICATES LOAD XXXX IS IN THE WRONG STATE**—This

EC alarm is associated with the first alarm condition. This alarm indicates that the sense point assigned to the load is not in the state the load is scheduled to be in according to the ILCF or PDSF.

- **SENSE POINT XXX CLOSED**—This EC alarm is associated with the second condition. This alarm indicates that a sensing device (eg, photo diode or gas detector) is not in the normal operating mode or has detected an unusual or emergency condition (see Caution).

3.131 The next 12 lines contain the binary feedback status for the first 20 sense points. Each page has two columns of binary feedback status. Each column has six items. The first item is titled **SENSE POINT** and lists each sense point assigned.

Note: There is a maximum of 384 sense points (ie, including remote) that can be assigned to sensing devices for the "B" and "C" memory configuration.

3.132 The sense point numbers alternate between columns as shown in Fig. 10. The second item is titled **ALM TYP** and displays the alarm type assigned to each sense point via the MAAP. The third item titled **SENSOR STATUS** displays what the current status of the sense point is (ie, OPEN or CLOSED). The last three items are displayed only if the sense point is assigned to a load number via the MAAP. The fourth item titled **LOAD NUM** displays the load number that the sense point was assigned to. The fifth item titled **LOAD STAT** displays the loads status (ie, on or off) that is in accordance with the load's daily schedule. The sixth item titled **DELAY (SEC)** displays the delay time which is assigned via the MAAP. The delay time is the time that is required to transmit the signal from ECSA to the load and actually have the load affected by the command (eg, turned on). The delay time also includes the time that ECSA waits before expecting the customer's sensing device to detect the new loads state and transmit this back to this sense point. The delay time can be from 000 to 300 seconds (ie, 0 to 5 minutes). It is assigned in 5-second intervals.

3.133 Function keys F6 through F8 respond in the same manner as previously stated.♦

E. F4—ILCF and Peak Demand Shedding Procedure

3.134 This procedure is reached from the base screen by depressing the F4 key (or by de-

pressing shift—F4 from any other screen) and is the one which is used to do all of the individual load scheduling. Each load has an entire screen dedicated for inputting its scheduling parameters.

Note: There are two memory configurations with ECSA. The “B” memory configuration can have a maximum of 400 loads assigned. The “C” memory configuration can have a maximum of 1008 loads assigned. These loads may be on- or off-premises.

3.135 When this procedure is first entered from another procedure, an individual load number has not yet been specified. Hence, most of the data fields are blank, and the cursor is positioned at the data field for the F3 key (see Fig. 11). When a load number is specified and the F3 key [DISPLAY (OR ADD) NEXT LOAD] is depressed, the screen fills with the scheduling information for that load, and the cursor is placed in the normal “home” position (the security code field). Figure 12 is an example of an 8-day schedule for one load number.

3.136 There is a box on the third line to declare the ILCF either active or inactive. This designation applies system wide, not just for the load on the screen. If it is declared inactive, all loads would remain in the energy enabled state unless the load is assigned to a group, the PDSF is active and a peak is encountered. In this event, the shed state is determined by the schedule (the same way it would with the ILCF active).

```

INDIVIDUAL LOAD CYCLING FUNCTION AND PEAK DEMAND SHEDDING PARAMETERS 08:57
ENTER SECURITY CODE HERE: [XXXX]
INDIV. LOAD CYCLING FUNCTION IS: [A] [A=ACTIVE,I=INACTIVE]
PEAK DEMAND SHEDDING FUNCT. IS: [A] [A=ACTIVE,I=INACTIVE]

F1-COPY LINE AT CURSOR
F2-PRINT PARAMETERS REPORT
F3-DISPLAY OR ADD NEXT LOAD [ ]
F4-DELETED LINE AT CURSOR
F5-COPY SCHEDULE FROM LOAD: [ ]
F6-RECORD NEW PARAMETERS
F7-RESTART PROCEDURE
F8-EXIT-PROCEDURE

MESSAGE:
..... [CARRIER] [SEND]
    
```

Fig. 11—F4—Typical Individual Load Scheduling Parameters Display (Initial Display)

INDIVIDUAL LOAD CYCLING FUNCTION AND PEAK DEMAND SHEDDING PARAMETERS 09:04
 ENTER SECURITY CODE HERE:
 INDV. LOAD CYCLING FUNCTION IS: [A=ACTIVE,I=INACTIVE]
 PEAK DEMAND SHEDDING FUNCT. IS: [A=ACTIVE,I=INACTIVE]

LOAD NUMBER: FAIL-SAFE CONDITION IS:
 LOAD IS IN SHEDDING GROUP NUMBER: 002
 LOAD STATUS: 10E8 LOAD CONSUMPTION: 0500KW LOAD RUN FACTOR: 100%

	HR	NRM	SHD	HRMN	NRM	SHD												
M	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
T	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
W	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
T	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
F	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
S	00	24A	24A	0600	06A	14A	1000	05A	12A	1400	01A	02A	1800	24A	24A			
S	00	24A	24A	0600	06A	14A	1000	05A	12A	1400	01A	02A	1800	24A	24A			
H	00	24A	24A	0600	06A	14A	1000	05A	12A	1400	02B	-05	1800	24A	24A			

F1-COPY LINE AT CURSOR
 F2-PRINT PARAMETERS REPORT
 F3-DISPLAY OR ADD NEXT LOAD
 F4-DELETE LINE AT CURSOR
 F5-COPY SCHEDULE FROM LOAD:
 F6-RECORD NEW PARAMETERS
 F7-RESTART PROCEDURE
 F8-EXIT PROCEDURE

MESSAGE:

Fig. 12—F4—Typical Individual Load Scheduling Parameters Display (After F3 Is Depressed)

3.137 There is a box on the fourth line of this screen used for declaring the PDSF active or inactive. When declared inactive, no shedding takes place. Again, this designation applies to the entire system.

3.138 The fields on the fifth, sixth, and seventh lines (displaying the load number, its shedding group, its status, consumption rate, and run factor) are all display only fields. The values for the shedding group number, consumption rate, and run factor are input in the Peak Demand Load Shedding parameters procedure (see procedure F5) and are not alterable on this screen.

3.139 There is one customer alterable parameter

on the sixth line which is used to designate the state of the fail-safe condition (ie, ON or OFF). If designated OFF, this load's energy is disabled when a power failure occurs (ie, if the energy to the load is not affected by the power failure). OFF is the default designation made automatically for the load when the load is assigned to the system. If designated ON, this load's energy is enabled when a power failure occurs (ie, if the energy to the load is not affected by the power failure). Since most system failures are caused by commercial power failures, this parameter is most likely to effect only off-premises loads.

3.140 Whichever fail-safe condition is used, the load's schedule and status are valid in comparison with the actual state of the load. If the fail-

safe condition is designated as "ON", the load control relay is de-energized (ie, opened) when the daily schedule for the load is scheduled to have the load on. With this fail-safe condition, the 8-day schedule correlates with the actual state of the load if there is an inverting relay or the power relay is a normally closed relay (see Fig. 13). If the fail-safe condition is designated as "OFF" the load control relay is energized (ie, closed) when the daily schedule for the load is scheduled to have the load on. With this fail-safe condition, the 8-day schedule correlates with the actual state of the load if there is no inverting relay and the power relay is a normally open relay (see Fig. 13).⁴

3.141 Lines 11 through 18 on the screen are used for inputting the scheduling parameters for a load. One line is used for each of the eight daily schedules. This daily schedule layout is referred to as the 8-day clock. Each line can be used to partition the corresponding day into as many as six intervals, and designate a normal pattern and a shedding pattern/modifier for the load in each desired time interval. The data fields under the column headings (hours and minutes) are used to designate the time intervals. The entry in each HRMN field specifies a time of day, using military time. The first entry in each line begins at midnight, ie, "00" and is a fixed display only field. The normal pattern and shedding pat-

FAIL-SAFE OFF							
USING NO INVERTER AND A NORMALLY OPEN POWER RELAY							
NORMAL OR SHED SCHEDULE	COMMAND SENT TO LOAD CONTROL RELAY	LOAD CONTROL RELAY (NORMALLY OPEN)	INVERTING RELAY	COMMAND GOING TO POWER RELAY	POWER RELAY NORMALLY OPEN	CLOSED	ACTUAL STATE OF LOAD
ON  OFF 	ENERGIZE	RELAY CLOSES	—	ENERGIZE	RELAY CLOSES	—	ON
ON  OFF 	DE-ENERGIZE	RELAY STAYS OPEN	—	DE-ENERGIZE	RELAY STAYS OPEN	—	OFF
FAIL-SAFE ON							
USING AN INVERTER							
ON  OFF 	DE-ENERGIZE	RELAY STAYS OPEN		ENERGIZE	RELAY CLOSES	—	ON
ON  OFF 	ENERGIZE	RELAY CLOSES		DE-ENERGIZE	RELAY STAYS OPEN	—	OFF
USING NORMALLY CLOSED POWER RELAY							
ON  OFF 	DE-ENERGIZE	RELAY STAYS OPEN	—	DE-ENERGIZE	—	RELAY STAYS CLOSED	ON
ON  OFF 	ENERGIZE	RELAY CLOSES	—	ENERGIZE	—	RELAY OPENS	OFF

Fig. 13—Relay Options for Fail-Safe ON/OFF

terns/modifiers for the first interval are entered in the fields under the first NRM and SHD headings, respectively. These patterns remain valid until the time designated in the first HRMN field. Similarly, the patterns specified in the second NRM and SHD fields are in effect between the times designated in the first and second HRMN fields, and so on. The patterns specified in the last NRM and SHD fields on the line are in effect between the time specified in the last HRMN field and midnight. It is not necessary to designate all six time intervals; however, there may be no holes (skipped time intervals) in a schedule. For example, if there are to be no changes during 1 day, only one NRM field and one SHD field would need patterns entered. Each daily schedule need not be entered before the parameters can be recorded. **Daily schedules with no entries are continually energy enabled.**

3.142 There are two methods for entering the patterns in the NRM and SHD fields as explained in the following paragraphs.

3.143 First Method: The first method of entering the normal and shedding patterns is to enter one pattern from Table A under the NRM column and another pattern from Table A under the SHD column. The first method is included primarily because it is easier to understand.

3.144 When the NRM and SHD pairs are chosen, it should be kept in mind that if a peak is encountered and a transition made between the NRM pattern and the SHD pattern, the SHD pattern is entered in synchronization with the wall-clock time. For example, if a peak is encountered at 17 minutes past the hour, and the SHD state is 11A (30 minutes on, 30 minutes off), the load would be on for the next 13 minutes before beginning to turn off and on every 30 minutes. Hence, considerable care must be taken to choose NRM and SHD pairs in a way which insures that the shedding of a load does not result in its going from an energy disabled pattern to an energy enabled pattern, and transitions in and out of shed conditions do not result in the load being switched on and off too frequently.

3.145 The best way to handle these problems is to insure that the normal and shedding patterns are compatible with each other. The NRM and SHD patterns are compatible with each other if, and only if, the following condition exists. That is, for any time within the hour when the NRM pattern has the

load off, the SHD pattern also has the load off. (See Fig. 1 for an example of three individual loads compatible with NRM and SHD patterns.) Table B simplifies the process of finding compatible shed patterns for chosen normal patterns. To use this table, find the normal pattern chosen from Table A along the left side of Table B. Choose an off time along the top of Table B that is greater than the off time of the chosen normal pattern. The letters within the corresponding box designate the compatible shed patterns for the shed off time and normal pattern chosen.

3.146 When the NRM and SHD are not compatible with each other, a warning message is given as explained in paragraph 3.199 (f). Because of this constraint and the limited number of cycling patterns in the list, many otherwise desirable combinations of normal and shedding patterns cannot be implemented with this method. The second method is easier to use and more flexible.

3.147 Second Method: The second method enters a pattern from Table A under the NRM column, and the entry under the SHD column is a 3-character string which takes the form "-xx", where the "xx" denotes digits 00 through 55 (eg, 00, 01, 02, ...55). This entry under the SHD column is not used to designate one of the patterns in Table A, but rather to modify the pattern specified in the NRM column by extending each off period in that pattern by "xx" minutes and postponing each on period in that pattern by "xx" minutes. The only constraint placed on the modifier is that the designated extended off time (ie, modifier) cannot exceed the on period for one cycle in the normal cycling pattern. For example, if the entry in the NRM column is 17A (10 minutes on, 20 minutes off, 10 minutes on, 20 minutes off) and the entry in the SHD column is -03, then the pattern which would be used in a shed condition would be: 3 minutes off, 7 minutes on, 23 minutes off, 7 minutes on, 20 minutes off (see Fig. 14).

3.148 If the entry in the NRM column is 01A (the constant on pattern) or 24A (the constant off pattern), the second method may not be used, and the SHD column must contain the label for one of the patterns in Table A. The reason is that the second method works by extending off times, and the constant on and constant off patterns have no off time to extend. This constraint combined with the fact that none of the preprogrammed cycling patterns has an off nor an on time less than 5 minutes presents a

TABLE B

NORMAL AND SHED PATTERN COMPATIBILITY TABLE
(See Note)

		COMPATIBLE SHED PATTERNS																							
OFF MIN/HR	0	5	10	10	15	15	20	20	20	25	30	30	30	30	35	40	40	40	45	45	50	50	55	60	
PATTERN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
CHOSEN NORMAL PATTERN	01A	A-L	A-F	A-F	A-D	A-D	A-C	A-C	A-C	A-L	A, B	A, B	A, B	A, B	A-L	A-C	A-C	A-C	A-D	A-D	A-F	A-F	A-L	A	
	02A		A	A	A	A	A	A	A	A, I-L	A	A	A	A	A, G-L	A, C	A, C	A, C	A, C, D	A, C, D	A, C-F	A, C-F	A, C-L	A	
	02B		A	B	A	B	A	A	B	A, B, J-L	A	A	A	B	A, B, H-L	A, C	A, C	A, B	A, C, D	A, B, D	A, C-F	A, B, D-F	A, B, D-L	A	
	02C		B	C	A	C	A	B	C	A-C, K, L	A	A	B	A	A-C, I-L	A, C	A, B	B, C	A, C, D	A-C	A, B, D-F	A-C, E, F	A-C, E-L	A	
	02D		B	D	B	D	A	B	A	A-D, L	A	B	B	B	A-D, J-L	A, C	A, B	A, C	A, B, D	B-D	A, B, D-F	A-D, F	A-D, F-L	A	
	02E		C	E	B	A	B	C	B	A-E	A	B	A	A	A-E, K, L	A, B	B, C	A, B	A, B, D	A, C, D	A-C, E, F	A-E	A-E, G-L	A	
	02F		C	F	B	B	B	C	C	B-F	A	B	A	B	A-F, L	A, B	B, C	B, C	A, B, D	A, B, D	A-C, E, F	B-F	A-F, H-L	A	
	02G		D	A	C	C	B	A	A	C-G	B	A	B	A	A-G	A, B	A, C	A, C	A-C	A-C	A-C	A-D, F	A, C-F	A-G, I-L	A
	02H		D	B	C	D	B	A	B	D-H	B	A	B	B	B-H	A, B	A, C	A, B	A-C	B-D	A-D, F	A, B, D-F	A-H, J-L	A	
	02I		E	C	C	A	C	B	C	E-I	B	A	A	A	C-I	B, C	A, B	B, C	A-C	A-C	A, C, D	A-E	A-C, E, F	A-I, K, L	A
	02J		E	D	D	B	C	B	A	F-J	B	B	A	B	D-J	B, C	A, B	A, C	B-D	B-D	A, B, D	A-E	A-D, F	A-J, L	A
	02K		F	E	D	C	C	C	B	G-K	B	B	B	A	E-K	B, C	B, C	A, B	B-D	A-C	B-F	A-E	A-K	A	
	02L		F	F	D	D	C	C	C	H-L	B	B	B	B	F-L	B, C	B, C	B, C	B-D	B-D	B-D	B-F	B-F	B-L	A
	03A				A		A	A		A, J-L	A	A	A		A, H-L	A, C	A, C	A	A, C, D	A, D	A, C-F	A-D, F	A-D, L	A	

TABLE B (Contd)

NORMAL AND SHED PATTERN COMPATIBILITY TABLE
(See Note)

