

ENERGY COMMUNICATIONS SERVICE ADJUNCT PREINSTALLATION AND PLANNING INFORMATION

CONTENTS	PAGE	CONTENTS	PAGE
1. GENERAL	3	CROSS-CONNECTIONS	30
2. HOW TO USE THE SECTION	6	A. Cross-Connect Field	30
3. FUNCTIONAL CONTROL	6	B. Cross-Connect Field Enclosures	30
4. INSTALLATION CONSIDERATIONS	8	C. Cross-Connect Tables	33
PHYSICAL ARRANGEMENTS	8	D. Energy Load and Power Meter Interface Cross-Connections	34
ENVIRONMENTAL REQUIREMENTS	12	E. Control Lead Cross-Connections	44
A. Atmospheric and Temperature	12	F. Alarm and Control Lead Cross- Connections	44
B. Filters	15	5. EQUIPMENT ASSOCIATED WITH FEATURES	44
C. Transportation	15	DATA CHANNEL REPEATER	44
D. Structural	16	A. Housing and Mounting	44
E. Electrical Fields	16	B. Range Extension and Lightning Protec- tion	44
F. Acoustics	17	C. Installation	47
G. Lighting	18	D. Data Range	53
H. Insects and Rodents	18	E. Propagation Delay	54
FEDERAL COMMUNICATIONS COMMISSION (FCC) REQUIREMENTS	18	PERIPHERAL INTERFACE CIRCUIT (PIC)	54
POWER	18	REMOTE MAINTENANCE, ADMINISTRATION, AND TRAFFIC SYSTEM (RMATS-1)	55
STANDARD MEMORY HOLDOVER	21	6. CIRCUIT PACKS AND OPTIONS	56
GROUNDING	21	A. Data Control Circuit (LC171B)	56
PROTECTION	23	B. Data Transfer Circuit (LC172B)	57
UNINTERRUPTIBLE POWER SERVICE (UPS)	25		
CABLING	29		

NOTICE

Not for use or disclosure outside the
Bell System except under written agreement

CONTENTS	PAGE
C. Digital Network Buffer Circuit (LC561)	57
D. Dual-Speed Serial Data Channel (LC366B)	57
E. Energy Load Control Circuit (LC562)	58
F. I/O and Memory Control Circuits (LC133B)	62
G. Network Clock Circuit (LC121B)	62
H. Power Monitor and Feedback Circuit (LC563)	62
I. Time-of-Day Clock Circuit (LC144)	62
7. REFERENCES	62
8. FILL-IN WORKSHEETS	65

Figures

1. Energy Communications Service Adjunct—Block Diagram	4
2. Block Diagram of an ECSA System	5
3. ECSA Console	7
4. ECSA Printer	8
5. Basic Cabinet With Single Carrier	9
6. Basic Cabinet With Two Carriers	10
7. Second Cabinet With Single Carrier	11
8. Humidity Design Range	14
9. Earthquake Environment (USA)	17
10. ECSA Minimum Floor Space Requirements—2-Cabinet System	19
11. Typical Load Center and Ground Bars	20
12. Nonreserve Power Distribution—Block Diagram	21

CONTENTS	PAGE
13. Ground Bar for Load Center	22
14. Grounding and Bonding Diagram for ECSA	24
15. Uninterruptible Power Service—Block Diagram	25
16. Uninterruptible Power Service—Extended Holdover	27
17. Uninterruptible Power Service—Extended Holdover	28
18. Cabling From the ECSA to Peripheral Equipment via Cross-Connect Field	29
19. Cabling Plan to Cross-Connect Field	31
20. Typical ECSA Cross-Connect Fields	32
21. Cross-Connect Field Enclosure	33
22. Control/Energy Carrier Cross-Connections	35
23. Energy Carrier Cross-Connections	37
24. Load Control to Carrier Through Cross-Connect Field	47
25. Control I/O Data Channel Cross-Connections	48
26. Control and Alarm Panel Cross-Connections	49
27. Data Channel Repeater (J58879KC)	50
28. Single-Channel Repeater With Range Extension (AE-48) or Without Range Extension (WJ-3)	51
29. Dual-Channel Repeaters With Range Extension (AE-48) or Without Range Extension (WJ-3)	52
30. Dual-Channel Repeaters for Off-Premises Use	53
31. Peripheral Interface Circuit (PIC) and Typical Connections	55

CONTENTS	PAGE
32. Peripheral Connectors SX02 and SR01	56
33. RMATS-1 Equipment	57
34. RMATS-1 Functional Block Diagram	58
35. LC171B Circuit Pack Options	59
36. LC172B Circuit Pack Showing Shorting Block Set for Option G	60
37. LC366B Circuit Pack Options	61
38. Circuit Pack LC133B Shorting Block Set for Option W	63
39. LC121B Circuit Pack Switch Location and Options	64
Tables	
A. ECSA Carrier Load Arrangements	11
B. System Configuration	12
C. ECSA System Equipment	13
D. Environmental Requirements	14
E. Total Current Drain	23
F. Backboard Designations	34
G. A Filled-In Example of a Control/Energy Carrier Cross-Connect Worksheet	45
H. A Filled-In Example of an Energy Carrier Cross-Connect Worksheet	46

1. GENERAL

1.01 This section provides information and instructions for planning a new Energy Communications Service Adjunct System (ECSA) installation (Fig. 1) or for planning growth and rearrangement to an existing system.

1.02 Whenever this section is reissued, the reason(s) for reissue will be listed in this paragraph.

DANGER: *Hazardous foreign voltages may exist on leads extended to customer.*

1.03 The ECSA system provides the energy communications service for host communications systems. Therefore, it is specifically designed for controlling and monitoring the energy consumed by customer equipment. It performs this function by using control signals originating from information stored in the system processor. The signals are transmitted via a dry contact closure. The closure is extended to the low-voltage circuits which control the power consuming equipment. Sensing the contact closure and operating the energy load controls is the responsibility of the customer.

1.04 The ECSA system provides monitoring circuits for connection to power meters or customer-provided equipment to determine power consumption and demand. The power meters provide pulses at a rate which is proportional to the power usage. The ECSA system counts the pulses in a given time period and calculates the electrical consumption and demand. The information can be used to study the peak and low patterns, and to actually control the demand by using load shedding in which loads are turned off or cycled at a lower rate on a priority basis.

1.05 The ECSA system has the capability of controlling up to a maximum of 1008 individual loads. The maximum of 512 groups may be utilized to further control the individual loads. When the system has fewer than 512 individual loads, the number of load groups will equal the number of loads. A block diagram of the ECSA is shown in Fig. 2.

1.06 Customer-provided equipment that may be controlled by an ECSA system includes heating, ventilating, and air-conditioning equipment; indoor or outdoor lighting; electric signs, etc.

1.07 Worksheets for apparatus and/or equipment interconnections are provided (see Part 8) for installation information. Appropriate worksheets should be arranged in the same sequence in which the work is to be performed. Worksheets for energy load and power meter interface cross-connections are not provided in this section. Those worksheets may be obtained and reproduced from the customer ordering document.