		COMPATIBLE SHED PATTERNS																							
OFF MIN/HR	0	5	10	10	15	15	20	20	20	25	30	30	30	30	35	40	40	40	45	45	50	50	55	60	
PATTERN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
CHOSEN NORMAL PATTERN	03B						A	B		A-C, L	A		B		A, B, J-L	A, C	A, B	C	A, D	B, C	A, B, D-F	A-C, F	A-C, F-L	A	
	03C				B		B	C		B-E	A	B	A		A-E, L	A, B	B, C	B	A, B, D	A, D	A-C, E, F	B-E	A-E, H-L	A	
	03D				C		B	A		D-G	B	A	B		B-G	A, B	A, C	A	A, B, C	B, C	A-D, F	A, D-F	A-G, J-L	A	
	03E						C	B		F-J	B		A		D-I	B, C	A, B	C	B, C	A, D	A-E	A-C, F	A-I, L	A	
	03F				D		C	C		H-K	B	B	B		F-K	B, C	B, C	B	B, C, D	B, C	B-F	B-E	B-K	A	
	04A							A	A			A		A	A, G	A	A, C	A, C	A, C	A, C	A, C	A, C, D, F	A, C-F	A, C-G, I-L	A
	04B							A	B			A		B	B, H	A	A, C	A, B	A, C	B, D	A, C, D, F	A, B, D-F	A, B, D-H, J-L	A	
	04C							B	C			A		A	C, I	C	A, B	B, C	A, C	A, C	A, C	A, B, D, E	A-C, E, F	A-C, E, I, K, L	A
	04D							B	A			B		B	D, J	C	A, B	A, C	B, D	B, D	A, B, D, E	A-D, F	A-D, F-J, L	A	
	04E							C	B			B		A	E, K	B	B, C	A, B	B, D	A, C	B, C, E, F	A-E	A-E, G-K	A	
	04F							C	C			B		B	F, L	B	B, C	B, C	B, D	B, D	B, C, E, F	B-F	B-F, H-L	A	
	05A							A			A, K, L	A	A			A, I-L	A, C	A		A, C, D	A	A, D-F	A, E, F	A, E-L	A
05B										B-D	A	B			A-D, L	A	B		A, B, D	D	A, B, E, F	B-D	A, D, H-L	A	

TABLE B (Contd)

NORMAL AND SHED PATTERN COMPATIBILITY TABLE
(See Note)

		COMPATIBLE SHED PATTERNS																								
OFF MIN/HR		0	5	10	10	15	15	20	20	20	25	30	30	30	30	35	40	40	40	45	45	50	50	55	60	
PATTERN		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
CHOSEN NORMAL PATTERN	05C										E-G	B	A			C-G	B	A		A, B, C	C	A-D	A, E, F	A-G, K, L	A	
	05D							C			H-J	B	B			F-J	B, C	B		B, C, D	B	B-E	B-D	B-J	A	
	06A														A					A	A, C, D	A, C, E	A, C, E	A, C-E, G-I, K, L	A	
	06B														B					D	A, B, D	A, C, E	B, D, F	A, B, D, F, H-J, L	A	
	06C														A					C	A, B, C	B, D, F	A, C, E	A-C, E-G, I-K	A	
	06D														B					B	B, C, D	B, D, F	B, D, F	B-D, F-H, J-L	A	
	07A											A, L	A			A, J-L	A, C	A		A, D		A, D-F	A, F	A, F-L	A	
	07B											D, E				B-E	A, B	C		A, B		A-C, F	D, E	A-E, J-L	A	
	07C											H, J	B			F-J	B, C	B		B, C		B-E	B, C	B-I	A	
	08A																	A	A, C	A	A, C		A, C, D, F	A, D, E, F	A, D-G, J-L	A
	08B																	C	A, B	C			A, B, D, E	A, B, C, F	A-C, F-H, I, L	A
	08C																	B	B, C	B	B, D		B, C, E, F	B, C, D, E	B-E, H-K	A
	09A																		A	A, C			A, D	A, C, D, F	A, C, D, F, G, I, J, L	A
	09B																		C	A, B			C, F	A, B, D, E	A, B, D, E, G, H, J, K	A

TABLE B (Contd)

NORMAL AND SHED PATTERN COMPATIBILITY TABLE
(See Note)

		COMPATIBLE SHED PATTERNS																							
OFF MIN/HR		0	5	10	10	15	15	20	20	20	25	30	30	30	30	35	40	40	40	45	45	50	50	55	60
PATTERN		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
CHOSEN NORMAL PATTERN	09C																	B	B, C			B, E	B, C, E, F	B, C, E, F, H, I, K, L	A
	10A											A				A, K, L	A			A, D		A, E, F	A	A, G-L	A
	10B											A				A, B, L	A			A, D		A, E, F	B	A, B, H-L	A
	10C															A-C	A			A		A, B, F	C	A-C, I-L	A
	10D															B-D	A			A, B		A, B, F	D	A-D, J-L	A
	10E															C-E	B			A, B		A-C	E	A-E, K, L	A
	10F															D-F	B			B		A-C	F	A-F, L	A
	10G												B			E-G	B			B, C		B-D	A	A-G	A
	10H												B			F-H	B			B, C		B-D	B	B-H	A
	10I															G-I	C			C		C-E	C	C-I	A
	10J															H-J	C			C, D		C-E	D	D-J	A
	10K															I-K	C			C, D		D-F	E	E-K	A
	10L															J-L	C			D		D-F	F	F-L	A
	11A															A, L	A		A	A, D		A, E, F		A, H-L	A
11B															F, G	B			B, C		B, C, D		B-G	A	
12A																		A		A, C		A, D	A, E, F	A, E-G, K, L	A

TABLE B (Contd)

NORMAL AND SHED PATTERN COMPATIBILITY TABLE
(See Note)

		COMPATIBLE SHED PATTERNS																								
OFF MIN/HR		0	5	10	10	15	15	20	20	20	25	30	30	30	30	35	40	40	40	45	45	50	50	55	60	
PATTERN		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
CHOOSEN NORMAL PATTERN	12B																	B		B, D		B, E	B-D	B-D, H-J	A	
	13A																				A, D	A, C, E		A, D, E, H, I, L	A	
	13B																				B, C	B, D, F		B, C, F, G, J, K	A	
	14A																				A, C		A, C, E	A, C, E, G, I, K	A	
	14B																				B, D		B, D, F	B, D, F, H, J, L	A	
	15A																A			A		A, F		A, I-L	A	
	15B																A			A		A, F		A, B, J-L	A	
	15C																				A		A, B		A-C, K, L	A
	15D																				B		A, B		A-D, L	A
	15E																B			B		B, C		A-E	A	
	15F																B			B		B, C		B-F	A	
	15G																				C		C, D		C-G	A
	15H																				C		C, D		D-H	A
	15I																			C		C		D, E	E-I	A
	15J																			C		D		D, E	F-J	A
	15K																					D		E, F	G-K	A
	15L																					D		E, F	H-L	A
	16A																					A		A, F	A, J-L	A
	16B																					B		B, C	B-E	A

TABLE B (Contd)

NORMAL AND SHED PATTERN COMPATIBILITY TABLE
(See Note)

		COMPATIBLE SHED PATTERNS																									
OFF MIN/HR		0	5	10	10	15	15	20	20	20	25	30	30	30	30	35	40	40	40	45	45	50	50	55	60		
PATTERN		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24		
CHOSEN NORMAL PATTERN	21F																								J,K	A	
	22A																									A,G	A
	22B																									B,H	A
	22C																									C,I	A
	22D																									D,J	A
	22E																									E,K	A
	22F																									F,L	A
	23 (A-L)																										A
	24A																										

Note: A chosen normal pattern is always compatible with itself.

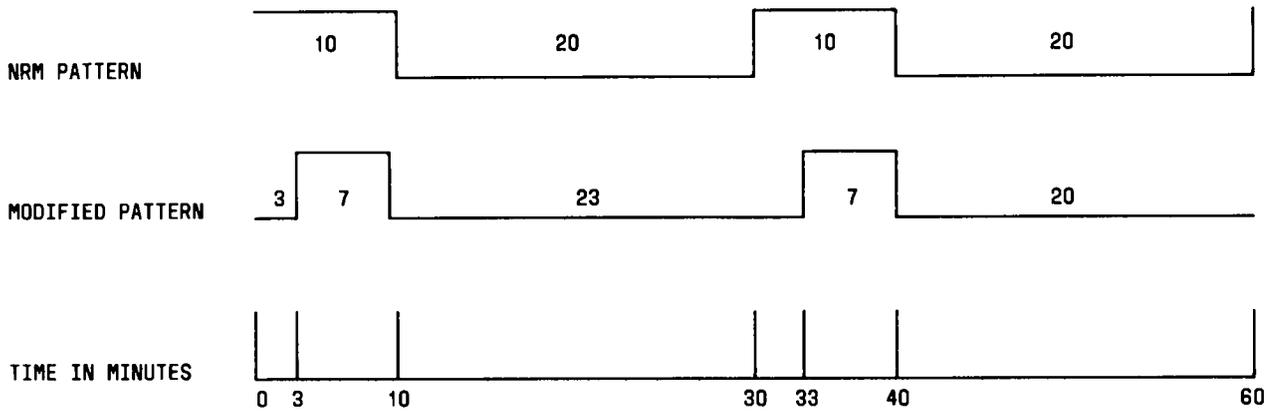


Fig. 14—Modified Pattern Example

problem for some loads. For example, some loads, in the event of a peak, can be cycled by the PDSF but cannot remain off for more than 2 minutes. Unfortunately, there is no direct way of setting up a cycling pattern with an off period of less than 5 minutes. However, in many cases there is an indirect method which can be used to implement the desired shed cycling pattern, but it involves the use of two load control relays to control a single load. This method is explained in paragraph 3.159.

3.149 With the second scheduling method, a shedding pattern may be entered without having to look up a second pattern in Table A, and without having to keep the shed pattern compatible with the normal pattern. More importantly, it gives the capability to fine tune the shed patterns with much greater accuracy. For example, an air-conditioning unit might be scheduled for a particular interval with 09A (10 minutes on, 5 minutes off) in the NRM field, and 18A (5 minutes on, 10 minutes off) or -05 in the SHD field. If the users see that no one becomes uncomfortable when the load is shed, they may wish to try shaving off another minute or two of the on time. This could be done by entering 09A in the NRM column, and -07 in the SHD column.

Note: Some loads may be damaged because they cannot change states (eg, on, off, on or off, on, off) in a short time frame (eg, 3 or 4 minutes). For these loads, even if the shed pattern is compatible, the modifier is within its limits and the minimum time between shed and next restore or restore and next shed is lengthy, a change of states in a short time frame may occur.

These loads should not be able to shed unless a constant off shed pattern is assigned. These loads should also not be assigned to load or system overrides. The minimum time between shed and next restore or restore and next shed system or safety band parameters are used to spread out the possibility of a change of states in a short time frame due to alterations between the shed and restore conditions.

3.150 The following paragraphs describe the operation of the function keys used with procedure F4.

3.151 Function key F1 is used to make it easier for the operator to enter one daily schedule for each of several days. In order to use it, the operator positions the cursor at the line to be copied. When the F1 key is depressed, the line at the cursor is copied into the next blank line. If function key F1 is repeatedly depressed, the line at the cursor is successively copied.

3.152 When function key F2 is depressed, a printed copy is produced of the schedules for the load on the screen (not all loads). New schedule entries must be recorded by function key F6 before the new schedules can be printed.

Note: For a printed report of all the individual loads, see the Printer Parameter and Report procedure.

3.153 In order to move to another load from the load scheduling screen or from the initial

screen (Fig. 11), the desired load number is entered in the field at the function key F3 position on the menu, and the F3 key is depressed. If this is done before the new parameters are recorded, any changes made in the schedule for the current load would be lost. The operator can schedule a new load by entering the desired load number and depressing function key F3 while the operator is in either the initial screen or a load displayed screen. The CRT screen then contains a display using the format as shown in Fig. 12; however, the load shedding group number, the load consumption, the load run factor, and the scheduling parameters are empty. The operator can now enter the new schedule data and record the new parameters using the function key F6. The new load must be assigned to a load group in the F5—Peak Demand Load Shedding procedure before the group number, load consumption, and run factor are displayed.

3.154 When the cursor is positioned at one of the eight lines which contain the daily schedules, and the function key F4 is depressed, the line at the cursor is blanked out. The cursor may be positioned anywhere on the line to be erased. This key makes it easier to use the F1 function key.

3.155 ♦Function key F5 titled “COPY SCHEDULE FROM LOAD: XXXX” is used to copy the 8-day schedule from one load to another load. To use the key, the console operator enters the load display screen of the load to be scheduled. The load number which has the desired 8-day schedule recorded is then entered in the customer alterable field of the F5 function key. With the depression of the F5 function key, the 8-day schedule from the load entered in this customer alterable field is copied into the screen being viewed, and the user may then make modifications to the copied schedules (in case the desired schedules for the new load are close to, but not exactly the same as, the schedules from the copied load) before recording parameters.

3.156 Function key F5 can also be used to copy only the desired days of an 8-day schedule from one load to another load. This is done very similarly to copying a full 8-day schedule. The difference is that when the F5 function key is depressed, schedules would only be copied for the days which showed blank lines on the screen before pressing the F5 function key. For example, suppose loads number 0100 and 0200 have already been scheduled. Load 0300 is to have the same schedule a load 0100 on Monday,

Wednesday, and Friday, but the same schedule as load 0200 on Tuesday, Thursday, weekends, and holidays. The user could bring up the load scheduling screen for load 0300, enter “0200” in the field next to the F5 function key, and then press the function key. Assuming the daily schedules for 0300 were blank when the screen was brought up (or the user used the F1 function key to delete existing schedules), the screen would now show all eight days as being scheduled exactly the same as load 0200. The lines for Monday, Wednesday, and Friday are then deleted using the F1 functions key (“DELETE LINE AT CURSOR”), “0100” is entered in the field next to F5, and this key is pushed again. Load 0300’s 8-day schedule is complete and should be recorded.♦

Shed Patterns with Short Off Periods

3.157 It was noted that there is no direct method of implementing a cycling pattern with an off period of less than 5 minutes. There is, however, an indirect method of implementing some of these patterns in the shed condition. The following two examples are using the fail-safe OFF condition. Suppose a load is to remain on in the normal condition but cycle with 2 minutes off and 8 minutes on in the shed condition. This can be accomplished by wiring the load to two load control relays in parallel (so that the load is energy disabled if, and only if, both load control relays have the contact open). The first load control relay would be scheduled with pattern 01A (constant on) in the NRM field, and pattern 14A (5 minutes on, 5 minutes off) in the SHD field. The second load control relay would be scheduled with pattern 14B (5 minutes off, 5 minutes on) in the NRM field and -02 in the SHD field (resulting in a pattern with 7 minutes off and 3 minutes on). The only time both load control relays would have the contact open (and hence, the only time the load would be energy disabled) would be during the 6th and 7th minutes (of the 10-minute cycles).

3.158 *Caution: Care should be taken when using this method to make sure the load is not damaged as a result of using short off times.*

3.159 This parallel method works in any situation where the load is to remain energy enabled in the normal condition and is to cycle on a pattern with a period of 10, 15, 20, 30, or 60 minutes in the shed condition. This method works well in situations where the load can remain off for only 1, 2, 3, or 4 minutes.

3.160 Another example of this method would be where the load is to remain on in the normal condition, and is to cycle with 4 minutes off and 6 minutes on in the shed condition. Using two load control relays in parallel, the first load control relay would be programmed with pattern 01A (constant on) in the NRM field, and pattern 14A (5 minutes on, 5 minutes off) in the SHD field. The second load control relay would be programmed with pattern 14B (5 minutes off, 5 minutes on) in the NRM field and -04 in the SHD field. The shed pattern thereby defined on the second load control relay is 9 minutes off and 1 minute on. At first glance, this would appear to be a problem since the on time is only 1 minute. However, closer inspection shows that the load behaves as desired. In order to verify this, it is necessary to trace the behavior of each load control relay and the load itself on a minute-by-minute basis. Suppose, for the sake of simplicity, that the load enters the shed condition at the beginning of an hour. For the first 5 minutes, the first load control relay would have closed contacts and so the load would be on. For the next 4 minutes, both load control relays would have open contacts so that load would be off. The next minute, the contacts on the second load control relay would close and so the load would be back on; and then the following minute (which starts the next 10-minute cycle), the second load control relay would be instructed to turn the load off again. The shedding pattern then would be 5 minutes on, 4 minutes off and 1 minute on which is a total of 6 minutes on and 4 minutes off for the 10-minute period.

3.161 The previous paragraphs illustrate that with two load control relays, short off periods can be implemented in the shed condition as long as the load is to remain on in the normal condition. However, the method does not work in situations where the load is to be cycled with an off time of less than 5 minutes in the normal condition.

F. F5—Peak Demand Load Shedding Parameters Procedure

3.162 This procedure is a 2-part procedure. The first part of this procedure displays the load group numbers that are currently established as load groups. A load must be assigned to a load group to be sheddable. If only normal cycling is desired for a load, the load can be unassigned to a load group, or if the load is assigned to a group, the shedding pattern and normal pattern should be the same for each interval desired to be shed in procedure F4. If a modi-

fier is used, the modifier should have no additional off-time specified (ie, 00). If the load is unassigned to a load group, the shed patterns/modifier specified in each interval can be any pattern/modifier because the PDSF will not affect this individual load. The second part of this procedure displays the consumption parameters (used to derive the shed estimates for each load group) of each load in a load group, one group at a time.

3.163 The first part of this procedure is entered from the base procedure by depressing function key F5. After depressing F5, a display appears on the CRT screen similar to the example shown in Fig. 15. As before, the first and second lines display the name of the procedure and the location to enter the security code. The displays line gives the current state of the PDSF. If PDSF is declared active, all load groups are available to the PDSF and are cycled at the shedding pattern specified in the ILCF and Peak Demand Shedding procedure, ie, when the PDSF algorithm decides that it is time to shed that group. Notice that the ILCF and PDSF may interchangeably control an individual load. That is, the ILCF cycling pattern and the PDSF shedding pattern may *both* affect a load group during any time interval. To do this, the ILCF and PDSF must be active and the load group must be assigned in this procedure.

3.164 The third line displays the current peak demand target level. Recall that this parameter specifies the demand level which the PDSF attempts to keep the customer's peak demand from exceeding. The PDSF starts to shed load groups when the customer's demand approaches this level, and it restores load groups when the demand falls sufficiently below the safety band width.

3.165 The third line also displays the safety band width. Recall that the width designated is subtracted from the target level and used as the level at which load groups can be restored. The safety band width must be within 10 percent of the target level.

3.166 The fourth and fifth lines display the minimum time between shed and next restore and the minimum time between restore and next shed. These parameters along with the safety band help prevent shed to restore and restore to shed oscillations.

3.167 The sixth line defines the predictor interval. This parameter allows the customer to

```

PEAK DEMAND LOAD SHEDDING PARAMETERS                                09:14
ENTER SECURITY CODE HERE: XXXX
PEAK DEMAND SHEDDING FUNCT. IS: A [A=ACTIVE,I=INACTIVE]
PEAK DEMAND TARGET LEVEL IS: 20000 KW SAFETY BAND WIDTH: 1900 KW
MINIMUM TIME BETWEEN SHED AND NEXT RESTORE IS: 03 MIN. [BETWEEN 00 AND 15]
MINIMUM TIME BETWEEN RESTORE AND NEXT SHED IS: 00 MIN. [BETWEEN 00 AND 15]
PREDICTOR INTERVAL: 01 MIN. [BETWEEN 01 AND 10]
START UP: 000 IS THE HIGHEST NUMBERED GROUP SHED
REACTION MINUTE: 03 [BETWEEN 00 AND 12]
DEMAND INTERVAL: 15 MIN. [05, 15, 30 MIN.]

CURRENT SHEDDABLE GROUPS:
 002  003

F1-DISPLAY LOAD GROUP AT CURSOR      F5-DISPLAY MORE LOAD GROUPS
F2-PRINT PARAMETERS REPORT           F6-RECORD NEW PARAMETERS
F3-DELETE LOAD GROUP AT CURSOR       F7-RESTART PROCEDURE
F4-ADD A NEW LOAD GROUP              F8-EXIT PROCEDURE
MESSAGE:
.....  
    
```

Fig. 15—F5—Typical Peak Demand Load Shedding Parameters Display (Initial Display)

choose the number of past minutes which are used by the PDSF algorithm to predict the remaining consumption within a demand interval. This parameter can be designated from 1 to 10 minutes. If not designated, the default value used is 1 minute.

3.168 The seventh line defines the highest numbered load group shed upon a system start-up. This parameter can be designated from one to the highest load group number assigned. If not designated, the default value used is load group number 000.

3.169 The eighth line displays the reaction minute. This customer alterable parameter allows the customer to choose the number of minutes in a demand interval the PDSF algorithm must wait be-

fore making a shed or restore decision. This parameter can be designated from 1 to 25 minutes. If not designated, the default value used is 0 minutes. This parameter is dependent on the demand interval used. If the demand interval is 5 minutes, then the reaction minute can be from 0 to 3 minutes. If the demand interval is 15 minutes, then the reaction minute can be from 0 to 12 minutes. If the demand interval is 30 minutes, then the reaction minute can be from 0 to 25 minutes.

3.170 The ninth line defines the length of time the power company uses to calculate demand. The demand interval may be 5, 15, or 30 minutes long. This parameter must be set if either the PDSF or ECDM functions are being used.♦

3.171 The next ten lines under the CURRENT SHEDDABLE GROUPS heading displays the load groups that are currently assigned. The first part of this procedure allows the operator to delete or display more load groups by using function key F3 or F5, respectively. The operator can delete a selected load group by positioning the cursor anywhere over the load group number, depressing function key F3, and then depressing function key F6 to record the deletion. When this 10-line display is filled, the operator can display more load groups by depressing function key F5. This gives the operator the capability to page to another 10-line display of current sheddable groups. The operator can initiate a print-out of all the information on the second part of this procedure for all the load groups, ie, Current Sheddable Groups, by depressing function key F2.

3.172 The second part of the procedure allows the operator to administer the parameters that are used to derive shed estimates which are associated with the load groups. This part of the procedure is entered by depressing function key F1 or F4. If the load group already exists, the operator moves the cursor over the load group number and depresses function key F1. The CRT screen then contains a display similar to the one shown in Fig. 16. The first two lines of this display are the same as the initial screen. The next line gives the load group number. This number is also the shed priority (see Note). The next two lines give the eight KW shed estimates (one for each day of the week and one for holidays) for the load group displayed. Shed estimates are generated automatically by the ECSA feature using the load's measured consumption rate (plate value) and the load's measured run factor of each load in the load group displayed. These estimates may only be displayed. Recall that the KW estimate is an estimate of the average number of KW that is shed (saved) when the load group is cycled according to the specified shedding pattern.

Note: Memory configuration B allows a maximum of 400 load groups (shed priority numbers), and memory configuration C allows a maximum of 512 load groups.

3.173 The next 12 lines contain 2 lists for display of the loads in this load group. Associated with each load in the group is the load's consumption rate (plate value) and the load's run factor. The load's consumption rate is the average rate at which the load consumes electrical energy over a short period

of time and is expressed in units of KW. The load's run factor is the percentage of time that the individual load consumes energy compared with the time the load is energy enabled. Often this is 100 percent, but some loads do not typically run and consume energy continuously, even while energy enabled. An example of this would be a heating/air conditioning unit which is wired to a thermostat.

3.174 In order to balance load groups in the shed condition, each load's run factor parameter used by ECSA to calculate the shed estimates should be the run factor of the load during the average peak demand of the week. For example, if the customer's peak demand occurs around 2:00 pm every day, the run factor value specified for each load (in every load group) should be the calculated run factor during that period.

3.175 Function key F1 is used to display more loads in the event that the load group contains more loads than can be displayed on one page. The operator can delete a load that is displayed on the screen by positioning the cursor over the load number and depressing function key F3 and then recording the parameter change. The operator can add new loads to the load group by entering the load number and associated parameters in any empty slot on the screen. When the operator is finished with the current load group, the operator can return to the first part of the procedure by depressing function key F7, or the current display can be restarted by depressing function key F2. Recall that a load can be assigned to only one load group.

Note: To remove a load in a load group from the system, delete the load as described in this procedure (craft personnel can then remove it from the system via the MAAP).

3.176 The operator can create a new load group by depressing function key F4 while the operator is in either part of this procedure. The CRT screen then contains a display using the format as shown in Fig. 16; however, the load group's KW shed estimates, the loads in the group, the associated load KW consumption, and run factor parameters are empty. The operator can now enter the appropriate data and record the new parameters using the function key F6. When the new parameters are recorded, the number of the load group is displayed under CURRENT SHEDDABLE GROUPS in the first part of this procedure. If new parameters are not recorded, they are lost when an exit is made from this display.

```

PEAK DEMAND LOAD SHEDDING PARAMETERS
ENTER SECURITY CODE HERE: XXXX
LOAD GROUP NUMBER (SHED PRIORITY) IS: 002 [001 TO 400]
THE KILOWATT SHED ESTIMATES FOR THIS GROUP ARE:
M-00208 T-00208 W-00208 T-00208 F-00208 S-00125 S-00125 H-00125

LOAD NUMBER   LOAD KW CONSUMPTION   LOAD RUN FACTOR %
0090          0500          100
LOAD NUMBER   LOAD KW CONSUMPTION   LOAD RUN FACTOR %
0091          5000          050

F1-DISPLAY (OR ADD) MORE LOADS
F2-RESTART THIS LOAD GROUP PROCEDURE
F3-DELETE LOAD AT CURSOR
F4-ADD A NEW LOAD GROUP
MESSAGE:
.....
CARRIER SEND
    
```

Fig. 16—F5—Typical Peak Demand Load Shedding Parameters Display (After F1 Is Depressed)

G. F6—Load Override Parameters Procedure

3.177 This procedure is entered from the base procedure by depressing function key F6. After depressing F6, a display similar to that shown in Fig. 17 appears on the screen. As before, the first and second lines give the name of the procedure and the location to enter the security code.

3.178 The next line gives the state of the system on override. When this override is active, all loads are enabled. As mentioned before, the system on override does not affect the operation of the energy control functions, except that it keeps the functions from disabling the loads via the load control relays. Thus, when the override is made inactive, all

the load's load control relays are sequentially returned to their proper pattern (the pattern determined by the ILCF and PDSF).

3.179 The next two groups of lines give the load number of selected loads which are forced to the enabled state (on override) or to the disabled state (off override). The system allows the operator to enter the same load number in both the load on override and load off override lists. In such a case, the load on override takes precedence. Also, the system on override takes precedence over the load off override list.

3.180 Similar to the other procedures, the operator can add loads to one of the override lists, de-

LOAD OVERRIDE PARAMETERS													09:20		
ENTER SECURITY CODE HERE: XXXX															
THE SYSTEM "ON OVERRIDE" IS: I [A=ACTIVE, I=INACTIVE]															
LOADS WITH "ON OVERRIDE" ACTIVE:															
0090	0091	0112													
LOADS WITH "OFF OVERRIDE" ACTIVE:															
0004	0001	0199													
F1-DISPLAY(OR ADD) MORE"ON OVRD"LOADS				F5-				F6-RECORD NEW PARAMETERS							
F2-PRINT PARAMETERS REPORT				F7-RESTART PROCEDURE				F8-EXIT PROCEDURE							
F3-DELETE LOAD AT CURSOR															
F4-DISPLAY(OR ADD) MORE"OFF OVRD"LOADS															
MESSAGE:															
.....													CARRIER		SEND

Fig. 17—F6—Typical Load Override Parameters Display

lete loads, and change the state of the system on override by use of the function keys defined at the bottom of the screen.

H. F7—Load Status Procedure

3.181 This procedure allows the operator to interrogate the current status of any or all load control relays, and display the information on the screen of the CRT or on any of the ECSA printers. This procedure is entered from the base procedure by depressing function key F7. After depressing this key, a display appears on the screen similar to that shown in Fig. 18.

3.182 As before, the first two lines give the name of the procedure and the location to enter the

security code. The next line gives the printer number that the report appears on if function key F2 is depressed. If the operator changes the printer number without recording the new parameter (function key F6), the change only affects the current printout. If the operator wants to make the new printer number permanent, the new parameter should be recorded.

3.183 The next line gives the range of load numbers that are to be displayed. The system displays the load status starting at the lower bound and going through the upper bound. The lower bound and upper bound values can be changed in a manner similar to the printer number. That is, if the values are changed without recording them, they pertain only to the current display. If the values are recorded, they become permanent.

LOAD STATUS		09:24	
ENTER SECURITY CODE HERE: <input type="text" value="XXXX"/>			
ALL DEMAND REPORTS ARE PRINTED ON PRINTER: <input type="text" value="01"/>			
LOAD STATUS DISPLAYED (OR PRINTED) FROM LOAD: <input type="text" value="0400"/> TO LOAD: <input type="text" value="0429"/>			
LOAD STATUS: [(ON/OFF)(OVERRIDES)(FUNCTIONS)(FUNCTIONS OFF)]			
LD.NO.	STATUS	LD.NO.	STATUS
LD.NO.	STATUS	LD.NO.	STATUS
LD.NO.	STATUS	LD.NO.	STATUS
LD.NO.	STATUS	LD.NO.	STATUS
LD.NO.	STATUS	LD.NO.	STATUS
F1-DISPLAY LOADS AND STATUS		F5-	
F2-PRINT LOADS AND STATUS		F6-RECORD NEW PARAMETERS	
F3-		F7-RESTART PROCEDURE	
F4-STOP PRINTING REPORT		F8-EXIT PROCEDURE	
MESSAGE:			
<input type="text" value="....."/>		<input type="text" value="CARRIER"/>	<input type="text" value="SEND"/>

Fig. 18—F7—Typical Load Status Display (Initial Display)

3.184 The operator can display the load status over the specified range on the CRT screen by depressing function key F1, or the load status can be printed on the specified printer by depressing function key F2. In the case of the CRT, if the specified range exceeds that which can be displayed, the display stops when the screen has been filled. The next page of loads can then be displayed by depressing F1 again. This process can be repeated until all loads have been displayed.

3.185 An example of a display is shown in Fig. 19. Notice that the load status is expressed as a 4-digit number. This 4-digit number can be decoded via Table C. The first digit (left-most digit S3) gives the current load status. A 0 indicates that the load is off (disabled), and a 1 indicates that the load is on

(enabled). The next three digits tell the operator what ECSA function(s) (if any) is affecting this load. The second digit from the left (S2) tells the operator if any override affects this load. The third digit from the left (S1) tells the operator which ECSA function(s) the load is currently included in. If, for example, a load is only assigned to the eight daily schedules in procedure F4 and not to a load group, then (S1) is an "A". If the load is only assigned to a group in procedure F5 but not to the 8-day clock, then (S1) is a "C". If the load is then assigned to both procedures, (S1) is an "E". If a load is assigned to the system via the MAAP but not to either function, then (S1) is an "8" (see Note). The fourth digit (S0) tells the operator which ECSA function(s) currently has the load disabled (if it is disabled). An example of how to use Table C follows. If a load had a status code of

10E8, it would tell the operator that the load is enabled (S3), there are no overrides active (S2), the load is an individual load capable of being controlled by the ILCF or the PDSF (S1), and is currently enabled by either the ILCF or PDSF (S0).

Note: If a load is assigned to ECSA via the MAAP but is not assigned to the ILCF nor to the PDSF (ie, in procedures F4 and F5), then the status display for this load in this procedure is 1088.

3.186 The operator should use caution in trying to compare the displayed status of a load with the actual status of the load. The displayed status is in accordance with the preprogrammable software pattern of the ILCF or PDSF. Remember that ECSA

is a dynamic system. The displayed status is a “snapshot” in time taken when the display is requested. That status can change shortly after it is displayed and, of course, it no longer agrees with the real status. For example, load 0002 has a normal schedule that turns the load on at 10:00 am and off at 10:05 am, and the operator views procedure F7 from 10:04 to 10:06 and notices the load is on. This status is correct when initially viewing the display; however, a minute after that, in this example, it has changed. The operator should also realize that at any time after the initial viewing of the display, the system may shed. This is also true for screen F4; however, there is one more factor to consider when a change is made to procedure F4. For example, the status displayed in procedure F4 for load 0001 is 1088. The operator enters a schedule for this day and records it. The operator

09:25

LOAD STATUS
 ENTER SECURITY CODE HERE:

ALL DEMAND REPORTS ARE PRINTED ON PRINTER:
 LOAD STATUS DISPLAYED (OR PRINTED) FROM LOAD: TO LOAD

LOAD STATUS: [(ON/OFF)(OVERRIDES)(FUNCTIONS)(FUNCTIONS OFF)]

LD.NO.	STATUS								
0400	00A8	0401	11A8	0402	1288	0403	0188	0404	00A8
0405	00AA	0406	1368	0407	1488	0408	1088	0409	0088
0410	0188	0411	12E8	0412	12E8	0413	0188	0414	00CC
0415	0188	0416	0088	0417	11A8	0418	00CC	0419	00EC
0420	1288	0421	00EA	0422	12A8	0423	00EC	0424	00EA
0425	12E8	0427	00AA	0429	1088				

F1-DISPLAY LOADS AND STATUS
 F2-PRINT LOADS AND STATUS
 F3-
 F4-STOP PRINTING REPORT

F5-
 F6-RECORD NEW PARAMETERS
 F7-RESTART PROCEDURE
 F8-EXIT PROCEDURE

MESSAGE :

Fig. 19—F7—Typical Load Status Display (After F1 Is Depressed)

TABLE C
LOAD STATUS CODES

ID, STATUS S ₃ S ₂ S ₁ S ₀	CODES															
	0	1														
S3—LOAD STATE	0	1														
Load off (disabled)	X															
Load on (enabled)		X														
S2—LOAD OVERRIDES	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
No overrides active	X															
Load off override active		X		X		X		X		X		X		X		X
Load on override active			X	X			X	X			X	X			X	X
System on override active					X	X	X	X					X	X	X	X
ECS inactive override									X	X	X	X	X	X	X	X
S1—ECS FUNCTIONS	—	—	—	—	—	—	—	—	8	—	A	—	C	—	E	
Individual Load									X							
Individual load cycling function											X				X	
Peak demand shedding function													X		X	
S0—LOAD FUNCTIONS OFF	—	—	—	—	—	—	—	—	8	—	A	—	C			
ILCF or PDSF has load on									X							
ILCF has load off											X					
PDSF has load off													X			

then notices the status did not change to 10A8 and is puzzled. The status does not change to 10A8 until this load's status is redisplayed by either reinitializing procedure F4 or by displaying this load's status in procedure F7.