1.08 A Mechanized Ordering Form (E-8190) may be used for ordering complete new systems. (This

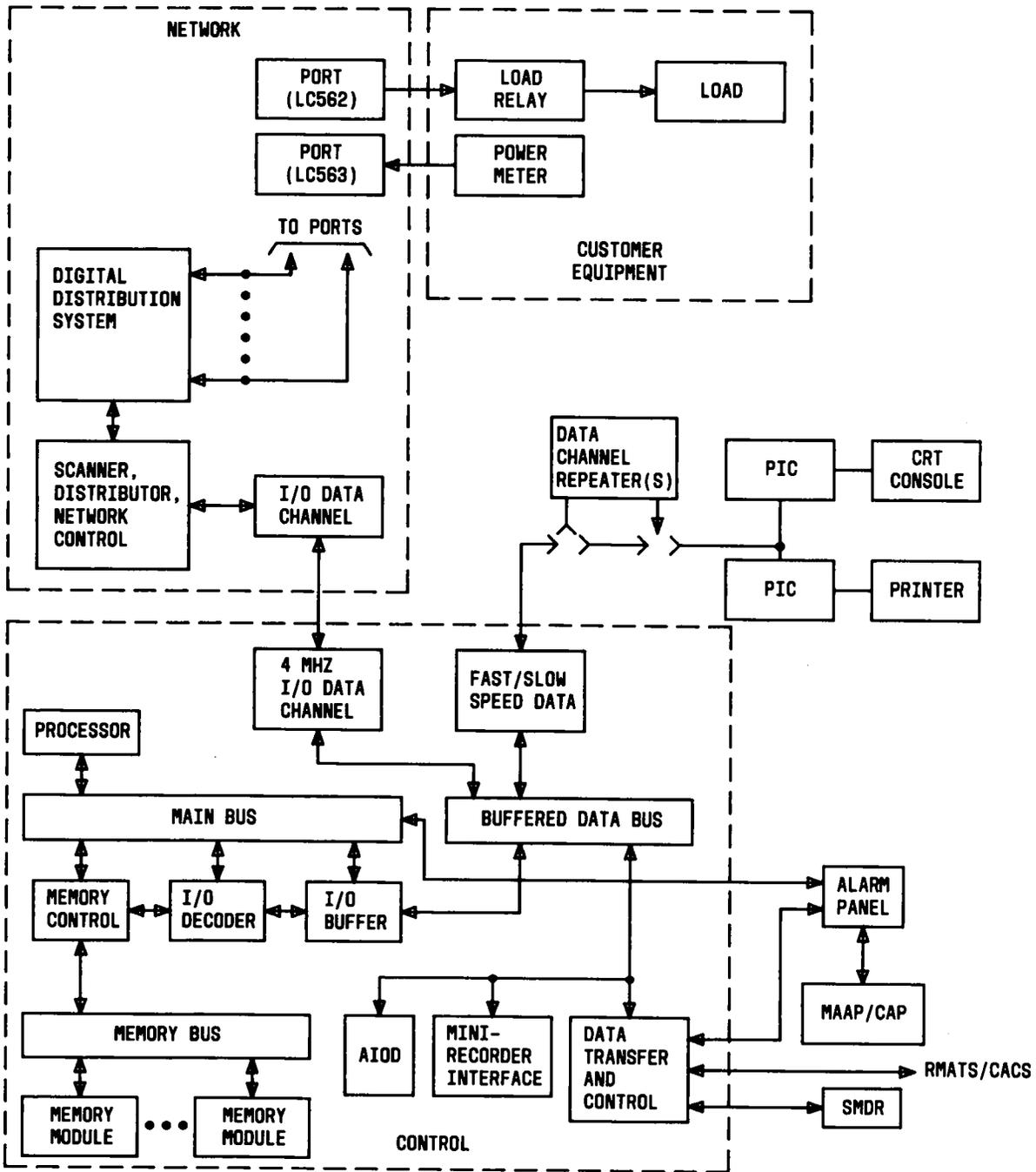


Fig. 1—Energy Communications Service Adjunct—Block Diagram

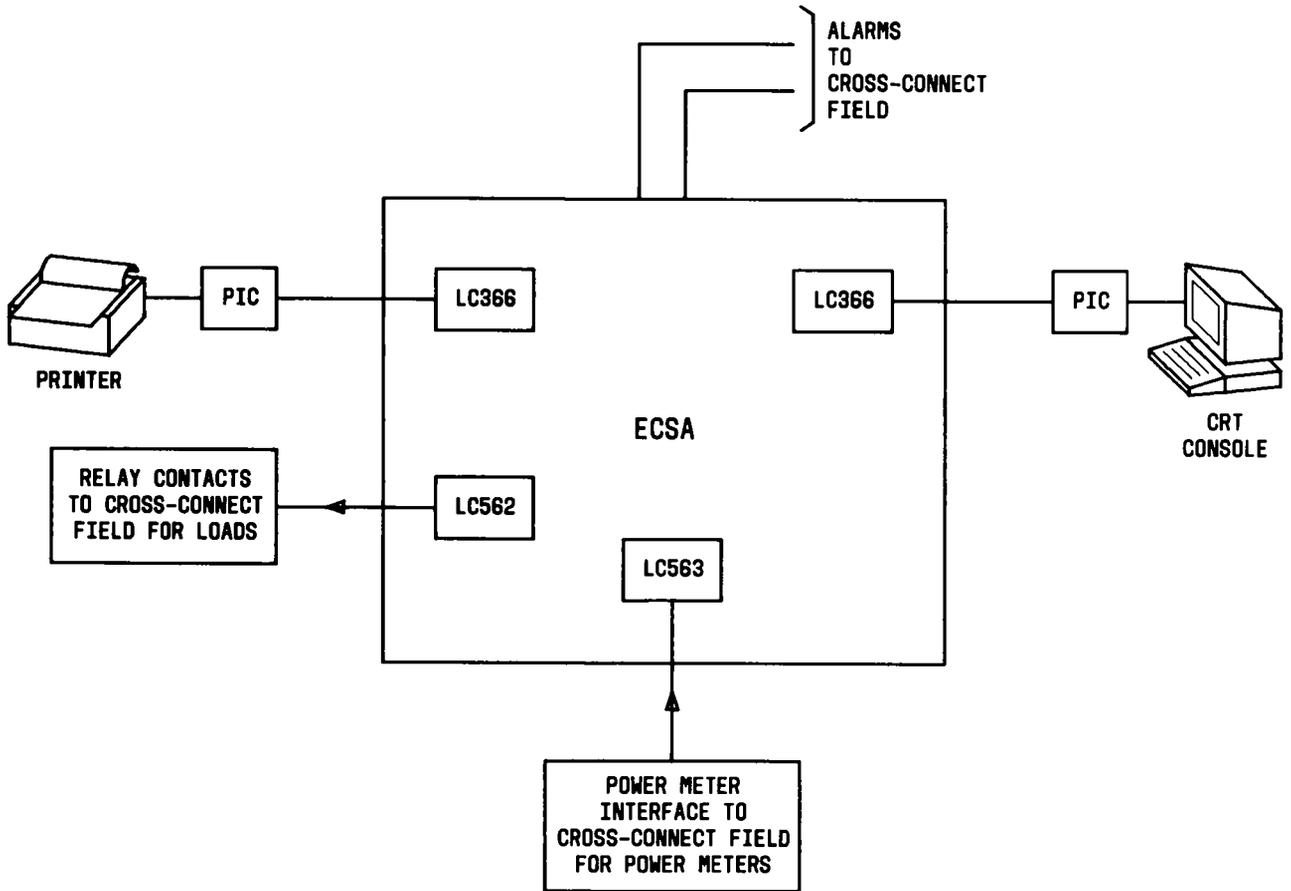


Fig. 2—Block Diagram of an ECSA System

form cannot be used for ordering additions to existing systems, or for ordering individual items.)

1.09 It is recommended that fill-in worksheets and diagrams provided in this section be reproduced locally, as required, and the originals kept with the section for future use. Copies of the required worksheets and diagrams should be completed before the actual work begins on customer premises. Copies should be provided at the customer location, along with any other installation information, for use during the installation of the system. After the installation is completed, copies of these documents should be stored on customer premises for future reference.



A worksheet should be completed for each feature and the data arranged in the sequence in which the work is to be performed. Where the sequence is critical, it may be desir-

able to complete one worksheet per feature even though this requires more than one copy of worksheet per maintenance and administration panel (MAAP) PROC.

1.10 Last-minute customer orders may require that changes to load assignments, load groupings, and other familiar customer-furnished data be modified at the time of installation.

1.11 Items such as power equipment, connector cables, etc, may be shipped ahead of the cabinets to facilitate the installation. The following items should be available at the customer location before the actual installation begins:

- System cabinets and energy console
- AC power installation
- Connector cables

- Termination field materials
- Power receptacle(s)
- Preinstallation worksheets completed for local minor additions or rearrangements
- Tools
- Factory computer-generated lists (shipped with the system).

1.12 This section is based on the drawings listed in Part 7. If this section is to be used with equipment or apparatus reflecting later issue(s) of the drawing(s), reference should be made to the schematic drawings and circuit descriptions to determine the extent of the changes and the manner in which the section may be affected.

2. HOW TO USE THE SECTION

2.01 When planning a new installation, the material in Parts 4 through 6 should be reviewed to ensure that all requirements for power, protection, miscellaneous components, floor plan, etc, have been given adequate consideration.

2.02 System changes may be required after the system is installed and accepted. When planning changes, obtain complete, current, and accurate system records then provide new fill-in worksheets showing each change.



A circuit pack is normally replaced with a circuit pack having either the same or later alpha suffix as printed on the carrier label. That is, an LC30 cannot be used if the label specifies LC30B. An LC30B, C, or later alpha-suffixed circuit pack is a suitable replacement.

2.03 Refer to Parts 4 through 6 and consider all necessary areas such as cabling, additional equipment, additional power and/or grounding, etc, that are required to provide the changes.

2.04 The fill-in interconnection worksheets (Part 8) should be reproduced and completed as required.

3. FUNCTIONAL CONTROL

3.01 The ECSA is designed to control energy-consuming devices within the customer prem-

ises. The ECSA allows a customer to establish equipment operation schedules in order to control total energy consumption. The scheduling software is part of the resident operating system of the ECSA.

3.02 The individual energy loads and power meter monitoring circuit pack locations are initially translated and defined within the system program tape. Changes, such as additions, deletions, or reassignments, may be accomplished by use of the MAAP. These circuit pack translations yield corresponding load numbers which are entered into scheduling routines via the ECSA console.

3.03 Once the energy loads are defined and the ECSA equipment is installed, the system is ready to accept additional instructions required to provide the following primary functions of the system:

- (a) Individual load cycling function (ILCF)
- (b) Peak demand shedding function (PDSF)
- (c) Energy consumption and demand monitoring (ECDM).

3.04 The three functions permit the ECSA system to be tailored for a particular customer. The tailoring is accomplished via an ECSA console (Fig. 3). The ECSA console displays specific forms (on its CRT) which permit parameters which govern the system performance to be defined and entered. Changes to the parameters in the forms displayed on the console may be made to enhance the system performance as well as to cover customer equipment changes or rearrangements.

3.05 Control of the three functions is established and monitored via the ECSA console. The console operator has the capability of assigning each energy load to the cycling and shedding functions, and the power meter interfaces to the consumption and demand monitoring function. The console permits ease of load assignments and provides screen displays to monitor the functions.

3.06 Various system status reports can be monitored via the console displays to determine system performance. Hard copies of the reports can be obtained via the system printers (Fig. 4). Some reports are made on demand while others are automatically printed when certain status plateaus are reached.