Note: The load status of the load assigned to the external alarm is AAAA.

I. F8—ECSA Printer Parameters and Reports Procedure

3.187 This procedure allows the operator to obtain information pertaining to the ECSA feature in hard-copy form. A complete explanation of the printed output from ECSA is given under ECSA PRINTED INFORMATION. This procedure is entered from the base procedure by depressing function

key F8. After depressing F8, a display appears on the screen similar to that shown in Fig. 20.

3.188 As before, the first two lines give the name of the procedure and the location to enter the security code. The next line specifies the printer number that demand reports are printed on. The operator can obtain any of the demand reports listed in the middle of the screen by positioning the cursor on the line of the desired report and depressing function key F1. The report appears on the printer specified for demand reports. The operator can direct this printout to another printer by changing the demand report printer number. If this parameter is changed without recording it, all reports that are initiated during the current procedure are redirected to the new printer. If the new printer number is recorded

PRINTER PARAMETERS AND REPORTS		09:29
ENTER SECURITY CODE HERE: <input type="text" value="XXXX"/>		
ALL DEMAND REPORTS ARE PRINTED ON PRINTER:	<input type="text" value="01"/>	
DAILY STATUS REPORT IS PRINTED ON PRINTER:	<input type="text" value="01"/>	
DAILY STATUS REPORT IS PRINTED EACH DAY AT:	<input type="text" value="08:00"/>	
PERIODIC STATUS REPORT IS PRINTED ON PRINTER:	<input type="text" value="01"/>	
PERIODIC STATUS REPORT IS PRINTED EVERY:	<input type="text" value="15"/>	MIN. [05 TO 60 MIN.]
REPORTS AVAILABLE ON DEMAND ARE:		
<input checked="" type="checkbox"/> ENERGY COMMUNICATIONS ALARMS		
* SYSTEM PARAMETERS		
* BINARY FEEDBACK STATUS		
* INDIVIDUAL LOAD CYCLING FUNCTION AND PEAK DEMAND SHEDDING PARAMETERS		
* PEAK DEMAND LOAD SHEDDING PARAMETERS		
* LOAD OVERRIDE PARAMETERS		
* SYSTEM STATUS		
* ALL ENERGY COMMUNICATIONS PARAMETERS		
F1-PRINT REPORT AT CURSOR	F5-	
F2-PRINT AND CLEAR TOTAL CONSUMPTION	F6-RECORD NEW PARAMETERS	
F3-PRINT AND CLEAR HIGHEST DEMAND	F7-RESTART PROCEDURE	
F4-STOP PRINTING REPORT	F8-EXIT PROCEDURE	
MESSAGE:		
<input type="text" value="....."/>		<input type="button" value="CARRIER"/> <input type="button" value="SEND"/>

Fig. 20—F8—Typical Printer Parameters and Reports Display

(function key F6 is depressed), it becomes the new default demand report printer number and appears the next time this procedure is entered.

3.189 The next two lines give the parameters associated with the daily status report. This report produces the same information that is contained in the Load Override Procedure and the information contained in the *daily* totals for the consumption history for each power meter. The operator can specify the printer number and time of day that the report is printed. The information in the daily status report is cleared from memory daily after the report is printed. See ECSA Printed Information for an example.

3.190 The next two lines give the parameters associated with the periodic status report. The periodic status report prints the same information as the demand report of the system status procedure which is the information on the base screen display and the consumption history for each power meter (running total consumptions and highest demands). The operator can specify the printer number and frequency of the report (from once every 5 minutes to once every 60 minutes). See the ECSA Printed Information description for an example.

3.191 The printer number associated with both of the periodic reports can be changed, but the change does not take effect until the new values are recorded. The operator can inhibit either periodic report from occurring by not specifying a printer number for the specified function. This is done by writing spaces in the printer number field.

3.192 The two function keys F2 and F3 are used to print and clear (set to zero) the *running* total consumption and highest demand data items.

The print and clear actions are combined so that there is no delay from the time one of these items is printed to the time it is cleared. This allows for accurate accounting if these values are compared to the power bill. The total consumption and highest demand are printed on the demand report printer.

Note: If no printer number has been specified for this function, the data is cleared but no printout occurs.

3.193 When function key F2 is depressed, the printer outputs the system's running total consumption since last print/clear and the running total consumption for each power meter since last print/clear (see Fig. 21). When function key F3 is depressed, the printer outputs the system's running highest demand since last print/clear and the running highest demand for each power meter since last print/clear (see Fig. 22). These function keys clear the system's running totals which affect the information on the System Status Display, the demand print of the System Status Display, and the Periodic Status Report. The date and time of each printout is printed at the bottom of both reports.

Note: The running total consumption and highest demand gives the ECSA operator more system performance information, making it easier to employ the PDSF to its best advantage.

3.194 The function key F4 is used to stop printing any report that is currently being printed on the ECSA demand printer. This is useful to stop a report that was started by mistake, or to stop one of the periodic reports that is being printed on the same printer on which demand reports are being printed.

```

TOTAL CONSUMPTION SINCE 10/05/82 10:53 IS: 00020340 KWH
INDIVIDUAL METER CONSUMPTION SINCE 10/05/82 10:53
01-0003390      02-0016950      03-0000000      04-0125100
05-0063009      06-0000000      07-0091800      08-0000000
09-0000000      10-0000000      11-0000000      12-0000000
13-0000000      14-0000000      15-0000000      16-0000000
TOTAL CONSUMPTION CLEARED 10/10/82 12:38

```

Fig. 21—Typical Total Consumption Report (After F2 Is Depressed on Procedure F8)

HIGHEST DEMAND SINCE 10/05/82 10:54 IS: 76320 KW			
INDIVIDUAL METER HIGHEST DEMAND SINCE 10-05-82 10:54			
01-12720	02-63600	03-00000	04-?????
05-?????	06-00000	07-?????	08-00000
09-00000	10-00000	11-00000	12-00000
13-00000	14-00000	15-00000	16-00000
HIGHEST DEMAND CLEARED 10/10/82 12:39			

NOTE: The meters with question marks (eg. ?????) indicate that this field is over the system monitoring (ECDM) limits of the highest demand (99,999 KW).

Fig. 22—Typical Highest Demand Report (After F3 Is Depressed on Procedure F8)

J. ECSA Console Error Codes

3.195 The ECSA console operator can make two types of errors when using one of the ECSA console procedures. The first type of error is a syntax error. Examples of syntax errors include trying to enter data onto a write-protected section of the screen, trying to enter an alphabetical character into a numeric field, or depressing a function key which is not defined. The system detects a syntax error immediately and responds by ignoring the key depression and sounding a beep.

3.196 The second type of error is a logical error. This type of error is not detected until the operator attempts to record a new parameter(s). Examples of logical errors include entering a load number that does not exist or activating a function without specifying the needed set of parameters. When the operator makes a logical error, a message giving the error number(s) appears near the bottom of the screen on the message line, and the data field which caused the error is also flashed. No new data which is associated with the error is recorded until the error is corrected. Refer to Table D for a listing of error codes and definitions of error conditions.

Note: The first digit of the error code generally corresponds to the screen the error is made on (eg, ERR 408 was made on the F4 procedure—Individual Load Scheduling Parameters Display).

Examples of Error Conditions For Procedures F4 and F5

3.197 The following error conditions are examples of logical errors (the error codes associated with each condition are represented in parenthesis).

Individual Load Scheduling Parameters Procedure

3.198 The following error conditions may arise while the ECSA operator is entering scheduling parameters.

- An entry in an HRMN field is not a valid time (ie, the HR part is greater than 23, or the MN part is greater than 59) (Error 402).
- The entry in an NRM field does not define a pattern (Error 401).
- The entry in the NRM field defines a pattern, but the entry in the SHD field does not (Error 401), and the SHD entry also does not define a valid modifier for the NRM entry (Error 403). The latter can occur either because the first character in the SHD field is not a “-” or because the last two characters in the SHD field do not specify a number which is less than or equal to the number of minutes in one on period of the pattern specified in the corresponding NRM field.
- The entry in an NRM field is 01A and the entry in the corresponding SHD field does not specify a pattern from the list (Error 401). A modifier is not allowed on patterns 01A nor 24A (Error 408).
- Both the NRM and SHD fields define valid patterns, but the SHD pattern is less restric-

TABLE D
ERROR CODES

ERROR CODE	MEANING				
200	Not a valid demand interval. Valid intervals are 05, 15 or 30 minutes.				
201	Time and date need updating via System Parameters Procedure.				
202	Not a valid ECS security code. Valid codes must be four digits.				
203	Not a valid date. The date must always be a valid 2 digit month (01 to 12) and a valid 2-digit day (01-31).				
204	Not a valid time-of-day expression. Valid expressions are 00:00 to 23:59.				
300	Not a valid range of sense point numbers. Valid sense point range is 000 through 999.				
400	Not a valid number or is reserved for external alarming.				
401	Not a valid cycling pattern number. Valid expressions are NNX, where NN is a number from 01 to 24 and X is a letter which is a valid modifier for NN.				
402	Not a valid time-of-day expression. Valid expressions are 0001 to 2359.				
403	Not a valid "modifier" time valid times are "-00" through "-55."				
404	The shed cycling pattern is less restrictive than the normal cycling pattern. A shed pattern's "total off" time summed over the entire 60-minute period cannot be less than the "total off" time for the associated normal cycling pattern.				
405	Time intervals must be contiguous. Up to 6 time intervals are available for a daily schedule but must be assigned from left to right with no time intervals skipped (no imbedded blanks).				
406	Not a valid modifier for the normal cycling pattern. The modifier can not exceed the longest "on" period for the normal cycling pattern. For example: <div style="text-align: center;"> <table style="border: none;"> <tr> <td style="padding-right: 20px;">NRM</td> <td>SHD</td> </tr> <tr> <td style="padding-right: 20px;">10C</td> <td>-40</td> </tr> </table> </div>	NRM	SHD	10C	-40
NRM	SHD				
10C	-40				
407	Time intervals must increase from left to right on the display screen.				
408	"Modifier" not valid for patterns 01A and 24A.				
WRN 409*	Normal and Shed cycling patterns are not compatible. At no time during the 60-minute period can a shed cycling pattern have an on time corresponding to				

TABLE D (Contd)

ERROR CODES

ERROR CODE	MEANING								
WRN 409* (Contd)	an off time in the associated normal cycling pattern. This is a special soft error condition which can be overridden by two successive "record parameters" operations.								
WRN 410*	Calculated KW estimate is greater than 65000KW								
411	Not a valid Fail-Safe condition. Fail-Safe condition must be "ON", "ON" or "OFF".								
500	Not a valid PDSF load group number/shed priority number. Valid numbers are 001 through XXX, B-400, C-512.								
501	PDSF load group number/shed priority number has already been used.								
502	PDSF load group number/shed priority number must be entered.								
503	Not a valid load number or load is reserved for external alarming.								
504	Load is already included in another load group.								
505	Load consumption and load run factor must be entered.								
506	Not a valid load run factor (Duty Cycle). Valid percentages are 000 through 100.								
WRN 507*	Calculated KW estimate is greater than 65000 KW. This is a special error condition which results in a value of 65,000 KW recorded in system for affected daily shed estimates.								
508	All available load groups have been used.								
509	Not a valid load consumption valid range is 0000→9999.								
510	Not a valid minimum time for shed to restore nor restore to shed interval.								
511	Start-up number greater than the maximum number of allowed groups.								
512	Not a valid predictor interval. Valid intervals are 1 thru 10.								
513	<p style="text-align: center;">Reaction minute out of range.</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; text-align: center;">DEMAND INTERVAL</td> <td style="width: 50%; text-align: center;">REACTION MINUTE RANGE</td> </tr> <tr> <td style="text-align: center;">5 minutes</td> <td style="text-align: center;">0 – 3 minutes</td> </tr> <tr> <td style="text-align: center;">15 minutes</td> <td style="text-align: center;">0 – 12 minutes</td> </tr> <tr> <td style="text-align: center;">30 minutes</td> <td style="text-align: center;">0 – 25 minutes</td> </tr> </table>	DEMAND INTERVAL	REACTION MINUTE RANGE	5 minutes	0 – 3 minutes	15 minutes	0 – 12 minutes	30 minutes	0 – 25 minutes
DEMAND INTERVAL	REACTION MINUTE RANGE								
5 minutes	0 – 3 minutes								
15 minutes	0 – 12 minutes								
30 minutes	0 – 25 minutes								
514	Safety band greater than 10% of target level.								

TABLE D (Contd)

ERROR CODES

ERROR CODE	MEANING
WRN 515*	Warning, may want to change safety band when peak demand target level is changed.
WRN 517*	Warning, may want to change reaction minute when the demand interval is changed.
600	Not a valid load number or is reserved for internal alarming.
700	Not a valid range of load numbers. Valid load range is 0000 through 9999.
800	The demand printer number must be entered.
801	Not a valid printer number.
802	Cannot initiate a report on the demand printer at this time: <ul style="list-style-type: none"> • The printer may be busy or "off line". • Attempting to initiate a Daily/Periodic/System Status report when the same report is printing on another printer.
803	No report is currently being printed on the demand printer.
804	Not a valid time-of-day expression. Valid expressions are 00:00 to 23:59.
805	Not a valid periodic status report period. Valid periods are 05 to 60 minutes.

* These codes are used to warn the console operator of possible problems.

tive (ie, has the load energy disabled for less time) than the NRM pattern (Error 404).

(f) Both the NRM and SHD fields define valid patterns and the SHD pattern is more restrictive than the NRM pattern, but the two are not compatible with each other (Warning 409). This is the case if there is some time within the hour at which the NRM pattern specifies the load to be off and the SHD pattern specifies the load to be on. Compatibility errors (ie, warning 409) are referred to as soft errors; all other logical errors are referred to as hard errors. Although WRN409 is displayed to the operator when the first attempt is made to enter parameters that are not compatible, the parameter recording is allowed if the operator depresses the Record Parameters function key for a second consecutive time. In the case where multiple errors of this type exist on one screen and the

first attempt is made to enter parameters, the eight lines which define the schedules for the load are scanned for errors a line at a time (starting with the bottom line). Each of the eight lines is scanned only once, looking for both hard and soft errors at the same time. For the purposes of the error search, a line is treated as an indivisible unit. Hence, all errors on a line are reported simultaneously. The scan continues, without returning control to the operator, until either a line with at least one hard error has been found, or all of the lines have been scanned. Hence, it is possible to have more than one line with errors flashing when control is returned. However, in the event that this happens, only the uppermost one of those lines could have one or more hard errors. Hard errors must be corrected before they can be recorded, and soft errors are recorded only if the Record Parameters function key F6 is depressed twice consecu-

tively. Table B is used to find compatible shed patterns for the desired normal pattern.

Note: Once a soft error (ie, WRN409) is recorded, it is not displayed as a soft error (ie, WRN409). The next time changes are made on that screen (unless the changes include a change to the same NRM or SHD field and the patterns chosen were again not compatible).

- (g) An NRM state is entered for an interval without a corresponding SHD state (Error 401). If it is desired for the load not to be shed during an interval, the SHD pattern chosen should be made identical to the NRM pattern.
- (h) A SHD state is entered for an interval without a corresponding NRM state (Error 401).
- (i) The NRM and SHD fields are entered without a corresponding HRMN entry (Error 405).
- (j) Entries in the HRMN fields on any one of the lines are not in strictly increasing order, ie, no skipped HRMN fields (Error 407). The only HRMN fields that may not be entered are those after the schedule is completed. In this case, the last time intervals, NRM and SHD patterns, are used until midnight.
- (k) A load has one or more daily schedules with no entries (Error 401). If it is desired to schedule some days before deciding how to schedule the others, enter the 01A pattern (constant on) in the NRM and SHD fields for the first time interval (ie, 00) for the blank days. If an individual load has no entries in its schedule at all, it remains energy enabled at all times. This is permitted to make provisions for the customer to gradually bring the system on-line. However, when a schedule is entered for a load, it must be complete.

Peak Demand Load Shedding Parameters

3.199 The following error conditions may arise while the ECSA operator is entering shedding parameters.

- (a) A load is put into a shedding group without specifying the consumption and/or run factor (Error 505).
- (b) The operator attempts to enter something other than an integer between 1 and 100 in the field for a load's run factor percentage (Error 506).

(c) If the operator attempts to enter something other than an integer between 0 and 9999 for the load's consumption rate (Error 509).

◆(d) The operator attempts to enter a safety band width that is greater than 10 percent of the target level (Error 514). When the target or the safety band width is changed, warning 515 is displayed indicating that the other related parameter (ie, target or safety band width) should be validated.

(e) The operator attempts to enter a reaction minute that is outside of boundaries imposed by the demand interval (Error 513).