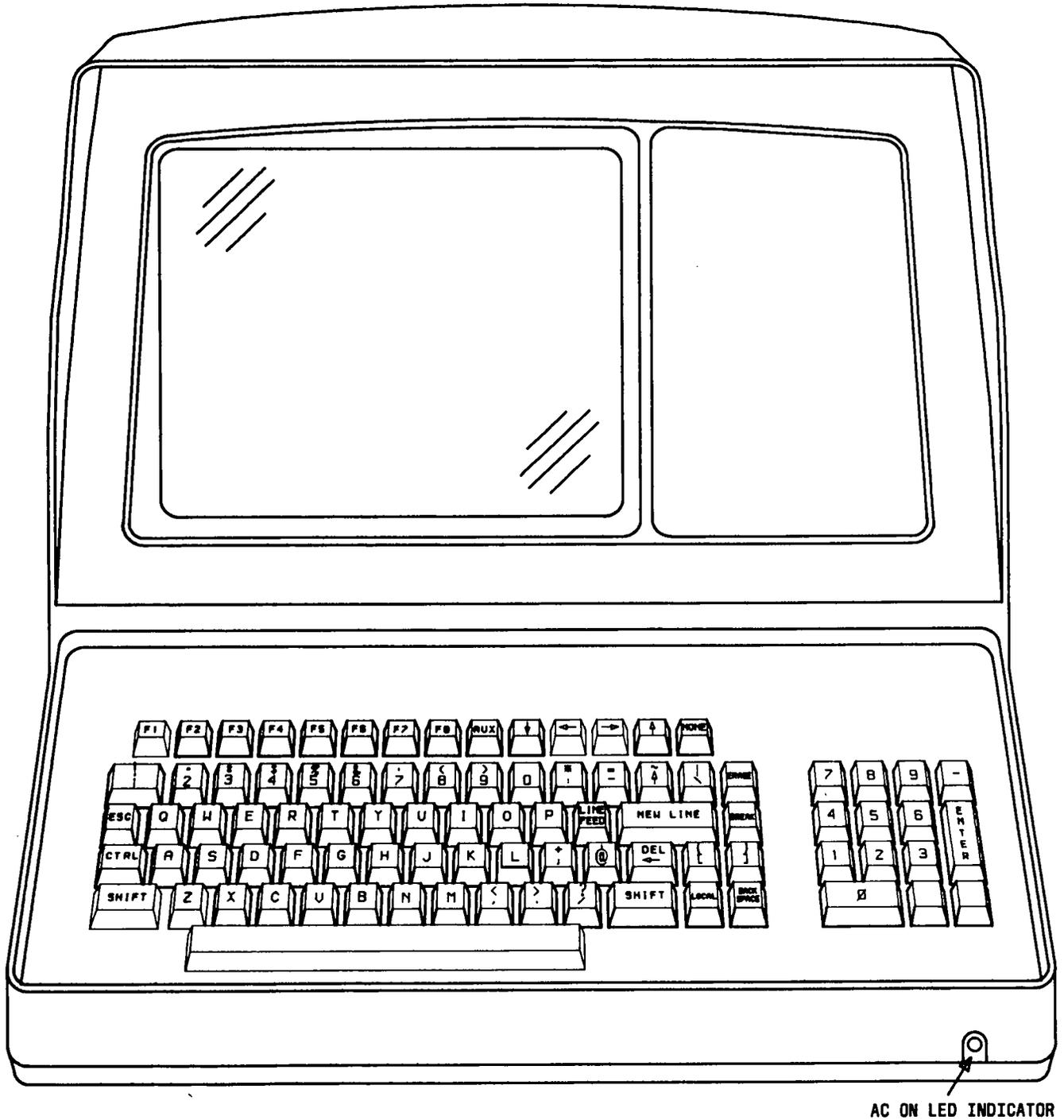


Fig. 3—ECSA Console

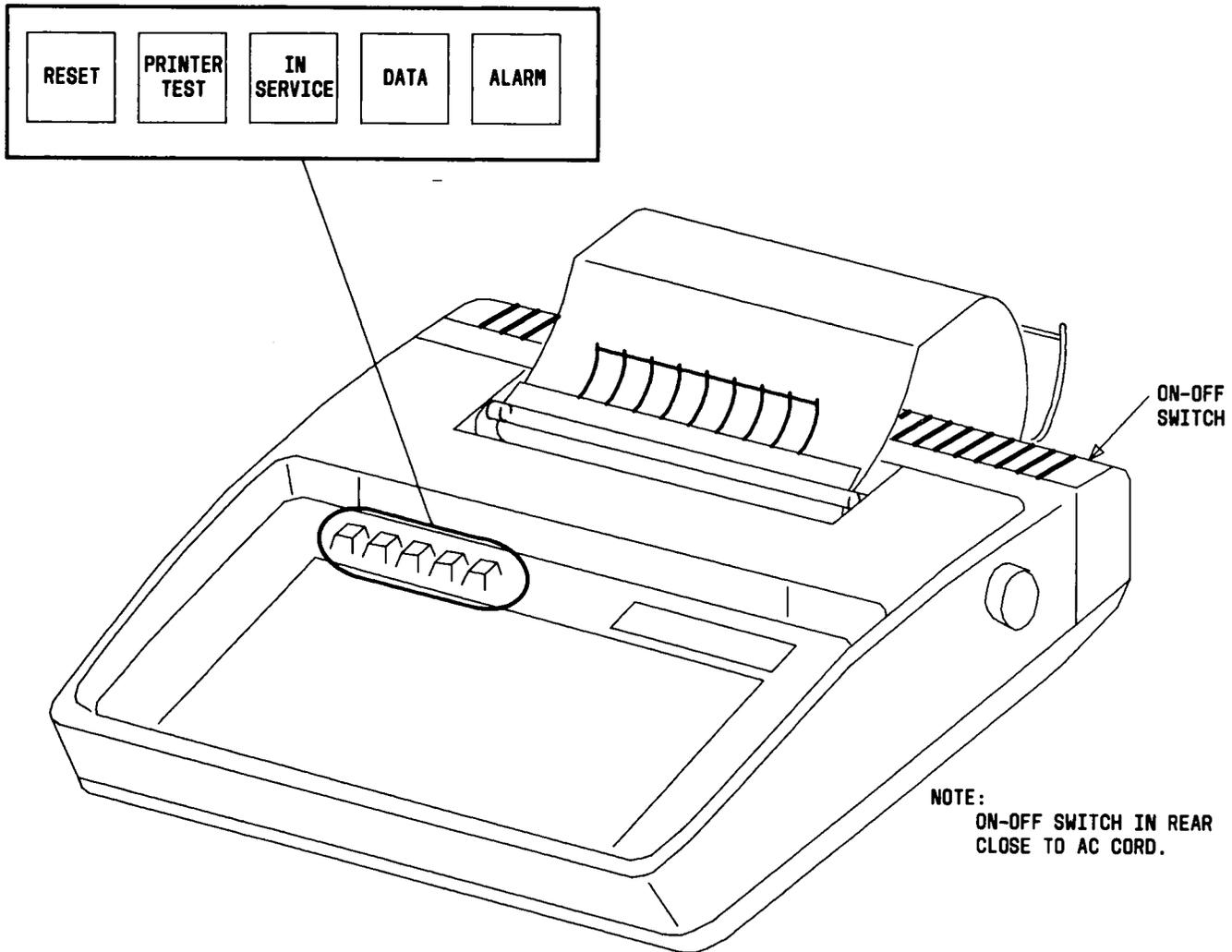


Fig. 4—ECSA Printer

3.07 Refer to Section 554-106-100 for a detailed description of the system functions.

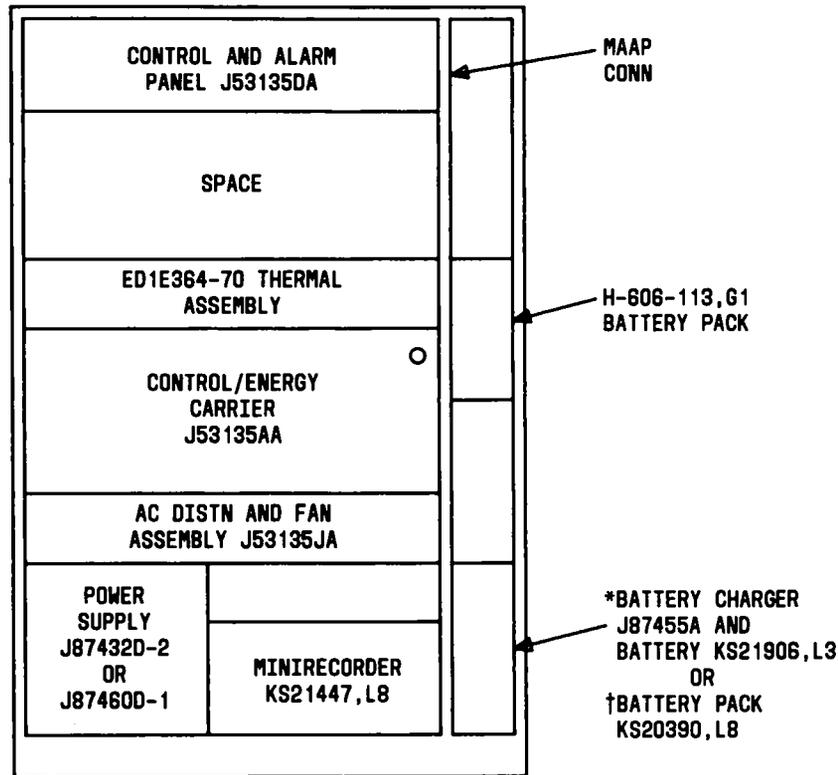
4. INSTALLATION CONSIDERATIONS

PHYSICAL ARRANGEMENTS

4.01 The ECSA system equipment is housed in either one or two cabinets measuring approximately 1207 mm (47-1/2 inches) high by 800 mm (31-1/2 inches) wide by 610 mm (24 inches) deep (Fig. 5, 6, and 7). The cabinets fit through standard door openings (2134 mm by 914 mm [7 feet by 3 feet]) crated and mounted on a 178-mm (7-inch) high dolly. Each cabinet consists of a basic framework with welded half-side panels. The rear panel is screw-

mounted to the cabinet. A wraparound cover assembly completely encloses the front half of the cabinet. The front cover is secured to the cabinet with five flip-latch fasteners. Depending on customer requirements, one or two carriers mount on the framework of each cabinet. The cabinets are shipped equipped from the factory, and are provided with rollers for ease of installation and maintenance.

Note: Only eight screws attach the rear cover to the cabinet when it is shipped from the factory. Remove the remaining screws (18) from plastic bag taped to the cover. Use screws to secure cover to cabinet before system installation is complete.



* REQUIRED WITH POWER SUPPLY J87460D-1
 † REQUIRED WITH POWER SUPPLY J87432D

Fig. 5—Basic Cabinet With Single Carrier

4.02 The ECSA may consist of a 1- or 2-cabinet system. The single- (basic-) cabinet system or the first cabinet of a 2-cabinet system always requires a control/energy carrier (J53135AA). When the individual energy loads exceed 176, an energy carrier (J53135AB) must also be provided in the first or single cabinet (J53135A). The energy carrier provides the interfaces for 608 additional loads.

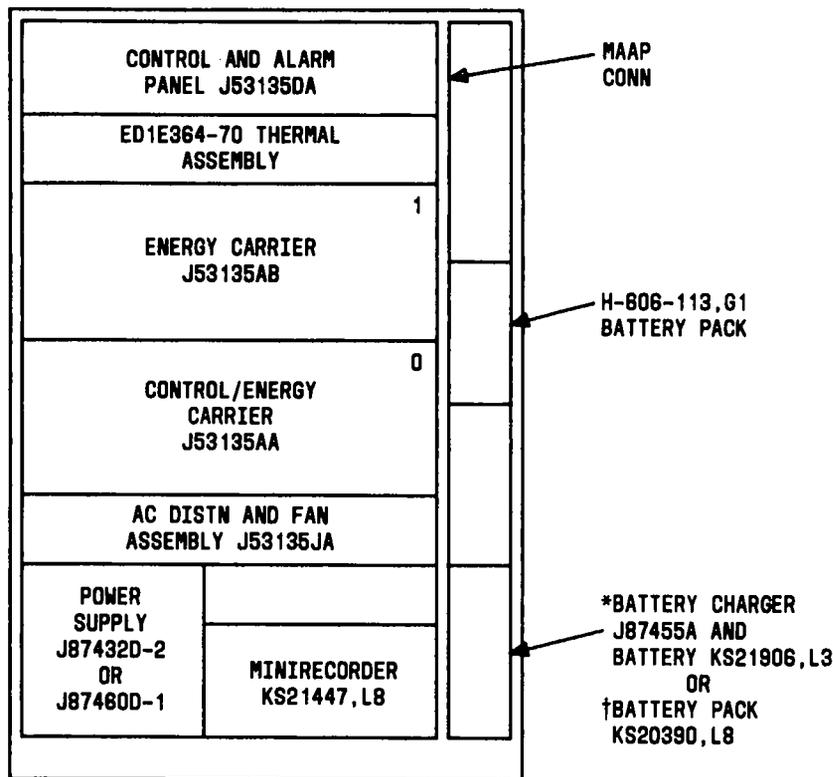
4.03 A second cabinet (J53135A) with a single energy carrier is required when the individual loads exceed 784. The energy carrier in the second cabinet is equipped to interface only 224 individual loads. Additional loads in the carrier would exceed the 1008 maximum of a 2-cabinet system.

4.04 The individual energy loads are provided by LC562 circuit packs (16 loads per board). Each circuit pack requires a physical carrier slot which represents two electrical slots. The paired electrical

slots are identified by an odd number followed by the next highest even number (ie, slots 3 and 4, 9 and 10, or 15 and 16). Refer to Table A for maximum load arrangements per each system carrier.

4.05 The ECSA is offered in the six system configurations outlined in Table B. Each configuration is arranged with a set number of loads based on memory size, load capacity, and loads equipped. In some cases, the total loads required for a particular installation will not match the system configuration load arrangements.

4.06 When the required loads for a certain system have been determined, compare the load number with the quantities shown in the LOADS EQUIPPED column in Table B. Select the equipped quantity that is less than the required loads. This represents the system configuration to be ordered.



* REQUIRED WITH POWER
SUPPLY J87460D-1
† REQUIRED WITH POWER
SUPPLY J87432D

Fig. 6—Basic Cabinet With Two Carriers

4.07 The additional LC561 and LC562 circuit packs required to bring the system up to the desired load quantity will be added at the factory. The units will ship installed in the proper carrier slots.

4.08 The translations for the additional loads must be added during installation. The original tape includes only the translations for the loads equipped with the ordered configuration. Use RMATS or MAAP to add the translations.

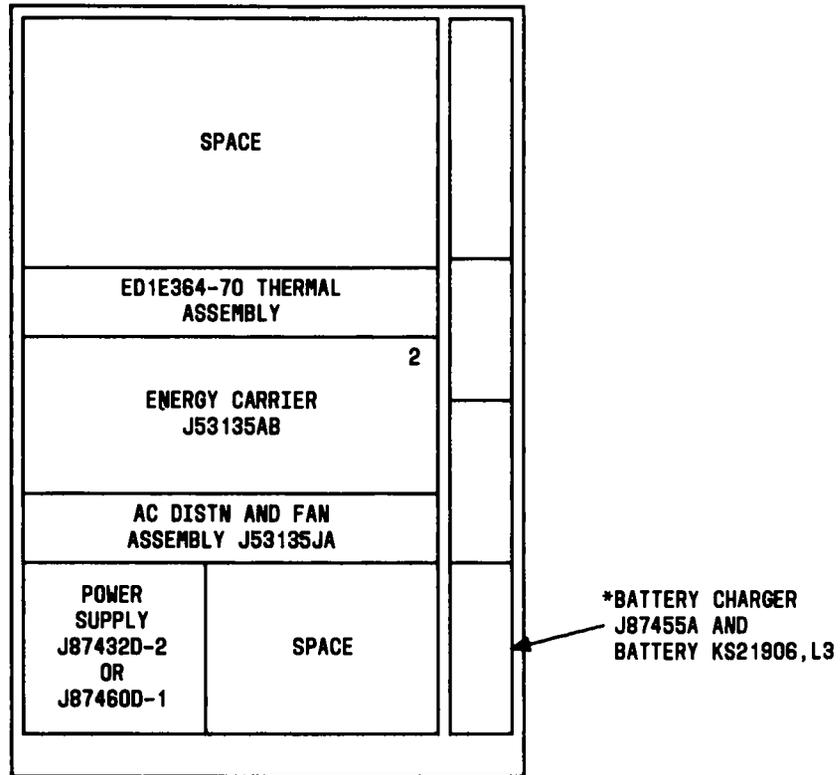
4.09 An example of choosing a system configuration and determining the additional LC562 circuit packs that will be installed follows:

- (1) Assume that the required number of loads is 350.
- (2) Compare the 350 loads with the quantities in the LOADS EQUIPPED column in Table B. The 350 loads fall between 192 and 416.

Note: The lesser quantity determines the system selected.

- (3) Select the system configuration equipped with 192 loads.
- (4) Subtract the selected quantity from the required load quantity ($350 - 192 = 158$).
- (5) Divide the difference by 16. The quotient is 9 plus a fraction which results in 10 being the number of additional LC562s that must be installed. (One LC562 is required for each whole number of the quotient plus one for the fraction. There will always be a fraction in the quotient when the required loads do not match the equipped loads.)

Note: Based on the example, an ordered system will ship equipped with hardware for 352



* REQUIRED WITH POWER SUPPLY J87460D-1

Fig. 7—Second Cabinet With Single Carrier

TABLE A

ECSA CARRIER LOAD ARRANGEMENTS

MAXIMUM LOADS	MAXIMUM LOADS PER CARRIER	CARRIERS REQUIRED	CABINETS REQUIRED
176	176	One control/energy	1
784	176	One control/energy	1
	608	One energy	
1008	176	One control/energy	2
	608	One energy	
	224	One energy*	

* Second cabinet required for this carrier.

TABLE B
SYSTEM CONFIGURATIONS

LOAD ARRANGEMENTS			EQUIPMENT PROVIDED							
LOADS EQUIPPED (NOTE 1)	LOAD CAPACITY	MEMORY SIZE	64K MEMORY LC346	LOAD INTERFACE LC562 (NOTE 2)	NETWORK BUFFER LC561	POWER METER INTERFACE LC563	CABINET J53135AA	CONTROL/ENERGY CARRIER J53135AA	ENERGY CARRIER J53135AB	POWER SUPPLY J87432D OR J87460D
32	176	B	2	2	1	2	1	1	—	1
64				4						
128				8						
192	400	C	3	12	3	2	2	1	1	2
416	784			26						
800	1008			50						

Notes:

1. Tape translations are provided for all loads equipped with each system configuration. Additional translations must be performed by RMATS or MAPP.
2. Quantity shown is provided by system configuration. Additional LC562s will be provided as required when the desired loads exceed the loads equipped.

loads (2 extra), but with translations for only 192 loads.

4.10 When the required loads are 433 through 784, an additional LC561 network buffer will be required. The circuit pack will ship mounted in slot 17, segment 2, of the energy carrier.

Note: An LC561 must always be provided in slot 17, segment 4, of each energy carrier.

4.11 Table C shows the coded equipment that may be used to provide an ECSA system installation. The quantities necessary will depend upon customer system configuration.

4.12 Refer to Section 554-106-100 for detailed information pertaining to physical arrangements.

ENVIRONMENTAL REQUIREMENTS**A. Atmospheric and Temperature**

4.13 Extreme conditions of temperature and humidity may have damaging effects on system equipment. Exposure to extreme temperature and/or humidity may degrade energy service, not only at the time of exposure but also when a normal environment is restored. Temperature is measured by an ordinary thermometer at a location 1524 mm (5 feet) above the floor and 381 mm (15 inches) in front of a system cabinet. Table D outlines the equipment room environmental requirements for the system. The humidity design range chart (Fig. 8) is provided to indicate the safe ranges for the equipment. The use of the chart requires a hygrometer to measure wet and dry bulb temperatures and a psychrometric table to determine the relative humidity from the difference in the two measurements.