(f) The operator attempts to enter a demand interval that is outside the boundaries imposed by the reaction minute (Error 513). The demand interval rarely changes. When the safety band width or the demand interval changes, warning 517 is displayed indicating that the customer should consider the other related parameter (ie, the safety band width or the demand interval) to determine that this is still the desired parameter.◆

K. Cursor Control

3.200 The ECSA console provides several facilities which aid the operator in the placement of the cursor. They allow the operator to position the cursor anywhere on the screen (see Fig. 4 and 5). These keys are:

“↑”—Moves the cursor up

“↓”—Moves the cursor down

“→”—Moves the cursor right

“←”—Moves the cursor left

“HOME”—Moves the cursor to the start of the security code field.

3.201 In order to explain the other cursor facilities, it is necessary to define the term data field. A data field is a set of one or more characters that are contiguous (together) and correspond to data which can be edited, deleted, or pointed to by a function key operation. The only portions of the screen which accept user-entered data are data fields. When the operator enters data into the last character posi-

tion of a data field, the cursor advances automatically to the first character of the next data field.

3.202 There are five tab keys which help the operator move the cursor to a desired data field. The ">" key (no shift required) tabs the cursor forward (to the right and down) until it reaches the first character position of the next data field. The "<" key (no shift required) tabs the cursor backward (to the left and up) until it reaches the first character position of the previous data field. The "]" key (long tab forward) advances the cursor one line and then tabs forward to the next data field. The "[" key (long tab backward) moves the cursor backward to the first data field of a line before the current line. The "DEL" key takes the cursor to the left-most data field of the current line (assuming there is a data field in the current line).

L. Method of Operation—An Example

3.203 An example of the administration of parameters for the ILCF and Peak Demand Shedding is as follows:

- (1) To call the Individual Load Scheduling Parameters from the base procedure, depress function key F4.
 - The CRT displays this procedure (Fig. 11).
 - The cursor is positioned at the reversed video data field for the F3 key (ie, Display Next Load).
- (2) Enter the desired individual load number and depress function key F3.
 - The screen fills with the scheduling information for that load (Fig. 12).
 - The cursor is placed in the security code field.
- (3) To change a parameter, enter the security code and move the cursor to the parameter which is to be changed.

Note 1: The operator can enter data only in those areas of the screen which are displayed in reversed video (white). If the operator tries to enter data anywhere else, the console sounds a beep and that data is ignored.

Note 2: Certain parameters require a specific character to designate the status of the

parameter. The characters, which are used to designate the status of the parameter, are shown in brackets beside the applicable parameter. If the operator attempts to enter any character, other than the allowable characters, a beep sounds and that data is ignored.

- (4) Enter the new parameter(s).
 - New data displayed at half intensity.
- (5) Depress function key F6.
 - New data displayed at full intensity.
 - Message displayed (PARAMETERS RECORDED).
- (6) If no further changes are required, depress function key F8.
 - Base procedure displayed (Fig. 6).

ECSA PRINTED INFORMATION

3.204 The ECSA feature is capable of producing three types of printed output. ♦These reports give the customer a record of the present value of the parameters, alarms, and status associated with each of the energy control functions. †These are:

- Demand Reports
- Periodic Reports
- ECSA Automatic Alarm Report.

A. Demand Reports

3.205 The demand reports are printed information which the ECSA console operator can obtain upon demand. These are:

- (1) ECSA Alarms
- (2) ECSA System Parameters
- (3) †Binary Feedback Status †
- (4) Individual Load Scheduling Parameters
- (5) Peak Demand Load Shedding Group Parameters
- (6) Load Override Parameters

- (7) ECSA System Status
- (8) All Energy Communication Parameters
- (9) ECSA Load Status.

3.206 The demand reports 1 through 6 shown in Fig. 23 through 28 can be obtained by using the print function on the associated ECSA console procedure F1 through F6 or by using the F8—Printer Parameters and Reports Procedure. Either method prints out the same information with the exception of report 4. When this report is initiated from the console procedure F4, the printout contains only the information for the load displayed. However, when this report is initiated from the Printer Parameters and Reports procedure, all the individual loads assigned to the ILCF are printed. An example of multiple loads assigned to the F4 procedure and printed on demand from procedure F8 is shown in Fig. 26.

3.207 A difference between the CRT displays and the printed reports is that the printed reports contain a change flag field in column 1 of many of the lines. If a change flag (represented by #) is present in column 1 of a line, it signifies that one or more parameters have been changed on that line (or group of lines which follow) since the last printout. This enables the operator to keep track of parameter changes that are made in the system.

3.208 Report 7 (Fig. 29) is identical to the periodic status report, except that it is available upon demand. Report 8 is a complete dump of all ECSA parameters and consists of the same information as printed in reports 2 through 6. This report is printed on demand (see Fig. 30).

3.209 The ECSA operator can keep track of the parameter changes by manually initiating the All Energy Communications Parameters report (Report 8) at some regular interval. The change flags get cleared at the end of printing the All Energy Communications Parameters report. If the report does not complete (report stopped, printer out of paper, etc), none of the flags are cleared. Note that the parameter change flags are printed when any of the other five demand reports are initiated; however, printing these reports does not cause the flags to be cleared.

3.210 Report 9 is initiated using the load status procedure. This report prints the same information which is displayed on the CRT console when using this procedure. An example of this report is shown in Fig. 31.

B. Periodic Reports

Periodic Status Report

3.211 The Periodic Status Report (Fig. 29) gives the customer a report of the information

```

ENERGY COMMUNICATIONS ALARMS
10/01/82 15:29 P-01

10/01 12:32 SYSTEM CLOCK NEEDS UPDATING

10/01 15:27 POWER METER 09 - NO PULSES RECEIVED
10/01 15:26 LOAD 0420 - FAILED
10/01 15:21 POWER METER 08 - NO PULSES RECEIVED
10/01 15:15 LOAD 0413 - FAILED
10/01 15:10 LOAD 0412 - FAILED
10/01 15:05 LOAD 0411 - FAILED
10/01 14:46 LOAD 0410 - FAILED
10/01 14:28 LOAD 0405 - FAILED
10/01 14:09 LOAD 0408 - FAILED
10/01 13:51 LOAD 0407 - FAILED
10/01 13:32 LOAD 0406 - FAILED

END

```

Fig. 23—Typical ECSA Alarms Report

SYSTEM PARAMETERS

10/05/82 12:02 P-01

#ENERGY COMMUNICATIONS FEATURE IS: A [A=ACTIVE.I=INACTIVE]

THE DEMAND INTERVAL IS: 05 MIN.

POWER METER PARAMETERS [ALM DETECTION: A=ACTIVE,I=INACTIVE]

NO.	KWH/PULSE	ALM									
01	010	.000 A	02	050	.000 A	03	000	.000 I	04	050	.000 A
05	025	.500 A	06	000	.000 I	07	100	.000 A	08	000	.000 I
09	000	.000 I	10	000	.000 I	11	000	.000 I	12	000	.000 I
13	000	.000 I	14	000	.000 I	15	000	.000 I	16	000	.000 I

HOLIDAY DATES

MO.	DAY										
01	/	01	02	/	14	04	/	20	05	/	26
07	/	04	09	/	07	11	/	25	11	/	26
12	/	25	12	/	31	/			/		

END

Fig. 24—Typical System Parameters Report

BINARY FEEDBACK STATUS

09:26

10/01/82 15:13 P-01

ALARM TYPES: 0-NO ALARM 1-ASTERISK ON SCREEN 2-ASTERISK PLUS EC ALARM

SENSE POINT	ALM TYP	SENSOR* STATUS	LOAD NUM.	LOAD STAT	DELAY (SEC)	SENSE POINT	ALM TYP	SENSOR* STATUS	LOAD NUM.	LOAD STAT	DELAY (SEC)
001	2	OPEN *	0017	ON	005	002	2	OPEN *	0037	OFF	000
003	2	CLOSED	0021	ON	030	004	0	OPEN	----	---	---
005	1	CLOSED	0035	ON	030	006	1	CLOSED*	0075	OFF	015
007	0	OPEN	----	---	---	008	2	OPEN	----	---	---
009	2	CLOSED*	0050	OFF	000	010	1	CLOSED	0101	ON	010
011	0	OPEN	0052	OFF	000	012	1	CLOSED	0087	ON	030
013	1	OPEN	0056	OFF	015	014	2	CLOSED*	----	---	---
015	1	OPEN	----	---	---	016	0	OPEN	0045	ON	000
017	2	CLOSED*	----	---	---	018	2	OPEN *	0093	ON	060
019	0	CLOSED	0061	ON	000	020	0	CLOSED	----	---	---

END

Fig. 25—Typical Binary Feedback Status Report

INDIVIDUAL LOAD CYCLING FUNCTION AND PEAK DEMAND SHEDDING PARAMETERS
10/01/82 15:33 P-01

#INDV. LOAD CYCLING FUNCTION IS: A [A=ACTIVE,I=INACTIVE]
#PEAK DEMAND SHEDDING FUNCT. IS: A [A=ACTIVE,I=INACTIVE]

#LOAD NUMBER: 0003

LOAD IS IN SHEDDING GROUP NUMBER: 002

LOAD STATUS: 10E8 LOAD CONSUMPTION: 0500KW LOAD RUN FACTOR: 100%

HR	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD
M	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
T	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
W	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
T	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
F	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
S	00	24A	24A	0600	06A	14A	1000	05A	12A	1400	01A	02A	1800	24A	24A		
S	00	24A	24A	0600	06A	14A	1000	05A	12A	1400	01A	02A	1800	24A	24A		
H	00	24A	24A	0600	06A	14A	1000	05A	12A	1400	02B	-05	1800	24A	24A		

LOAD NUMBER: 0004

LOAD IS IN SHEDDING GROUP NUMBER: 003

LOAD STATUS: 10E8 LOAD CONSUMPTION: 5000KW LOAD RUN FACTOR: 080%

HR	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD
M	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
T	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
W	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
T	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
F	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
S	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
S	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A
H	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A 24A

#LOAD NUMBER: 0005

LOAD IS IN SHEDDING GROUP NUMBER: 003

LOAD STATUS: 00EC LOAD CONSUMPTION: 0100KW LOAD RUN FACTOR: 100%

HR	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD	HRMN	NRM	SHD
M	00	24A	24A	0730	14A	-03	1600	24A	24A								
T	00	02A	-05	1000	22A	23A	1200	06B	19D	1400	02G	23G	1600	02A	-05		
W	00	24A	24A	0730	14A	-03	1600	24A	24A								
T	00	02A	-05	1000	22A	23A	1200	06B	19D	1400	02G	23G	1600	02A	-05		
F	00	24A	24A	0730	14A	-03	1600	24A	24A								
S	00	02A	-05	1000	22A	23A	1200	06B	19D	1400	02G	23G	1600	02A	-05		
S	00	24A	24A														
H	00	24A	24A														

END

Fig. 26—Typical Individual Load Scheduling Parameters Report

```

PEAK DEMAND LOAD SHEDDING PARAMETERS
10/11/82 02:23 P-01

PEAK DEMAND SHEDDING FUNCT. IS: A [A=ACTIVE,I=INACTIVE]
PEAK DEMAND TARGET LEVEL IS: 20000 KW      SAFETY BAND WIDTH: 1900 KW
MINIMUM TIME BETWEEN SHED AND NEXT RESTORE IS: 02 MIN. [BETWEEN 00 AND 15]
MINIMUM TIME BETWEEN RESTORE AND NEXT SHED IS: 08 MIN. [BETWEEN 00 AND 15]
PREDICTOR INTERVAL: 01 MIN. [BETWEEN 01 AND 10]
START UP: 000 IS THE HIGHEST NUMBERED GROUP SHED
REACTION MINUTE: 06 [BETWEEN 00 AND 12]
DEMAND INTERVAL: 15 MIN. [05, 15, 30 MIN.]

LOAD GROUP NUMBER (SHED PRIORITY) IS: 002 [001 TO 400]
THE KILOWATT SHED ESTIMATES FOR THIS GROUP ARE:
M-00208 T-00208 W-00208 T-00208 F-00208 S-00125 S-00125 H-00125

      LOAD      LOAD KW      LOAD RUN      LOAD      LOAD KW      LOAD RUN
      NUMBER    CONSUMPTION  FACTOR %    NUMBER    CONSUMPTION  FACTOR %
      0003      0500          100          0090      5000          050

#LOAD GROUP NUMBER (SHED PRIORITY) IS: 003 [001 TO 400]
THE KILOWATT SHED ESTIMATES FOR THIS GROUP ARE:
M-01669 T-01669 W-01669 T-01669 F-01669 S-01669 S-01669 H-01669

      LOAD      LOAD KW      LOAD RUN      LOAD      LOAD KW      LOAD RUN
      NUMBER    CONSUMPTION  FACTOR %    NUMBER    CONSUMPTION  FACTOR %
      0005      1000          100          0010      8000          033
      0004      5000          080

END

```

Fig. 27—Typical Peak Demand Load Shedding Parameters Report

listed under the ECDM function. This report is printed automatically each hour on the hour and at specified intervals (ie, from once every 5 minutes to once every 60 minutes) designated at the Printer Parameters and Reports procedure. For example, if the operator specifies a 10-minute interval, using the printer parameters and reports procedure, the periodic status report would be printed at 12:00, 12:10, 12:20, 12:30, etc. This report prints the same information as the demand report of the system status procedure which is the information on the base screen display and the running consumption. The running consumption history is the system's running totals of the total consumption and highest demand for the system and for each power meter assigned since last cleared. These parameters are cleared on demand from procedure F8.4

Daily Status Report

3.212 The Daily Status Report is automatically printed once a day at a time which is specified by the operator as part of the console Printer Parameters and Reports procedure. This periodic report consists of the Load Override Parameters information and the consumption history for the day, as shown in Fig. 32. This means that every time a Daily Status report is printed, the **daily** totals for the total consumption and highest demand for the system and for each power meter are cleared. Normally, when this report is printed, the consumption history covers the previous 24-hour period. The only exception occurs when the user changes the time of day at which the report is to be printed. In this case,

```

LOAD OVERRIDE PARAMETERS
10/01/82 15:14 P-01

# THE SYSTEM "ON OVERRIDE" IS: I [A=ACTIVE,I=INACTIVE]

# LOADS WITH "ON OVERRIDE ACTIVE:
0407 0422 0919

# LOADS WITH "OFF OVERRIDE" ACTIVE:
0908 0920 0921

END

```

Fig. 28—Typical Load Override Parameters Report

the next report covers the time since the last report was printed.

C. ECSA Automatic Alarm Report

3.213 An automatic printing of the ECSA alarms occurs when the number of EC alarms in memory reaches 35. This report appears the same as Fig. 23 except that 35 alarms are printed. The total number of alarms allowed in memory is 42. Automatic printing at 35 alarms gives the system a buffer in case the printer is busy and more alarms are recorded before the original 35 can be printed. The alarms are deleted from memory only after a successful print of the alarms has been made. Even if there is a printer failure, the process to delete the alarms waits for a message verifying that the print has been completed.

Note: If a clock alarm occurs, this report is printed when the number of alarms in memory reaches 36.

D. Printout Interactions

3.214 The Demand, Periodic Status, and Daily Status Reports can each be assigned by the ECSA console operator to a different printer. The Automatic Alarm Report must be assigned to the Demand Report printer. The operator can also assign a printer to share with two or more types of reports. If a printer is shared, the following interactions occur:

- (a) Once a demand report is in progress, it causes the periodic reports and the automatic report

to be delayed until the demand report is completed. Then they are initiated.

- (b) A demand report cannot be initiated while a periodic report, a previous demand report, or the automatic report is in progress on the selected printer.

- (c) Once either the automatic report or periodic report is in progress, it causes both periodic reports or the automatic report and the other periodic report, respectively, to be delayed until the report is finished.

3.215 The message "NEW DAY" and the new date and time are printed each night at midnight on all printers.

RESPONSE TO POWER FAILURE

3.216 If ECSA is controlling loads in several areas and the possibility exists of the area with ECSA losing power and some or all of the other areas not losing power during a power failure, then maintaining ECSA's operation may be very desirable. When a power failure occurs, the ECSA hardware and software react as described in the following paragraphs.

A. Hardware Response

3.217 The ECSA console and printer are the hardware that is dependent on the customer's ac

```

SYSTEM STATUS
10/05/82 11:30 P-01

TOTAL CONSUMPTION SINCE 10/05/82 10:53 IS: 00020340 KWH
HIGHEST DEMAND SINCE 10/05/82 10:54 IS: 26320 KW
CURRENT DEMAND: 26320 KW PEAK DEMAND TARGET: 20000 KW
HIGHEST LOAD GROUP NOW SHED: 001
TOTAL NUMBER OF LOADS NOW OFF: 0001

HISTORY OF DEMAND AND HIGHEST LOAD GROUP SHED
TIME          00:00 10:50 10:55 11:00 11:05 11:10 11:15 11:20 11:25 11:30
DEMAND (KW)   00000 76320 76320 76320 76320 76320 76320 76320 76320 76320
HIGST.GRP.SHED --- --- --- --- --- --- --- --- 001 001 001

INDIVIDUAL METER CURRENT DEMAND
01-12720 02-63600 03-00000 04-63600 05-32436 06-00000 07-????? 08-00000
09-00000 10-00000 11-00000 12-00000 13-00000 14-00000 15-00000 16-00000

CONSUMPTION HISTORY

TOTAL CONSUMPTION SINCE 10/05/82 10:53 IS: 00020340 KWH
INDIVIDUAL METER CONSUMPTION SINCE 10/05/82 10:53
01-0003390 02-0016950 03-0000000 04-0125100
05-0063009 06-0000000 07-0091800 08-0000000
09-0000000 10-0000000 11-0000000 12-0000000
13-0000000 14-0000000 15-0000000 16-0000000

HIGHEST DEMAND SINCE 10/05/82 10:54 IS: 76320 KW
INDIVIDUAL METER HIGHEST DEMAND SINCE 10/05/82 10:54
01-12720 02-63600 03-00000 04-?????
05-????? 06-00000 07-????? 08-00000
09-00000 10-00000 11-00000 12-00000
13-00000 14-00000 15-00000 16-00000
END

```

NOTE: The meters with question marks (eg, ?????) indicate that this field is over the system monitoring (ECDM) limits of current demand (99,999 KW), highest demand (99,999 KW) or total consumption (99,999,999 KWH).

Fig. 29—Typical System Status Report

distribution system. If this system fails and the customer has no emergency generation system provided or does not have a customer provided override, these devices are inoperable.

3.218 If the customer has installed an emergency generation system to provide electricity for

the customer's premises in case of power failure, then the ECSA console, printer(s), and ECSA feature work if they are connected into this generation system. If the customer has selected the Uninterruptible Power Service (UPS) Extended feature for ECSA, then ECSA remains operational for 8 hours in a power failure, but not the ECSA console and printers.

```

ALL ENERGY COMMUNICATIONS PARAMETERS
10/01/82 10:32 P-03

"#" DENOTES PARAMETERS THAT HAVE BEEN CHANGED SINCE 10/01/82 08:36

SYSTEM PARAMETERS

#ENERGY COMMUNICATIONS FEATURE IS: A [A=ACTIVE,I=INACTIVE]
# THE DEMAND INTERVAL IS: 05 MIN.
# POWER METER PARAMETERS [ALM DETECTION: A=ACTIVE,I=INACTIVE]
NO. KWH/PULSE ALM NO. KWH/PULSE ALM NO. KWH/PULSE ALM NO. KWH/PULSE ALM
01 010 . 000 A 02 050 . 000 A 03 000 . 000 I 04 050 . 000 A
05 025 . 500 A 06 000 . 000 I 07 100 . 000 A 08 000 . 000 I
09 000 . 000 I 10 000 . 000 I 11 000 . 000 I 12 000 . 000 I
13 000 . 000 I 14 000 . 000 I 15 000 . 000 I 16 000 . 000 I

# HOLIDAY DATES
MO. DAY MO. DAY
01 / 01 02 / 14 04 / 20 05 / 26 07 / 04 09 / 07 11 / 25 11 / 26
12 / 29 12 / 31 / / / / / /
    
```

Fig. 30—Typical All EC Parameters Report (Sheet 1 of 3)

INDIVIDUAL LOAD CYCLING FUNCTION AND PEAK DEMAND SHEDDING PARAMETERS

#INDV. LOAD CYCLING FUNCTION IS: A [A=ACTIVE,I=INACTIVE]
 #PEAK DEMAND SHEDDING FUNCT. IS: A [A=ACTIVE,I=INACTIVE]

#LOAD NUMBER: 0003

LOAD IS IN SHEDDING GROUP NUMBER: 002

LOAD STATUS: 10E8 LOAD CONSUMPTION: 0500KW LOAD RUN FACTOR: 100%

	HR	NRM	SHD	HRMN	NRM	SHD												
M	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
T	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
W	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
T	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
F	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
S	00	24A	24A	0600	06A	14A	1000	05A	12A	1400	01A	02A	1800	24A	24A			
S	00	24A	24A	0600	06A	14A	1000	05A	12A	1400	01A	02A	1800	24A	24A			
H	00	24A	24A	0600	06A	14A	1000	05A	12A	1400	02B	-05	1800	24A	24A			

LOAD NUMBER: 0004

LOAD IS IN SHEDDING GROUP NUMBER: 003

LOAD STATUS: 10E8 LOAD CONSUMPTION: 5000KW LOAD RUN FACTOR: 080%

	HR	NRM	SHD	HRMN	NRM	SHD												
M	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
T	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
W	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
T	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
F	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
S	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
S	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A
H	00	24A	24A	0700	03C	07B	1200	02B	13A	1700	05A	12A	2000	08A	16A	2200	24A	24A

LOAD NUMBER: 0005

LOAD IS IN SHEDDING GROUP NUMBER: 001

LOAD STATUS: 00EC LOAD CONSUMPTION: 0100KW LOAD RUN FACTOR: 100%

	HR	NRM	SHD	HRMN	NRM	SHD												
M	00	24A	24A	0730	14A	-03	1600	24A	24A									
T	00	02A	-05	1000	22A	23A	1200	06B	19D	1400	02G	23G	1600	02A	-05			
W	00	24A	24A	0730	14A	-03	1600	24A	24A									
T	00	02A	-05	1000	22A	23A	1200	06B	19D	1400	02G	23G	1600	02A	-05			
F	00	24A	24A	0730	14A	-03	1600	24A	24A									
S	00	02A	-05	1000	22A	23A	1200	06B	19D	1400	02G	23G	1600	02A	-05			
S	00	24A	24A															
H	00	24A	24A															

Fig. 30—Typical All EC Parameters Report (Sheet 2 of 3)

PEAK DEMAND LOAD SHEDDING PARAMETERS

PEAK DEMAND SHEDDING FUNCT. IS: A [A=ACTIVE,I=INACTIVE]

PEAK DEMAND TARGET LEVEL IS: 20000 KW SAFETY BAND WIDTH: 1900 KW

MINIMUM TIME BETWEEN SHED AND NEXT RESTORE IS: 02 MIN. [BETWEEN 00 AND 15]

MINIMUM TIME BETWEEN RESTORE AND NEXT SHED IS: 00 MIN. [BETWEEN 00 AND 15]

PREDICTOR INTERVAL: 01 MIN. [BETWEEN 01 AND 10]

START UP: 000 IS THE HIGHEST NUMBERED GROUP SHED

REACTION MINUTE: 06 [BETWEEN 00 AND 12]

DEMAND INTERVAL: 15 MIN. [05, 15, 30 MIN.]

LOAD GROUP NUMBER (SHED PRIORITY) IS: 002 [001 TO 400]

THE KILOWATT SHED ESTIMATES FOR THIS GROUP ARE:

M-00208 T-00208 W-00208 T-00208 F-00208 S-00125 S-00125 H-00125

LOAD NUMBER	LOAD KW CONSUMPTION	LOAD RUN FACTOR %	LOAD NUMBER	LOAD KW CONSUMPTION	LOAD RUN FACTOR %
0003	0500	100	0090	5000	050

LOAD GROUP NUMBER (SHED PRIORITY) IS: 003 [001 TO 400]

THE KILOWATT SHED ESTIMATES FOR THIS GROUP ARE:

M-01669 T-01669 W-01669 T-01669 F-01669 S-01669 S-01669 H-01669

LOAD NUMBER	LOAD KW CONSUMPTION	LOAD RUN FACTOR %	LOAD NUMBER	LOAD KW CONSUMPTION	LOAD RUN FACTOR %
0005	1000	100	0010	8000	033
0004	5000	080			

LOAD OVERRIDE PARAMETERS

THE SYSTEM "ON OVERRIDE" IS: I [A=ACTIVE,I=INACTIVE]

LOADS WITH "ON OVERRIDE" ACTIVE:
(NONE)LOADS WITH "OFF OVERRIDE" ACTIVE:
(NONE)

END

Fig. 30—Typical All EC Parameters Report (Sheet 3 of 3)

LOAD STATUS									
10/01/82 15:14 P-01									
LOAD STATUS: [(ON/OFF)(OVERRIDES)(FUNCTIONS)(FUNCTIONS OFF)]									
LD.NO.	STATUS	LD.NO.	STATUS	LD.NO.	STATUS	LD.NO.	STATUS	LD.NO.	STATUS
0400	00A8	0401	11A8	0402	1288	0403	0188	0404	00A8
0405	00AA	0406	13C8	0407	1088	0408	1088	0409	0088
0410	0188	0411	12E8	0412	12E8	0413	0188	0414	00CC
0415	0188	0416	0088	0417	11A8	0418	00CC	0419	00EC
0420	1288	0421	00EA	0422	12A8	0423	00EC	0424	00EA
0425	12E8	0427	00AA	0429	1088				
END									

NOTE: The status of each load number is given as another number. The status number can be interpreted one digit at a time (See Table C for the interpretation of the load status number)

Fig. 31—Typical Load Status Report

3.219 The power meter interface circuits, load control relays, and on-premises sense points derive their power from ECSA. Therefore, in case of power failure, if ECSA has power (either due to the UPS or a stand-by generator), then these three portions of the ECSA feature's hardware operate. If the power meter interface circuits are operating and the power failure lasts longer than a demand interval, the customer should expect the POWER METER-XX NO PULSES RECEIVED alarms to occur. These alarms are noticeable only if the ECSA console and the ECSA are operable. The cause of the alarms should be obvious, and they may be retired immediately.

3.220 In the case where an ECSA controlled load's power is not affected by a power failure, the state of the load is determined by the fail-safe condition until ECSA has power (see procedure F4 for details).

3.221 The ECSA contains a software time-of-day clock and a hardware time-of-day clock synchronizer (LC144B). The software clock is accurate to about 5 minutes every month. Because clock accuracy is essential with the ILCF and the PDSF, the hardware time-of-day clock synchronizer improves the time-of-day clock to be accurate to 1 minute per month.

Note: If the difference between the software clock and hardware clock is less than 30

seconds, then the hardware clock is used to reset the software clock. If the difference is greater than 30 seconds, it is assumed that a power failure occurred and the software clock resets the hardware clock.

3.222 The time-of-day clock synchronizer has a battery backup which keeps the synchronizer running in the event of a power failure lasting up to 8 hours. If the customer has UPS Extended, the battery backup for the synchronizer is not needed. When power is restored following a power failure, the synchronizer and its battery allow the time-of-day clock to be accurate as soon as ECSA becomes operational. The synchronizer with the backup eliminates unnecessary on-off or off-on transitions in controlled loads that would occur when a lapsed clock is updated, because control is restored with the loads in the proper state for the current time.

B. Software Response

3.223 When a power failure occurs, ECSA can lose the information that it has stored in volatile memory, if some means of preventing this loss of information has not been adopted. This information includes the current ECSA parameter settings that are displayed via the console, the recent figures on KWHs consumed per minute used in the PDSF demand computations, the total consumption figure,

```

DAILY STATUS
10/01/82 15:28 P-01

"#" DENOTES PARAMETERS THAT HAVE BEEN CHANGED SINCE 10/05/82 08:00

LOAD OVERRIDE PARAMETERS

THE SYSTEM "ON OVERRIDE" IS: I [A=ACTIVE,I=INACTIVE]

# LOADS WITH "ON OVERRIDE" ACTIVE:
0407 0422 0919

# LOADS WITH "OFF OVERRIDE" ACTIVE:
0908 0920 0921

CONSUMPTION HISTORY

TOTAL CONSUMPTION SINCE 10/05/82 10:53 IS: 00020340 KWH
INDIVIDUAL METER CONSUMPTION SINCE 10/05/81 10:53
01-0003390    02-0016950    03-0000000    04-0125100
05-0063009    06-0000000    07-0091800    08-0000000
09-0000000    10-0000000    11-0000000    12-0000000
13-0000000    14-0000000    15-0000000    16-0000000

HIGHEST DEMAND SINCE 10/05/82 10:54 IS: 76320 KW
INDIVIDUAL METER HIGHEST DEMAND SINCE 10/05/81 10:54
01-12720     02-63600     03-00000     04-?????
05-?????     06-00000     07-?????     08-00000
09-00000     10-00000     11-00000     12-00000
13-00000     14-00000     15-00000     16-00000

END

```

Fig. 32—Typical Daily Status Report

the highest demand figure, changes in schedules, changes in load status, etc. With a tape reload after a power failure, the information going into the volatile (erasable) memory may be up to 23 hours old, since the tape is updated at least once every 23 hours. This restored memory may contain old parameter settings that have been changed since the last tape update. The old figures for total KWH consumption and highest demand and the recent KW-per-minute figures are initialized to zero when memory is lost.

3.224 In order to prevent this loss of information, one or more of the following emergency backup systems may be used:

- UPS Nominal
- UPS Extended
- Emergency Backup Generation System (provided by the customer).

3.225 The ECSA feature is supplied with batteries which are capable of maintaining the volatile memory for 90 seconds after a power failure. If a customer has a backup generation system, this should be enough time to have it cut in without memory loss. The 90 seconds also prevents memory loss due to short power interruptions. If the customer has UPS Nominal or Extended, there is no memory loss due to power failure for up to 5 minutes or 8 hours, respectively.

3.226 If ECSA remains operational during a power failure because UPS or a backup generation system is provided, the system responds as normal. If the rest of the customer's premises has no emergency power, then no printouts are available, and the ECSA console does not work. The loads that have no power, obviously, cannot be controlled.

3.227 If ECSA has no power backup during the power failure, the situation is not so straightforward. As discussed previously in the section, whether or not the time-of-day clock and the volatile memory were backed influence the ECSA feature's behavior after restoration of power. After restoration of power and the tape reload, the software routines start to operate in the start-up sequence.

3.228 ♦System start-up brings certain loads up in the shed condition to prevent large power surges common with restorals of control systems. Upon system start-ups (ie, the power returns or the system is turned on), loads in the designated load groups are started up in their shed schedules. The customer designates these load groups via the START UP: XXX HIGHEST NUMBERED GROUP SHED parameter on procedure F5. This load group and all lower number load groups are started up in their shed schedules. Higher numbered load groups and loads that are not in groups are started up in their normal schedules. These shed and normal schedules are started at the point that corresponds to the current minute setting on the time-of-day clock. The system is not capable of making valid shed or restore decisions for 5 minutes or a predictor interval plus 1 minute, whichever is longest. The reason for this is that the consumption information necessary to make these decisions is not available until this time period has passed.♦

3.229 If the hardware clock is valid, the software clock is updated; all schedules are halted and

restarted at the portion that agrees with the new clock setting.

3.230 ♦If the power failure lasts longer than 8 hours or the hardware clock synchronizer fails, both the software and hardware clocks are invalid. When the system is brought up, the "SYSTEM CLOCK NEEDS UPDATING" alarm is displayed on the first line of procedure F1 and the current time (displayed in the upper left-hand corner of the base procedure and the upper right-hand corner of all other procedures) is displayed as "—:—". Under these circumstances ECSA loads are placed in their fail-safe condition until the time can be reset. The time can be updated using procedure F2 or the MAAP after a tape reload in order to get ECSA back on track with the actual current time. Again when the time is updated, all schedules are halted and restarted in accordance with new time.♦

4. SYSTEM OPERATION

4.01 The system operation of the ECSA feature involves the interaction between the ECSA console, the power meter interface(s) (if provided), and the ECSA printer(s) (if provided). Refer to Fig. 3 for a block diagram of an ECSA system configuration.

BASIC SYSTEM OPERATION

4.02 An overview of the system operation of the ECSA feature is presented in the following paragraphs. Figure 32 is a flow diagram which illustrates the sequence of steps executed via software.

4.03 ♦The system first checks the status of the ECSA feature and the status of the system on override. If the ECSA feature is made inactive via procedure F2, the next state of all loads is ON and all ECSA functions are deactivated. This state is indicated in the Load Status Table when this table is updated. If this feature is active, all ECSA functions are active and the system continues to check the system on override. If the system on override is made inactive, the next state for all loads is ON. This state is indicated in the Load Status Table when this table is updated. The system and load override do not impede the operation of any of the ECSA functions except that the loads are enabled or disabled and not controlled as long as they are activated. All printing, displaying, timing, and software activities continue normally. When the system on override is declared

inactive, all loads are sequentially restored to their proper state according to the wall clock time and their schedules. The system override and ECSA inactive override have precedence over a load off override and all ECSA functions.

4.04 The ECSA software maintains a record for each load controlled by ECSA. A record contains several tables which are indexed via the load number. For example, these tables contain the 8-day clock and load override information. Every minute or less, all load records are checked to determine if the load is going to change state this minute. The system first checks the load override table. If the load on override is declared active in this table, the next state of this load is ON. This state is indicated in the Load Status Table when this table is updated. This override takes precedence over the load off override. If the load off override is declared active the next state of this load is OFF. This state is indicated in the Load Status Table when this table is updated. The load overrides have precedence over the ILCF and PDSF. If no load overrides are active, the system then checks to see if the PDSF algorithm has decided to shed or continue shedding the load's group, if so, the PDSF determines the next state of the load, if not the ILCF determines the next state of the load. The controlling function determines the next state of the load via the 8-day clock. This state is indicated in the Load Status Table when this table is updated.