4.14 The requirements presented in Table D represent the extreme limits of the equipment operating ranges. These requirements should not be

**TABLE C
ECSA SYSTEM EQUIPMENT**

CODE	EQUIPMENT
J53135A	List 1 Framework, assembly, wiring, and equipment for one 3-carrier, basic, small cabinet.
	List 2 Equipment required in addition to List 1 to provide one minirecorder (KS-21447, List 8).
	List 3 Equipment required in addition to List 1 to provide one power supply (non-UPS) (J87432D-2).
	List 4 Equipment required in addition to List 1 to provide one power supply (UPS) (J87460D-1).
	List 5 Equipment required in addition to Lists 1 and 4 to provide nominal holdover battery (KS-21906, List 3) and charger (J87455A-1, List 1).
	List 6 Equipment required in addition to List 1 to provide one battery pack assembly (H606-113, G-1) and hardware for time of day clock.
J53135AA	List 1 Assembly, wiring, and equipment for one control/energy carrier.
	List 2 Apparatus required in addition to List 1 to provide: <ul style="list-style-type: none"> • Processor, control, and interface circuits (LC135C, LC136, LC454, LC147, LC455B, LC133B, LC134B, LC29B, LC30C) • 64K memory (LC346) • Time of day clock (LC144) • Four data channel circuits (LC366C) • Four MHz channel control (LC130) • Four MHz sub-channel control (LC131) • One network buffer circuit (LC46, LC121B, LC123, LC124, LC561) • One power monitor and feedback circuit (LC563).
	List 3 Apparatus required in addition to List 1 to provide one 64K memory circuit Pack-3 List 3 max. (LC346).
	List 5 Apparatus required in addition to List 1 to provide one data control circuit pack for RMATS (LC171B, LC172B).
	List 6 Apparatus required in addition to List 1 to provide one data channel circuit pack (four circuits) (LC366C).
	List 7 Apparatus required in addition to List 1 to provide one power monitor and feedback circuit pack-1 List 7 max. (LC563).
	List 8 Apparatus required in addition to List 1 to provide one energy load control circuit pack-12 List 8 max. (LC562).
	List 1 Assembly, wiring, and equipment for one energy carrier.
J53135AB	List 2 Apparatus required in addition to List 1 to provide one network buffer circuit (LC46, LC121B, LC123, LC124, LC561).
	List 3 Apparatus required in addition to List 1 to provide one buffer circuit-2 List 3 max. (LC561).
	List 4 Apparatus required in addition to List 1 to provide one energy load control circuit-38 List 4 max. (LC562).
	List 5 Apparatus required in addition to List 1 to provide one power monitor and feedback circuit (LC563).
	J53135DA-1 Assembly, wiring, and equipment for one control and alarm panel (unduplicated).
J53135JA	List 1 Assembly, wiring, and equipment for one ac power distribution unit (non-UPS).
	List 2 Assembly, wiring, and equipment for one ac power distribution unit (UPS).
	List 3 Wiring and equipment required in addition to List 1 or 2 to provide fans when required.
	List 4 Wiring and equipment required in addition to List 1 or 2 to provide fusing for minirecorder.

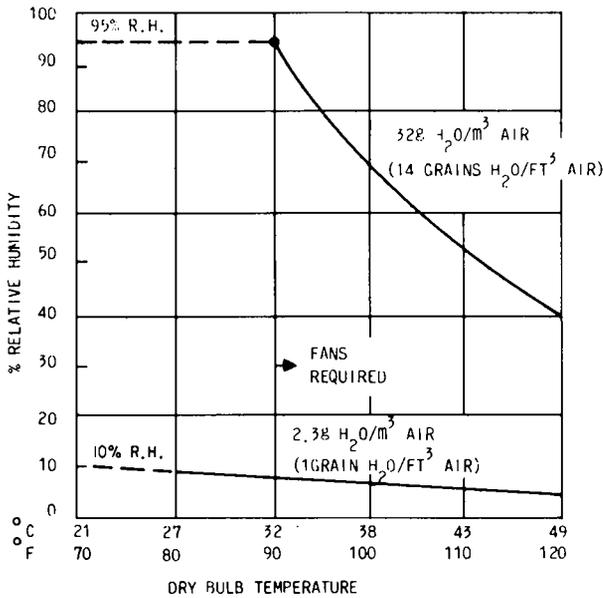


Fig. 8—Humidity Design Range

construed as being desirable working conditions for minimum maintenance. Installation in undesirable areas (eg, areas outside the temperature range of 4.5° C to 35°C [40°F to 95°F] and outside the relative humidity range of 20 to 60 percent) will cause degradation of service and reduce system life.

TABLE D
ENVIRONMENTAL REQUIREMENTS

SYSTEM	ROOM AMBIENT (DRY BULB) TEMPERATURE °C (°F)		PERMISSIBLE RANGE HUMIDITY (%)	
	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
Without Fans	0 (32)	27 (80)	10	95
	0 (32)	29 (85)	8	95
	9 (32)	32 (90)	7	95
With Fans	0 (32)	35 (95)	6	80
	0 (32)	39 (100)	5	70
	0 (32)	41 (105)	4	60
	0 (32)	43 (110)	4	55
	0 (32)	46 (115)	3	45
	0 (32)	49 (120)	3	40

4.15 The permissible extremes for storage and transportation environments are 66°C (150°F) with a minimum relative humidity of 15 percent and a low temperature of -40°C (-40°F) with the humidity uncontrolled. Large temperature excursions, shock, and vibration affect the tape cartridge and can cause read/write errors when operation begins. The tape cartridge should not be inserted in the transport during shipment, but should be placed in a dust-free container such as a sealed plastic wrapper.

4.16 The equipment should be installed in an air-conditioned area whenever possible. Fans will be required in each cabinet whenever:

- (a) The equipment area is not air-conditioned and the ambient temperature can exceed 32°C (90°F).
- (b) Filters are used.

4.17 Environments which are not recommended for installation because of potential temperature problems include:

- (a) Rooms in which a major heat source (eg, boiler room, furnace room, manufacturing areas using hot processes) can affect the room ambient temperature significantly.
- (b) Areas in which the ambient temperatures can become excessive. Such areas include:
 - (1) Unventilated rooms with less than 4.6 square meters (50 square feet) of floor space.
 - (2) Unventilated rooms with two or more exterior walls which are frequently exposed to high temperatures.

4.18 Total power dissipation of system cabinets may be used to determine air-conditioning requirements when space is allocated. The maximum power dissipation per each energy cabinet is approximately 500 watts. This power dissipation is sufficient to heat a small room above the maximum operating temperature of the equipment if air-conditioning or ventilation is not provided. The equipment engineer should analyze the room ventilation and/or air-conditioning system and ensure that requirements for each installation site are met.

B. Filters

4.19 The use of filters in the equipment will be determined by the environment. The environment can be divided into the following air contamination classifications:

- **Heavy Industrial:** Space in which industrial processes or construction work act as sources of excessive dust or lint. This environment is not recommended as an installation site. However, if it is necessary to install a system in this environment, filters will be required on each cabinet.
- **Average Industrial:** Nonmanufacturing space in industrial areas. Filters must be used on each cabinet installed in this environment.
- **Average Residential:** Storage or office space which has heavy traffic or which is adjacent to building exits and entrances. In this environment, if the system is equipped with fans, filters are required on each cabinet.
- **Relatively Clean Room:** Interior rooms in office space with little or no traffic. Filters are never required in this environment.

4.20 The ECSA equipment is primarily solid-state electronics. However, this equipment is susceptible to adverse effects from certain contaminants. Copy machines have been identified as a potential source of contaminants which can leave deposits on, erode, and insulate open contact relays. It is recommended that relay equipment be located away from equipment which exhibits this type of contaminant emission. In severely contaminated industrial environments, other ECSA equipment may be affected. Gold fingers and connector interfaces could chemically deteriorate through the corrosive effects of gases on particle surfaces. Environments containing high concentrations of corrosive gases, such as sulfur or chlorine, should not be used as installation sites. The performance of the minirecorder may be affected if high concentrations of metallic contaminants are present. These can interfere with magnetic tape read or write operations. Dust, paper fiber, or carbon particles can also affect the tape transport operation. Industrial areas suitable for prolonged human activity (without safety protection) are not considered to be severely contaminated and can be used as installation locations.

4.21 Filters will require periodic replacement as they become contaminated. The replacement interval will vary from a few weeks to a year or more, depending upon local conditions. Under average conditions, filter life can be expected to be in excess of 6 months. It is the responsibility of the telephone company to conduct periodic filter inspections to ensure replacement when deemed necessary. Filters should be inspected (preferably in conjunction with service orders) at intervals to be determined by the nature of the environment.

C. Transportation**In Transit**

4.22 The system should always be shipped packaged in the Western Electric-provided crates.

4.23 The packing material used for shipping cabinets from Western Electric is adequate for upright or lay-down (on-side) shipment. However, upright shipment is preferred. If on-side shipment is used, installation personnel should carefully raise the cabinets to an upright position before unpacking.

4.24 The basic system cabinet will be fully loaded and ready for operation, with the exception of cabling, when shipped. This includes all maintenance books and manuals to be kept inside the door. This does not include the spacer assembly and floorplate which will be shipped in a separate crate.