4.05 After the next state of load has been determined, the Load Status Table is updated. This table also indicates the status of system and load overrides and the status of the ILCF and PDSF. This information is displayed in coded form via the F7—Load Status Procedure for each load. Once the Load Status Table is updated, the fail-safe condition is checked.

4.06 The fail-safe condition is the desired state (ie, enabled or disabled) of the load when a power or system failure occurs. The relay hardware used leading to the load determines which software condition fail-safe condition to use (ie, ON or OFF). The fail-safe condition during normal ECSA operation allows the Load Status Table to agree with the final state of the load (see Fig. 13). As seen in Fig. 33, to enable the load, a command is sent to open (fail-safe OFF) or close (fail-safe ON) the load control relay. To disable the load, a command is sent to close (fail-safe OFF) or open (fail-safe ON) the load control relay.

4.07 After the delay time starts timing (upon a change in state), the next load assigned goes through the same decision process.♦

PEAK DEMAND SHEDDING FUNCTION

4.08 The following paragraphs describe in general the method used by the PDSF in determining if a load(s) should be shed or restored.

4.09 Each minute, the energy consumed during that minute, the consumption rate for that minute, KW shed estimates for each load, and the KW saved by shedding throughout the system are calculated and stored in a history file. If the system is not currently shedding, the KWs saved is equal to zero. Then a decision is made to shed or not each minute by the PDSF algorithm, based on the stored information, the minimum time between restore and next shed parameter, and the peak demand target level. If the decision is to shed, individual loads within a group being shed are started cycling at each load's shed/modified pattern. Lowest priority (numbered) load groups shed first, so the total KW estimates for these load groups meet or exceed the amount calculated to keep the demand below the target level.

4.10 If the decision is not to shed and there are currently load groups that have been shed, a decision is made on whether to restore load groups or not. This decision is based on the same data calculated for the shed decision, with the minimum time between shed and next restore and the safety band added. If the current demand is sufficiently below the lower threshold of the safety band and no loads have been shed in the time designated by the minimum time between shed and next restore parameter, load groups are restored, highest priority (numbered) load group first. This is done in such a way that the total KW estimates for these load groups does not exceed the amount calculated to keep the demand below the target level.

4.11 If the PDSF algorithm has made a restore request, then no groups may be shed within the time designated by the minimum time between restore and next shed parameter. The purpose of these enforced waiting periods between alternating shed and restore decisions is to prevent the algorithm from oscillating between shedding and restoring while demand is hovering near the target level.

ENERGY CONSUMPTION AND DEMAND MONITORING

4.12 ♦The following paragraphs describe the system operation of the ECDM function. Figure

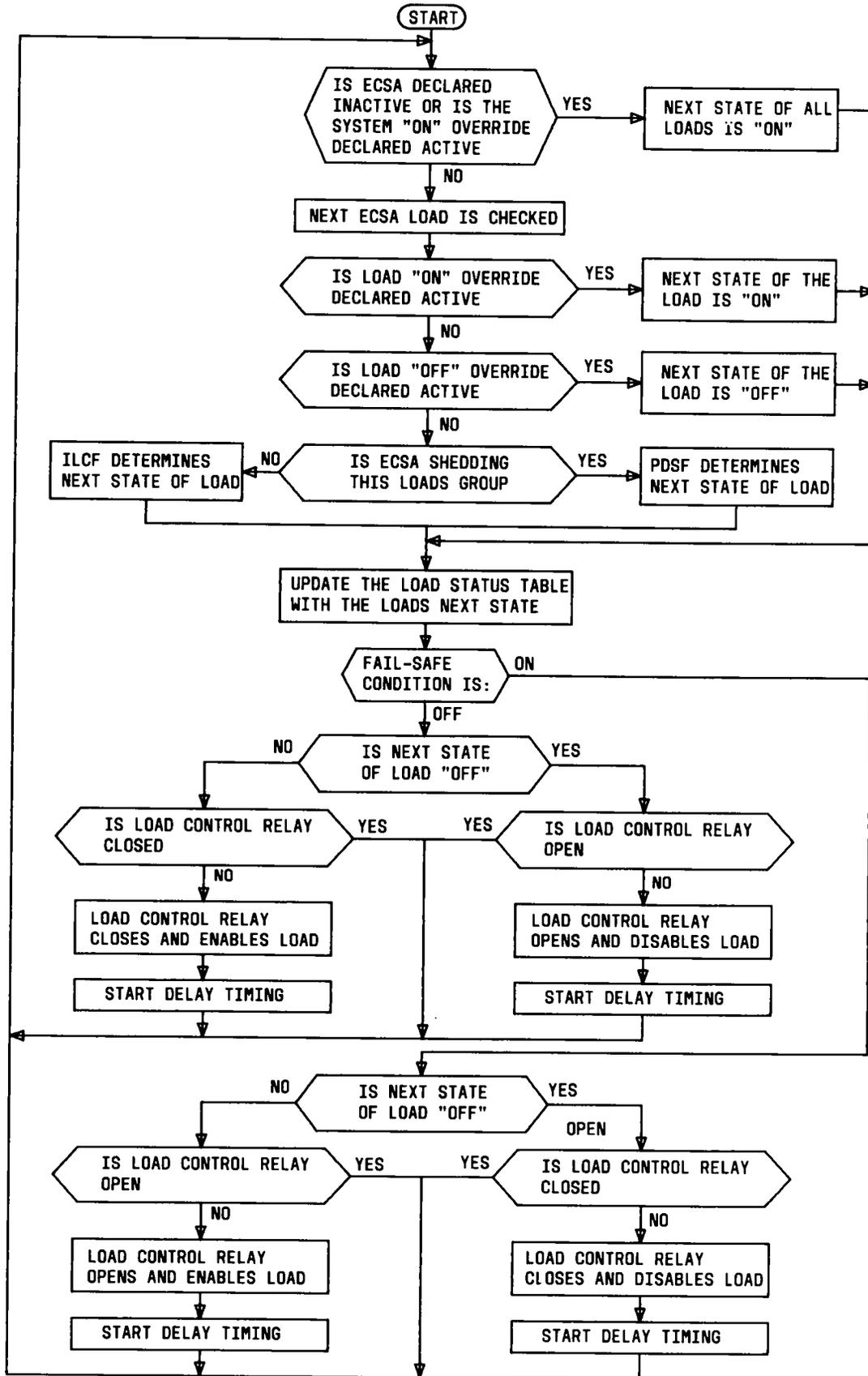


Fig. 33—Feature Flow Diagram of Basic System Operation

34 is a flow diagram which illustrates the sequence of events executed via the ECDM function.

4.13 The power company usually provides a pulsing relay with each power meter. These pulsing relays are usually the "normally open" relays that send contact closures to the PMI circuits. In this case, a pulse would represent a KWH; however, any application that provides contact closures to ECSA for measurement may be used (eg, gas meter). A contact closure enables the PMI circuit relay to close. The PMI circuits are scanned frequently for closures by the ECSA software. If a closure is found, a counter is enabled for the appropriate PMI circuit. These counters along with the KWH/pulse constant allow the ECDM function to calculate consumption and demand for each power meter and the system. Each minute the ECDM function calculates the Consumption History. The Consumption History is printed information containing running and daily totals of the total consumption and highest demand for the system (which is calculated from PMIs measuring electrical energy) and for each power meter (which can be a measurement of any power source). The ECDM function also calculates the system current (electrical) demand highest load group now shed, the total number of loads now off, and the current demand for each individual meter. This information along with the total consumption and highest demand for the system is displayed on the base procedure. The ECDM function also displays on the base procedure the history of demand and highest load group shed every 5 minutes.

BINARY FEEDBACK

4.14 The following paragraphs describe the system operation of the Binary Feedback function. Figure 35 is a flow diagram which illustrates the sequence of events executed via the Binary Feedback function.

4.15 Once the command has been sent from the load control relay (LC562) to the inverter and/or power relay and the load responds, the response of the load can be monitored via a customer provided sensing device, a sense point, and the Binary Feedback function.

4.16 The sensing device sends the contact closures (indicating the actual state of the load) to ECSA sense points. The ECSA Binary Feedback software scans these sense points every minute, or less,

for any change in state. If a sense point has a change of state, ECSA software records the new state of the sense point in the sensor status buffer and determines if the load is assigned to an ECSA controlled load or to the ECSA system.

4.17 If the sense point is assigned to an ECSA controlled load, the customer provided sensing device must be able to detect the actual state of the assigned load and send contact closures to the sense point. The customer's sensing device should be configured so that a sensed ON state of the load activates the sensing device to send a closed contact signal to the sense point which closes the sense point and vice-versa for a sensed OFF state. The ECSA software can then compare the sensor status to the stored current load status (mentioned in the basic system operation description) to see if they correspond. A closed sensor status should correspond to an ON state in the load status table and vice-versa. If they do not, alarm(s) can be displayed to the ECSA operator. The alarm type (0, 1, or 2) is assigned via MAAP procedure 002 (see Part 9). If the alarm type is 2, then an EC alarm is logged in memory and a NEW EC ALARM message is displayed/sounded. Only with alarm type 2 is the delay time considered. If the alarm is a type-1 or type-2, then an asterisk is displayed when procedure F3 is displayed.

4.18 If the sense point is assigned as a stand alone, the customer provided sensing device must be able to detect some condition (eg, a maximum temperature, a minimum pressure, light entering a chamber, air movement, a maximum content of some chemical or gas, etc) and send a contact closure to the sense point. If the customer desires to not only monitor for this condition but also to initiate an alarm when the condition arises, then the customer should configure the sensing device so that when the condition arises a closed contact signal is sent to the sense point and vice-versa. If the alarm type is 2, then an EC alarm is logged in memory and a NEW EC ALARM is displayed/sounded. Only with alarm type 2 is the delay time considered. If the alarm is a type-1 or type-2, then an asterisk is displayed when procedure F3 is displayed.♦

CHARACTERISTICS

5. FEATURE ASSIGNMENT

5.01 The ECSA loads are assigned sequentially on a board (LC562) basis via the MAAP. Power

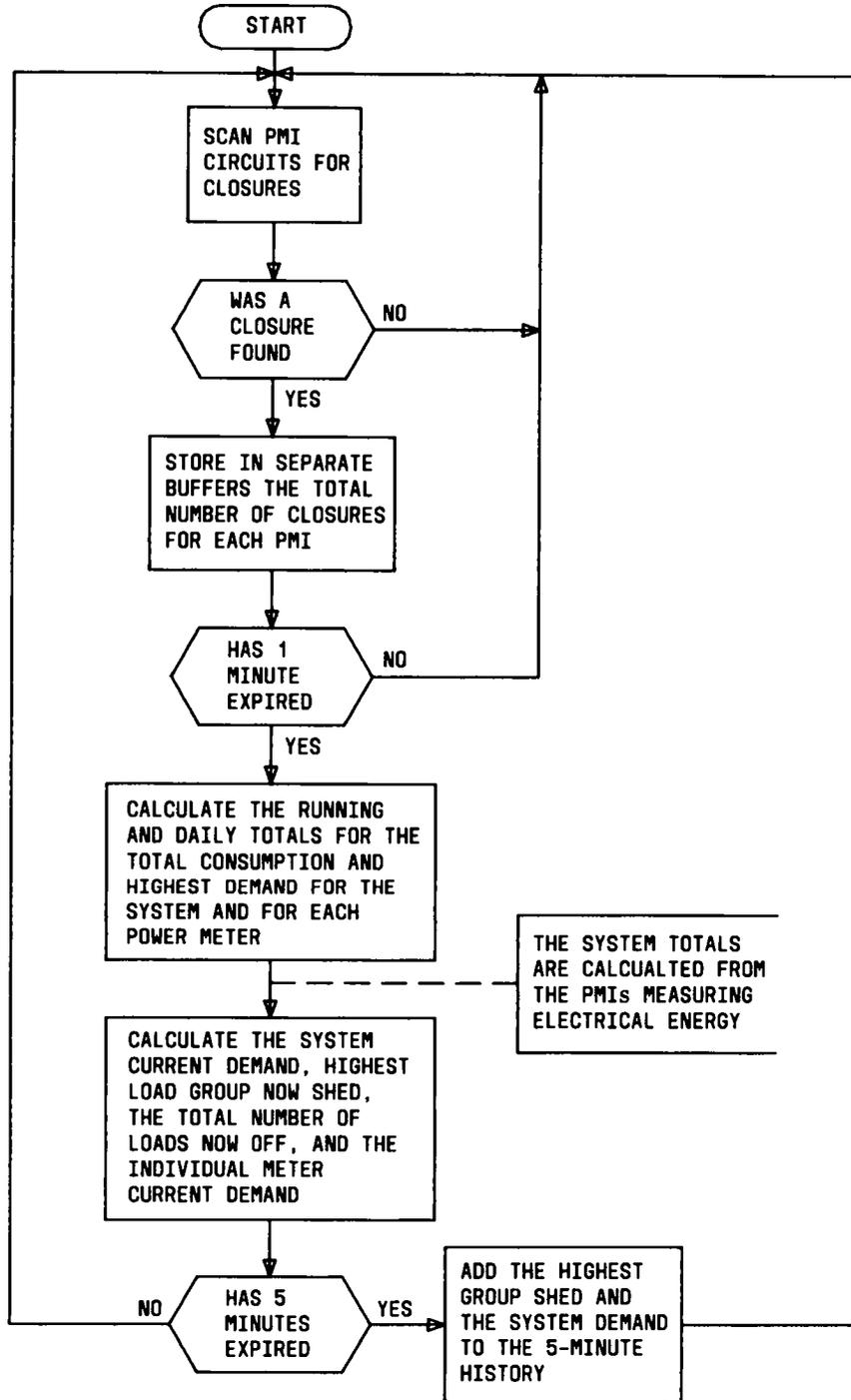


Fig. 34—Flow Diagram of the ECDM Function

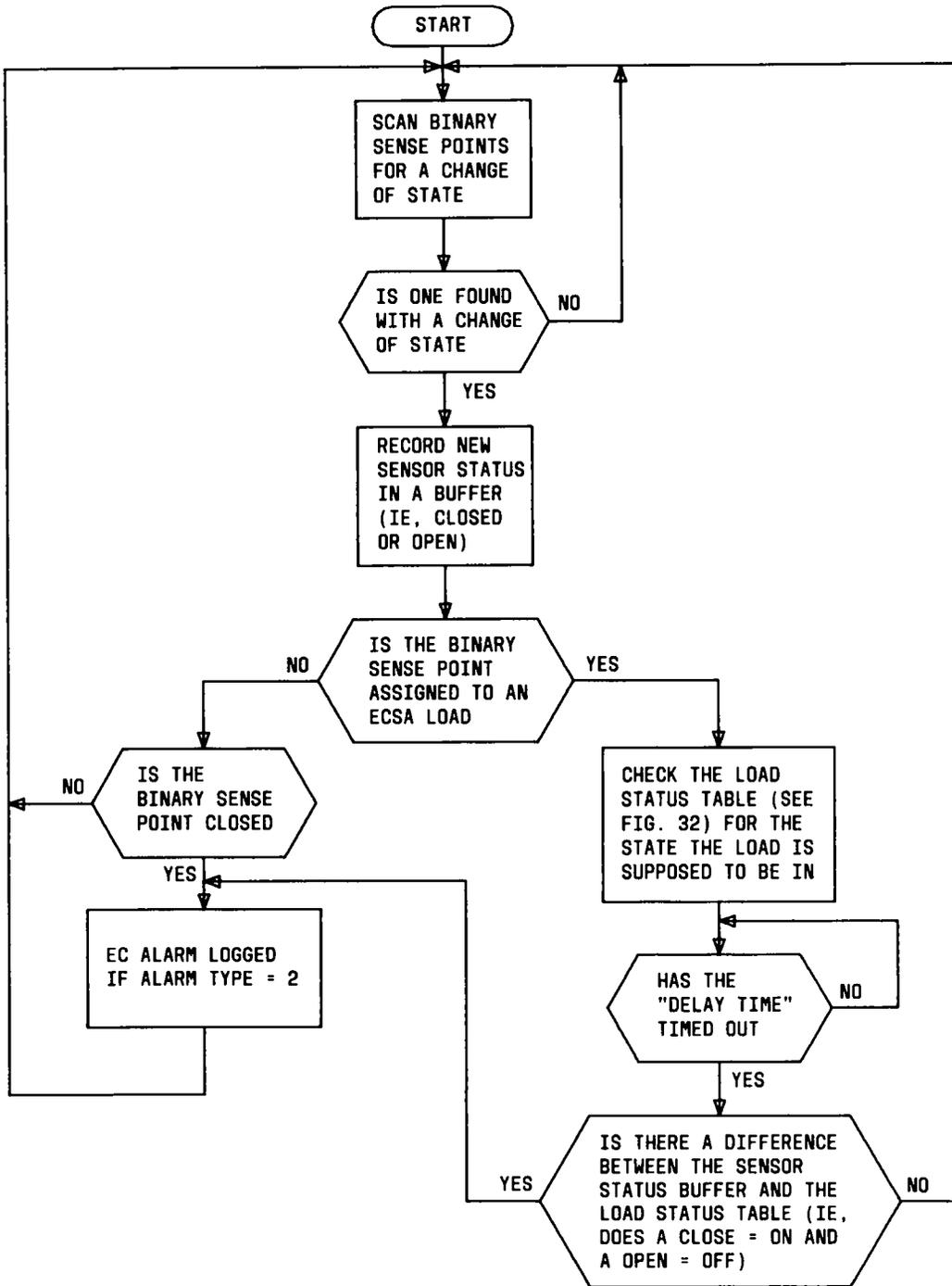


Fig. 35—Flow Diagram of the Binary Feedback Function

meter interfaces are assigned on a per trunk group basis via the MAAP. Sense points are assigned on a per trunk group basis via the MAAP. The ECSA authorization code (security code) is assigned on a per system basis via the ECSA console (ie, procedure F2). The authorization code for Remote Maintenance, Administration, and Traffic System (RMATS) access is assigned via the MAAP.