4.25 The preferred modes of transportation are, in order of preference, truck, rail, and air. Air transportation is known to subject the equipment to severe handling shocks. Rail transportation is less severe, but railroad car coupling shocks can be severely stressing on the system.

Handling on Site

4.26 It is preferable (when possible) that the system remain packaged in its crate until it is in the room in which it is to be located.

4.27 Forklifts and dollies are acceptable means of handling the crated system on customer premises. The pallet portion of the crate has been designed for these methods of handling.

4.28 Care should be taken to avoid dropping the system (either crated or uncrated) from any

height. Under no circumstances should the system be allowed to drop from a height greater than 203 mm (8 inches) packaged or 25 mm (1 inch) unpackaged.

D. Structural

Floor Loading

4.29 The minimum requirement found in any commercial floor loading codes is 23 kilograms per 0.09 square meter (50 pounds per square foot). The maximum weight of the ECSA (2-carrier) cabinet is about 225 kilograms (500 pounds). Thus, a free maintenance area of at least .93 square meters (10 square feet) per cabinet must be provided on a floor which is rated at 23 kilograms per 0.09 square meter (50 pounds per square foot).

4.30 The average floor load is found by summing the weights of all equipment over a particular floor area and dividing the total weight by that area. The area includes aisles and open areas associated with the cabinets. The average floor load must not exceed the rated floor loading of the building.

Stability and Movement

4.31 When earthquake or disaster bracing is required by law, or when local telephone company engineers feel that it is necessary, such bracing can be provided. Areas in the continental United States in which study for the need for bracing may be desirable are shown in Fig. 9. The ECSA can be braced by bolting the cabinets directly to the floor. Four insulating bolts and washers and four spacer assemblies are used in holes provided in the baseplate of the cabinet for this purpose. When the cabinet is bolted to the floor, maintenance access space must be provided behind the cabinet.

4.32 Whenever maintenance access space cannot be allocated behind the cabinets, an alternate method (for earthquake bracing) is recommended. This method requires the use of ED-1E362-70 to adapt the cabinets for rail mounting. This alternate method bolts a floor rail assembly ED-1E362-70, Group 4, to the floor and uses cabinet assembly J58879C, List 22. A restraining cable is furnished to be slipped into appropriate slots on the rail and rear of cabinet.

4.33 When the system is installed on any rough floor or carpeting, the floorplate and rollaway

assembly will be placed on the floor surface and the cabinet on the plate assembly. This will protect the customer's floor surface and aid maintenance personnel in moving the cabinet on its casters when necessary to gain access.

4.34 Care should be taken in moving the cabinet across deep pile carpets in order to prevent tipping. The cabinet casters have been placed so as to allow adequate force (about 45 kilograms [100 pounds]) to get the cabinet moving on thick carpeting. Also, the placement of the casters allows a moderately rapid movement, about 610 mm per second (2 feet per second), of the cabinet without risk of tipping when a bump or irregularity in the floor is encountered. Movement faster than 610 mm per second (2 feet per second), however, should be considered dangerous with regard to cabinet tipping.

E. Electrical Fields

4.35 Power lines (feeders) dedicated to the ECSA should be used. Separate branch circuits may be sufficient to serve this purpose.

4.36 Electromagnetic fields may cause noise to be introduced into the ECSA. Care should be taken to avoid placing the system near powerful radio or television transmitters. In these cases, the field strength must be measured using a standard field strength meter such as the electric field sensor, Model EFS-1, manufactured by Instruments for Industry, Inc., or a tunable R70 meter from Electro-Metrics Company. If the reading (number obtained) is greater than unity, interference into the PBX is likely.

4.37 Properly measured field strength values of less than 0.05 volt per meter from a radio station antenna will not likely cause a problem. For measured values between 0.05 and 1.0, corrective measures may or may not be necessary. Generally, amplitude modulation (AM) radio stations are more likely to cause interference than frequency modulation (FM) stations (such as television). A building may also provide considerable shielding effect, reducing the interfering capability of the radiating station. Other possibly interfering radiators include industrial radio frequency (RF) heating equipment and welders.

4.38 The ECSA may be subject to noise interference from motors (greater than one-fourth

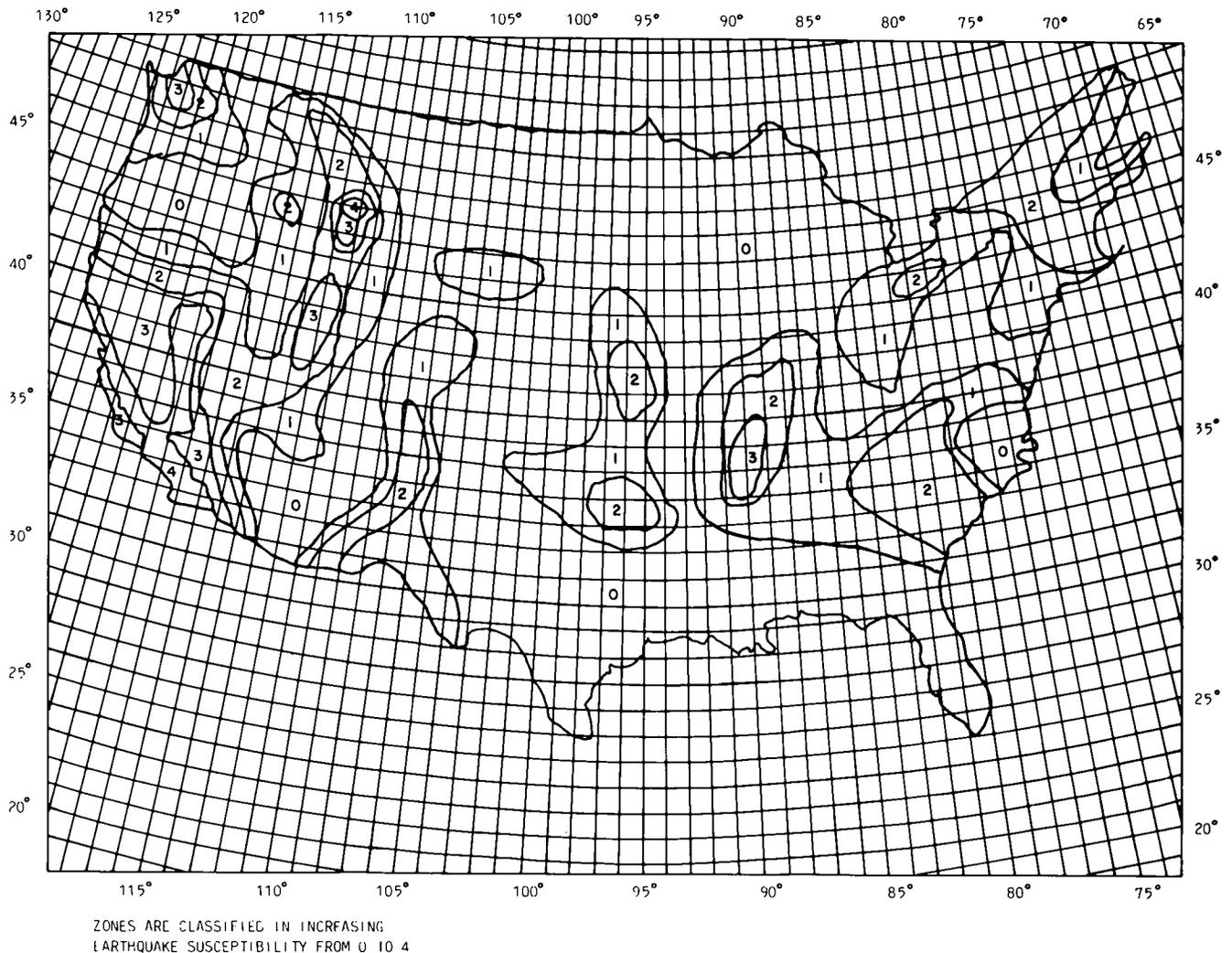


Fig. 9—Earthquake Environment (USA)

horsepower) having commutators if they are located in the same room or in a room adjacent to the ECSA. Small tools with universal motors are generally not a problem if operated on separate power circuits. Motors without commutators, whether synchronous or asynchronous, generally do not cause interference into the system.



In order to preclude electrostatic noise in the system, the frame shall be well grounded as discussed in this section. Maintenance personnel should touch the unpainted frame and attach authorized wrist grounding strap before working on the sys-

tem or handling circuit packs to remove electrostatic charge from themselves and avoid charging the circuit boards.

F. Acoustics

4.39 The system should be located in an acoustic environment which allows maintenance personnel to hear tones through a standard headset while performing necessary tests.

4.40 The noise levels which do not permit sound to be heard over the standard headset are about the same or greater than those specified in the Occu-

pational Safety and Health Act (OSHA). This is normally 90 dB. Therefore, the OSHA requirements for sound satisfy the environmental requirements for the system, and these must be met wherever the machine is placed. Refer to current OSHA requirements for acceptable levels.

G. Lighting

4.41 The light intensity level around the system cabinet should be sufficient to conform with OSHA standards to provide a comfortable amount of light for maintenance personnel to do the repair tasks required. To obtain accurate footcandle measurement, measure level in center aisle, 1524 mm (5 feet) above the floor, aiming meter upward. Light measurements can be made with a WESTON* Footcandle Meter, Model 614.

4.42 The lighting configuration in the system area should meet OSHA standards for minimum required lighting to allow maintenance personnel to perform their tasks. The light intensity level should be adequate from any of the directions necessary, ie, from the front or back of the cabinet.



Standard 48-Vdc lights used by some maintenance personnel for lighting are not to be powered by the system 48-volt taps, either in the power supply or backplanes.

H. Insects and Rodents

4.43 The ECSA cabinets are designed to seal off internal areas from insects and rodents. For this reason, the provided panels and doors should be in place at all times, particularly when such pests are known to exist in a particular location.

FEDERAL COMMUNICATIONS COMMISSION (FCC) REQUIREMENTS

4.44 To comply with FCC technical requirements, the ECSA equipment cabinet(s) is designed to meet FCC Part 15 requirements. A screen is provided within the cabinet to prevent signals from radiating from the system, and to prevent outside signals from interfering with system operations.

4.45 Another FCC requirements is that all cabling leaving the ECSA cabinets be shielded. The

*Registered trademark of Weston Instruments, Inc.

cabling shield should be extended for a minimum distance of 30 cable-feet. The 30-foot minimum also includes cabling going to the cross-connect field.

POWER

4.46 Prepare a sketch of the proposed installation similar to Fig. 10 to show the desired placement of the cabinets, cross-connect field, and the location of the customer-provided load center and power receptacles.

4.47 The commercial power provided to the system should be capable of providing each cabinet with 120-Vac 20-ampere service. This service is adequate for any fully equipped system cabinet. Each 20-ampere circuit should be protected by a 20-ampere thermal magnetic circuit breaker (ITE QP1-B020 typical, or approved equivalent).

4.48 The 2-cabinet installation shown in Fig. 10 could be powered from a 3-wire, single-phase, 240-Vac 60-ampere feeder. However, there is no phase restriction between cabinets. Therefore, the 120-Vac 20-ampere circuit required for each cabinet could be derived from either 2-phase or 3-phase mains.

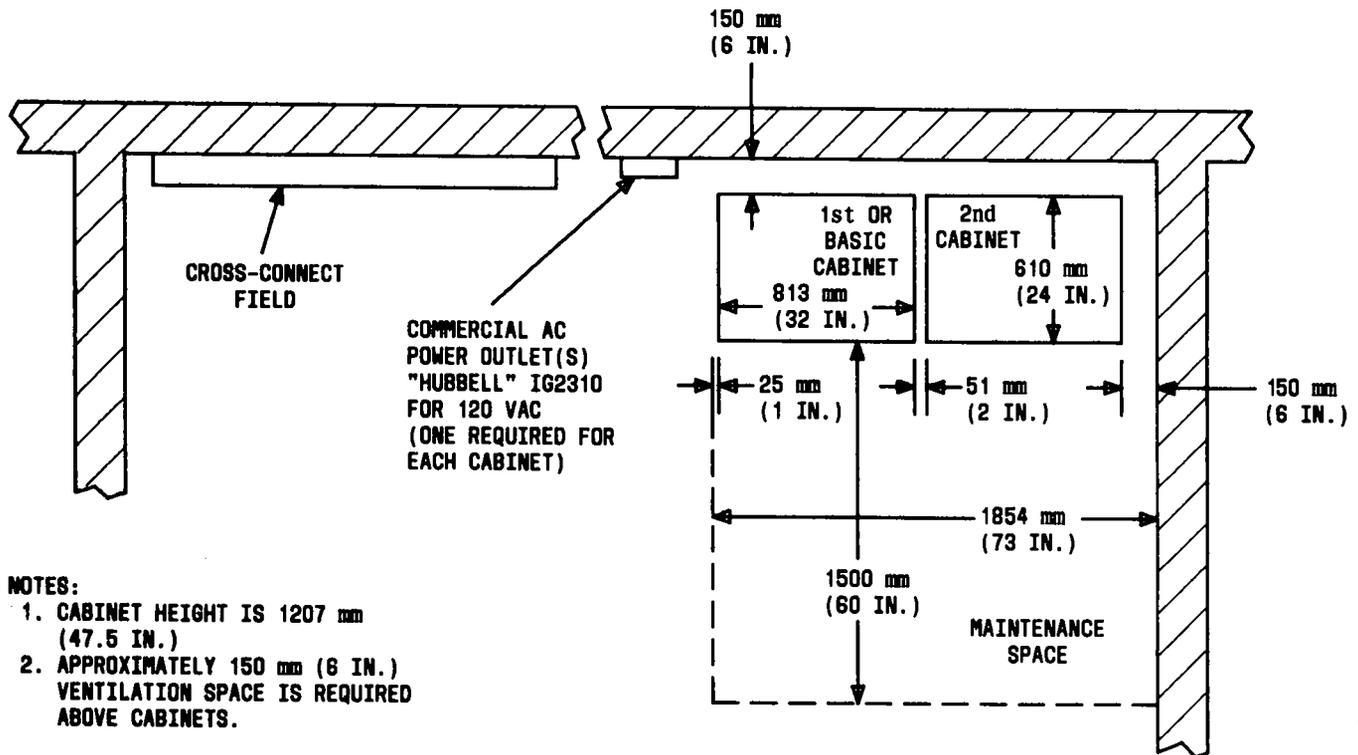


In order to maintain system integrity, a dedicated power feeder should be used. In lieu of this, separate branch circuits from a dedicated load center are sufficient to meet minimum requirements.

4.49 The ECSA is equipped with two types of power supplies. The first type, J87432D, is provided for nonreserve service, and the second, J87460D, is provided for uninterruptible power service (UPS). The same type supply must be provided for each cabinet.

4.50 The ECSA power supplies, or rectifiers, are capable of operating under a wide range of frequency or input voltage conditions, provided both conditions do not occur simultaneously. The operating ranges are 99V to 129V if the variation from 60 Hz is not greater than ± 0.3 Hz, or 105V to 129V if the variation from 60 Hz is not greater than ± 3.0 Hz.

4.51 The ac distribution required for a typical ECSA system consisting of two cabinets is shown in Fig. 11. A block diagram of a nonreserve



NOTES:

1. CABINET HEIGHT IS 1207 mm (47.5 IN.)
2. APPROXIMATELY 150 mm (6 IN.) VENTILATION SPACE IS REQUIRED ABOVE CABINETS.

Fig. 10—ECSA Minimum Floor Space Requirements—2-Cabinet System

power distribution is shown in Fig. 12. The telephone company engineer must arrange with the customer and an electrical contractor for the installation and wiring of an approved load center equipped with thermal magnetic circuit breakers, branch circuit wiring, and a wall-mounted receptacle for each cabinet. One circuit breaker and one receptacle are required per cabinet. In all cases, ac wiring and equipment must comply with local codes.



The load center (ITE EQ4, or approved equivalent), ground bars (ITE GB-10), and HUBBELL (IG-2310) receptacles should be installed by the customer prior to start of ECSA installation.*

Load Center

4.52 The customer-provided load center (circuit panel ITE EQ4, or approved equivalent) of appropriate current rating shall be equipped with 20-ampere, single-pole thermal magnetic circuit break-

*Registered trademark of Harvey Hubbell, Inc.

ers (ITE QP1-B020 typical, or approved equivalent). Each circuit breaker is to protect one associated wall-mounted receptacle. A circuit breaker and receptacle shall be provided to accommodate each cabinet (Fig. 11).

4.53 A 2-piece ground bar (ITE GB-10 typical, or approved equivalent) will be provided locally. The ground bar (Fig. 13) should be installed according to details given later in this Part under the heading **GROUNDING**.

4.54 The National Electrical Code and most local codes require that the load center be grounded through an "equipment grounding conductor" which can be one, or a combination, of the following:

- (1) A separate corrosion-resistant conductor (green wire)
- (2) Rigid metal conduit
- (3) Electrical metallic tubing.