6. LIMITATIONS

HARDWARE LIMITATIONS

6.01 Wiring distances mentioned in this part of the feature document are assuming the use of 24-gauge wire and no repeaters.

A. On-Premises Hardware

6.02 The maximum number of load control relays is limited to the number of LC562 circuit packs provided (16 circuits per circuit pack). Each LC562 circuit pack is capable of interfacing with 16 loads (one per LC562 circuit). Maximum contact rating of the load control relay is 25VA with a one amp maximum. The maximum distance a load can be from the ECSA cabinet is dependent on if repeaters are used and what type of power relay is used.

6.03 The maximum number of LC563 in an ECSA system is 26. One LC563 is needed to interface with power meters for the ECDM and PDSF functions. One LC563 is needed for off-line testing of the load control relay (LC562 or AGW1). The other 24 may be used for the Binary Feedback function.

6.04 The maximum number of power meter interfaces is limited to 16. There are 16 circuits per LC563 circuit pack [used as an interface between ECSA and the power meter(s)]. The maximum pulse rate for the PMI circuit relay (LC563 circuit pack) is 400 pulses per minute. The minimum pulse rate for the PMI circuit relay is 20 pulses per minute. The maximum loop length (resistance) to the relay is 1500 ohms. The maximum distance the power meter can be from the PMI is approximately 1520 meters (5,000 feet).

6.05 The maximum number of sense point boards (LC563) is limited to 24. The LC563 has 16 circuits each capable of monitoring a customer's sensing device. The maximum distance a sensing device can be from the ECSA cabinet is 1520 meters (5000 feet).

The maximum loop length (resistance) to the relay is 1500 ohms.

B. Off-Premises Hardware

6.06 The maximum number of LC601s and MRUs that can be assigned is 12 (ie, 400 controllable off-premises loads) for memory configuration B and 22 (ie, 1008 controllable off-premises loads) for memory configuration C.

6.07 Whether on- or off-premise the maximum distance the MRU can be from the ECSA cabinet is 10,670 meters (35,000 feet). The maximum distance with repeaters is virtually unlimited. The MRU requires a standard 120 Vac receptacle capable of delivering 0.25 amps. The MRU has a 1.8-meter (6-foot) cord. The MRU can control or monitor a maximum of 64 loads or sensing devices, respectively. The MRU is limited to eight AGW1 boards or eight AGW2 boards or some combination of each not exceeding eight boards.

6.08 The AGW1 board has eight remote load control relays. This normally open relay provides a 25VA at 1 amp (maximum) closure for load control. The maximum distance that a load can be from the MRU is dependent on if repeaters are used and what type of power relay is used.

6.09 The AGW2 board has eight remote sense points. A sensing device must be within 4570 meters (ie, 15,000 feet) of the MRU to be monitored by a remote sense point.

C. Peripheral Hardware

6.10 Each system is limited to three ECSA consoles (see Base Procedure, Note 2 for details). The operating temperature range for this console is 0 to 50 degrees C.

6.11 Each system is limited to three ECSA printers.

6.12 Each system is limited to eight data channels; four are used for the printer(s) and the ECSA console. The other four are reserved for future enhancements.

6.13 The maximum distance the ECSA console and printer(s) can be from the ECSA cabinet is to 1520 meters (5000 feet). Also, the maximum distance

the alarm leads coming can extend from ECSA's alarm panel to the remote system alarm location is 1520 meters (5000 feet). The minimum length the ECSA shielded cables can be that lead from the ECSA cabinet to the load cross-connect field is 9.14 meters (30 feet).

6.14 The maximum number of Peripheral Interface Circuits (PICs) is four (one PIC required for each data channel). The maximum distance from the ECSA cabinet(s) is 1520 meters (5000 feet). The maximum distance from the last repeater is 300 meters (1000 feet).

6.15 The maximum distance the MAAP can be from the ECSA cabinet is 300 meters (1000 feet).

6.16 The Interface Power Relay must have a maximum of 250 ohms loop resistance between the interface power relay and the MRU or LC562 circuit pack. Using 24-gauge wire, the maximum distance would be 1520 meters (5000 feet) or using 26-gauge wire, 915 meters (3000 feet). This relay provides 24 Vdc with a 2.4 amp maximum to power a low power load or to operate a high power relay. The relay is current sensitive and requires 7.2 mA to operate with a maximum continuous three watt coil rating. This is a single poll double throw (SPDT) relay.

6.17 One common power supply can power up to 216 Interface Power Relays. The common power supply provides the relay with 24 Vdc with a maximum of 2.4 amps. This power supply requires a standard 120 Vac receptacle capable of delivering 2.5 amps.◆

GENERAL LIMITATIONS

6.18 The following limitations are general limitations which apply to the ECSA feature:

- (a) Maximum number of load records (ie, for on- and off-premises loads) for memory configuration B—400, for memory configuration C—1008.
- (b) Power meter KWH/pulse constants—.001 to 999.999.
- (c) Security code—0000 to 9999.
- (d) Maximum number of alarm message which may be stored—42.
- ◆(e) Maximum number of binary sense point records for memory configuration B—384 for

memory configuration C-384 (this applies to both on- and off-premises sense points).

- (f) The system is limited to one external alarm load.
- (g) The system is limited to 784 loads with a cabinet system and 1008 loads with a 2-cabinet system. This applies to both on- and off-premises loads.◆

ILCF LIMITATIONS

6.19 The following limitations apply to the ILCF:

- (a) Maximum number of individual loads per group—the number of individual load records (see general limitations)
- (b) Maximum number of daily schedules—seven consecutive days and one holiday schedule for each load
- (c) Maximum number of time intervals per daily schedule—up to six intervals per schedule
- (d) Longest time interval—24 hours (eg, 0000-2359)
- (e) Time interval format—expressed in military format (HR-00 to 23 hours, MN-00 to 59 minutes)
- (f) A fixed number of patterns—116 patterns (with increments no shorter than 5 minutes) are available to choose from for the NRM (normal) and SHD (shed) states when scheduling an individual load.

PDSF LIMITATIONS

6.20 The following limitations apply to the PDSF:

- (a) Maximum number of load groups—400 "B" or 512 "C" memory configuration
- (b) Maximum number of loads per group—400 "B" or 1008 "C" memory configuration
- (c) Peak demand target level—1 to 99,999 KW
- (d) Load group computed KW estimates—1 to 65,000 KW
- (e) Maximum number of priority levels (load groups) for memory configuration B—400, for memory configuration C—512

- ◆(f) The safety band limited to—10 percent of the target level
- (g) The floating demand interval—5, 15, or 30 minutes
- (h) Designated minimum time between shed and next restore/restore and next shed—0 to 15 minutes
- (i) Reaction minute—0 to 25 minutes
- (j) Predictor Interval—1 to 10 minutes.◆

ECDM LIMITATIONS

- 6.21** The following limitations apply to the ECDM function:
- (a) ECSA console update—once every minute
 - (b) Printed update—once every 5 to 60 minutes
 - (c) Maximum total consumption—99,999,999 KWH
 - (d) Maximum highest demand—99,999 KW
 - (e) Maximum current demand—99,999 KW
 - (f) Maximum number of power meters designated as electrical or nonelectrical—16.

BINARY FEEDBACK

- 6.22** ◆The only limitation which applies to this function is that only 384 sense points may be assigned to the system (ie, on- or off-premises).◆

7. INTERACTIONS

- 7.01** None.

8. RESTRICTION CAPABILITY

- 8.01** There are several methods by which the ECSA feature/functions may be either partially or fully restricted by using the ECSA console.
- 8.02** The ECSA feature may be restricted by using the F2—SYSTEM PARAMETERS display.
- 8.03** The ILCF and PDSF may be restricted by using the F4—INDIVIDUAL LOAD CY-

CLING AND PEAK DEMAND SHEDDING PARAMETERS display.

8.04 The following may be restricted by using the F5—PEAK DEMAND LOAD SHEDDING PARAMETERS display:

- Load group number (shed priority)
- Individual loads in a load group
- PDSF
- Safety band
- Start Up: XXX highest numbered group shed
- Peak demand target level.

8.05 The F6—LOAD OVERRIDE PARAMETERS display allows the customer to restrict loads from being controlled by any of the ECSA functions. Each load may be designated as being either constantly on or constantly off and with the system on override, every load is constantly enabled.

INCORPORATION INTO SYSTEM

9. INSTALLATION/ADDITION/DELETION

9.01 ◆The following procedures can be used at the MAAP and RMATS to administer the ECSA feature.

Note: The Off-Premises Capability is not activated by setting a parameter via the ECSA console nor the MAAP. This capability is provided when the off-premises hardware (shown in Table E) is installed. Once a Remote Controller is installed in a carrier, the next three consecutive physical slots must remain empty. The four physical slots each have 16 equipment locations. At the MRU, there are eight slots with eight equipment locations each. Thus, one physical slot at the ECSA cabinet addresses two physical slots at the MRU. These two slots may be AGW1 or AGW2 boards placed in them but not one of each. There must be at least one AGW1 or AGW2 board in one of these two slots to be able to assign any off-premises loads to the system or to a remote sense point, respectively. If these hardware conditions are met off-premises, loads and remote sense points can

then be administered just as though they were on-premises loads and sense points.

9.02 Procedure 000: This procedure is used to assign an LC562 equipment location to the system which automatically assigns a load number to each of the 16 port locations if not already assigned. To control these loads, the ILCF/PDSF must be assigned via the ECSA console. Load numbers and equipment locations may be added, displayed, or removed via this procedure. The "next data" key is used to step through all the assigned load numbers in the system. Available loads within the system may be found using this key. Individual loads must be removed first via this procedure unless included within a group. If assigned to a group, the individual load should first be removed from procedure F5 and recorded (using F6), then removed from the system via this procedure. If a load within a group is removed using any other method, the shed estimate seen on procedure F5 does not reflect the removed load.

Note: The procedure is also used to designate a load number and equipment location as an external alarm. Only one external alarm can be assigned to a system.

9.03 Procedure 002: This procedure is used to assign a sense point number (001 through 384) to a load number or as a stand alone. How this is done is very similar to how a load number is assigned to an LC562 equipment location in Procedure 000. In this case, an LC563 equipment location is added to the system which automatically assigns a sense point number to each of the 16 port locations if not already assigned. If the sense point is associated with a load, a delay time must be entered in this procedure. Delay time is the delay between the time that a load is instructed to go ON or OFF and the time when an alarm is raised if the associated sense point does not indicate that the load is in the proper state. The delay time for off-premises loads usually has a longer time delay for transmission of the control instruction to the load and the response of the sensing device back to the ECSA cabinet than on-premises load. Delay time must be in increments of 5 between 000 and 300 seconds. Each sense point must have an alarm type 0, 1, or 2 assigned to it via this procedure. The sense point, equipment locations, delay time, associated load numbers, and alarm type may be added, displayed, or removed via this procedure. The "NEXT DATA" key is used to step through all the assigned

sense point numbers in the system. Available sense points within the system may be found using this key.

Note: A sense point cannot be assigned to the external alarm load.

9.04 Caution: *The user should be aware that the actual location of the off-premises loads is transparent to the ECSA feature. If a Load Failed or Sense Point EC alarm occurs, the maintenance personnel should not assume that the load or sense point is located off-premises. It is highly recommended that a list of load numbers, load location, and load identification for on- and off-premises loads be made.*

9.05 Procedure 010: This procedure is used to search for sense points associated to load numbers. A load number is entered and then this procedure displays the load's equipment location, the sense point associated with it (if any) and this sense point's equipment location. If no sense point is associated with the particular load, then the equipment location for the load is displayed along with dashes for the sense point.

9.06 Procedure 150: This procedure is used to assign trunk group 18 (which is the special interface trunk group used for interfacing power meters) to the equipment locations of an LC563 board.

Note: A second LC563 board is used by maintenance to test the load control relays. The location of this board is fixed in translations and cannot be administered.

9.07 Procedure 151: This procedure is used to administer the 16 port circuits on an LC563 circuit pack as power meter interfaces. Basically, the circuit provides a means of detecting a relay contact closure.

Note: A 2-character field in Procedure 151 is used to designate the highest meter of the 16 power meters to be treated as an electric power meter. The remaining ports may be used for nonelectrical power meters (eg, gas or water).

9.08 Procedure 250: This procedure is used to assign a segment type (either to an energy control carrier or to an energy carrier) to a segment location. A segment is a portion of the energy or energy/control carriers that has eight LC562s.

TABLE E
HARDWARE REQUIREMENTS

USAGE	CODE	DESCRIPTION	APPLICATION
ON-PREMISE HARDWARE	LC561 Circuit Pack	Digital Network Buffer Board	Max. 6 (1 per every 2 segments)*
	LC562 Circuit Pack	Load Control Relay Board	Max. 63 (1 per 16 controlled loads)
	LC563 Circuit Pack	Power Meter Interface Board	Max. 1 (1 per 16 power meters)
	LC563 Circuit Pack†	Load Control Relay Test Board	Max. 1 (used for off-line maintenance of the LC562s)
	LC563 Circuit Pack	Sense Point Board	Max. 24 (1 per 16 sensing devices)
OFF-PREMISE HARDWARE	LC601 Circuit Pack	Remote Controller	Max. 22 (1 per 64 controlled loads)
	AGW1	Remote Load Control Board	Max. 112 (1 per 8 controlled loads)
	HN18	Remote Interface Board	Max. 22 (1 per MRU)
	AGW2	Remote Sense Point Board	Max. 48 (1 per 8 sensing devices)
	J53135QA-1 (List 1)	Master Remote Unit (MRU)	Max. 22 (1 per 64 controlled loads)
PERIPHERAL EQUIPMENT	LC366B Circuit Pack	High density I/O Board	1 for every 4 PICs
	J58882 GA	Peripheral Interface Circuit (PIC)	1 Required for CRT Interfaces 1 Per Printer
	J53135K-1 (List 1 and List 3)	Common Power Supply	Optional—Max. 5 (1 per 216 Interface Power Relays)
	J53135KA-1 (List 1 and 2)	Interface Power Relay	Optional—Max. 1008 (1 per controlled load)
	Applied Digital Data Systems (ADDS) Model REGENT 40	ECSA Console	1 Per System Required

TABLE E (Contd)

HARDWARE REQUIREMENTS

USAGE	CODE	DESCRIPTION	APPLICATION
PERIPHERAL EQUIPMENT	TELETYPE Model 4310 (Without Keyboard)	Printer (12" Wide Paper)	Optional
	LC172B	Maintenance and Administration Panel (MAAP)	Optional

* A segment is equivalent to eight LC562 circuit packs.

† Place in slot 01/02 of segment 0 in the Control/Energy corner.

9.09 Procedure 253: This procedure is used to administer data channel assignments to the time-of-day clock synchronizer (LC144), the ECSA printer(s) (LC366C), and the ECSA console(s) (LC366C). When a journal printer is assigned, the printer type is automatically set for long form paper.

9.10 Procedure 279, Word 1: This procedure is used to activate or deactivate the ECSA feature.

9.11 Procedure 279, Word 2: This procedure may be used to display the ECSA authorization code (security code) which allows the ECSA console operator to change customer alterable parameters. After the system is initially installed, the ECSA authorization code is automatically set to

0000. The operator may then change the code by using the SYSTEM PARAMETERS procedure.

9.12 Procedure 284: This procedure is used to display or change the hour, minute, month, day, and year of the system clock and to display the presence or absence of the system hardware clock (LC144).

9.13 Procedure 496: This procedure is used to display or change the authorization code to use ECSA via RMATS.♦

10. HARDWARE REQUIREMENTS

10.01 Table E represents the basic and optional hardware required for this feature.