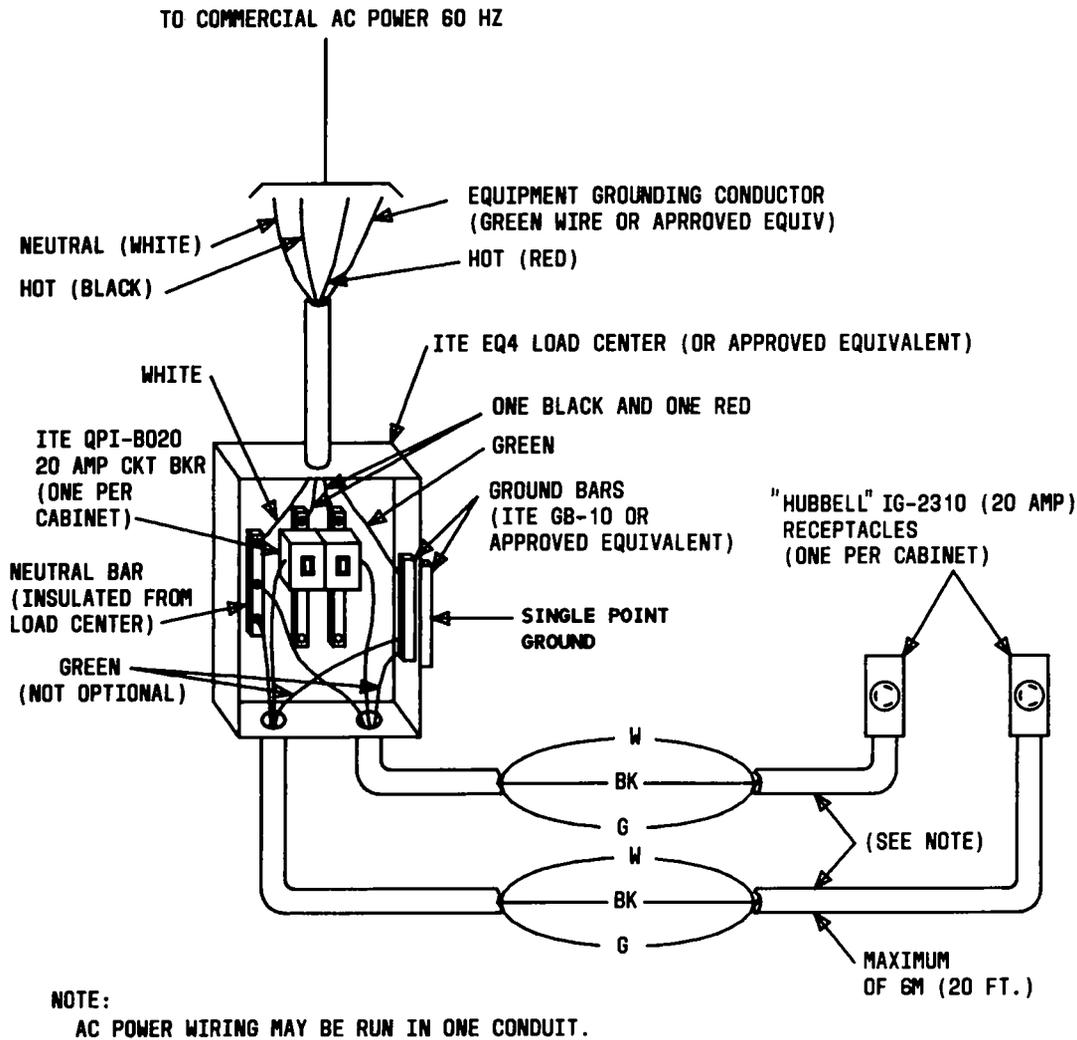


Fig. 11—Typical Load Center and Ground Bars

The presence of a separate green wire (between the load center and the ac service entrance), when provided in addition to the approved metallic conduit, contributes negligibly to the protection of the PBX against lightning surges. A separate green wire conductor is therefore not specified as an installation requirement but is recommended, if practical, in order to provide a more reliable equipment grounding conductor.

Power Receptacles

4.55 One HUBBELL twist-lock power receptacle, Cat. No. IG-2310, may be ordered to be shipped

with each cabinet for the power outlet installation. It may also be purchased locally by the telephone company, if desired. A power outlet must be provided behind each cabinet.

4.56 The ac wiring between the load center and wall-mounted receptacle should be kept as short as practical and should not exceed 6096 mm (20 feet) in length. A separate neutral wire (white) shall be run from the load center neutral bar (this is not the single-point ground) to each receptacle. The cabinet circuits shall be distributed evenly as possible over the feeder circuit.

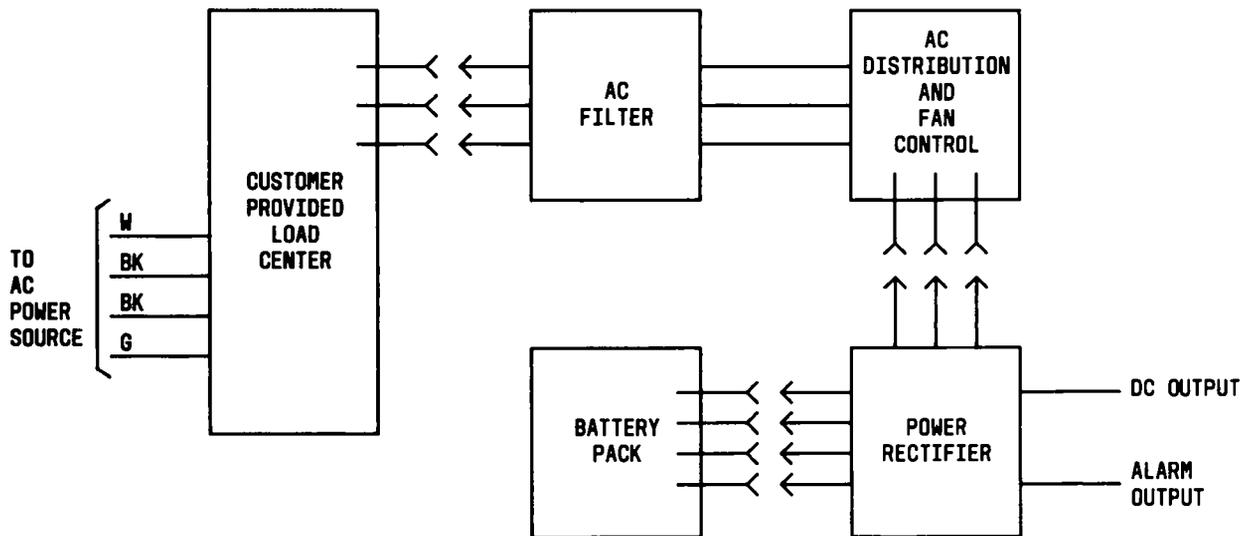


Fig. 12—Nonreserve Power Distribution—Block Diagram



The conduit, or other metallic enclosure, shall not be used to replace the green wire ground between the load center and the HUBBELL receptacles. A separate equipment ground wire (green wire) is required between the load center and each receptacle.

4.57 Since the equipment ground for the wall-mounted ac receptacles should be connected through the green conductor only, receptacles that are designed to obtain equipment ground through the conduit (when mounted in a metallic junction box) should not be used in the ECSA installation. The HUBBELL IG-2310 (insulated ground) receptacle has its ground terminal insulated from its mounting hardware and has been specified for this purpose.

ECSA AC Current Drain



The values given here for current drain should not be used either for design purposes or for specifying the electrical service required for the ECSA.

4.58 The values calculated from the information that follows are typical current drains (in amperes) at 120 Vac 60 Hz. These values should only be used to estimate the electrical power consumption

of a given system at a given time since current drain varies with voltage, frequency, traffic, etc.

4.59 The ac current drain for the ECSA system is the sum of the current in both cabinets. The current drain for a single cabinet depends on the number of carriers and other equipment in the cabinet. The equivalent -48V current drain for the carriers and other equipment is shown in Table E and can be used to determine the total current drain in a cabinet.

STANDARD MEMORY HOLDOVER

4.60 A standard non-reserve power arrangement provides approximately 90 seconds of memory holdover during a power failure. A rechargeable battery pack KS20390, List 8 provides the backup power.

4.61 If power is not restored to the system within 90 seconds, information pertaining to energy loads, power meter interfaces, and other stored data could be lost. When some form of backup power is available, the 90-second period should be sufficient time for the backup system to come on-line and begin powering the ECSA.

GROUNDING

4.62 Grounding for the ECSA cabinets is provided by a system single-point ground. The single-

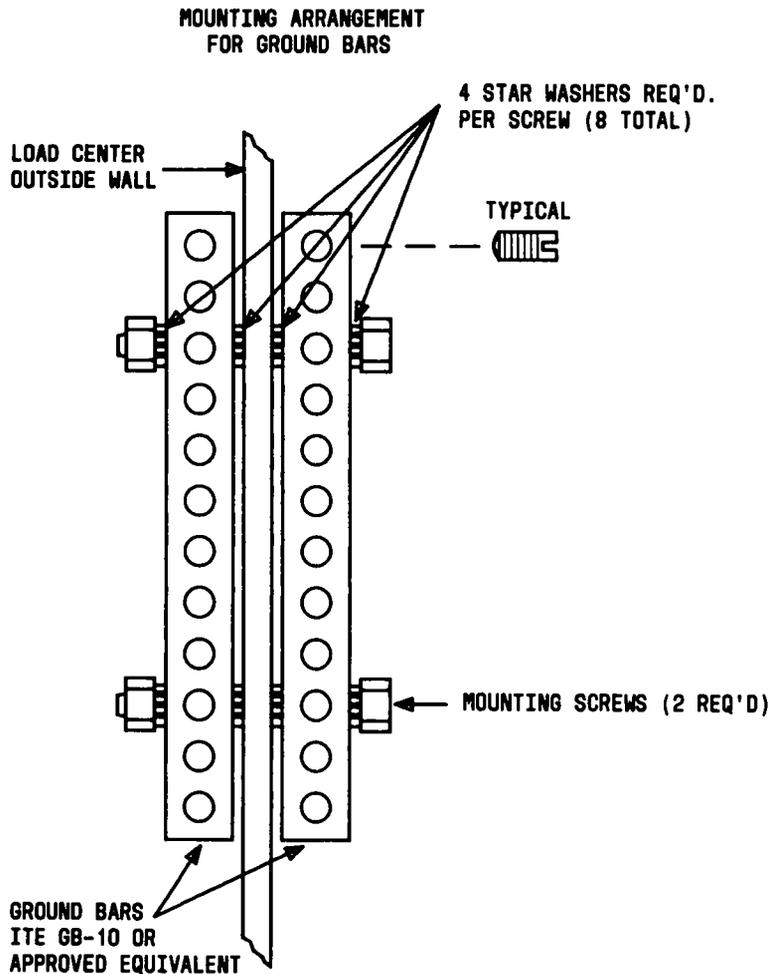


Fig. 13—Ground Bar for Load Center

point ground is a sandwiched ground bar arrangement (Fig. 13) mounted on the side of the load center (Fig. 11 and 14). The load center (of appropriate current rating) should be installed by an approved electrical contractor in accordance with the National Electrical Code and local codes.

4.63 The ground bars (two ground bars) shall be mounted back-to-back on the side of the load center. They are to be held together by two screws in a sandwiched arrangement, with one part inside the load center cabinet and the other part outside. Star washers (which dig into the metal surface) shall be used between screwheads and ground bar, between nuts and ground bar, and between each ground bar and load center wall (two places per screw). These star washers are used to ensure a reliable electrical bond between the ground bar and load center. The part of the ground bar (single-point ground) inside

the load center shall be used to terminate the green wire ground (equipment grounds). The neutral (circuit ground) shall not terminate on the single-point ground.

4.64 The part of the ground bar on the outside wall of the load center shall be used by the ECSA installer for grounding the system. All of the following connections must be made to the single-point ground:

- (a) A No. 6 AWG conductor to one of the following approved ground sources:
 - A metallic cold water pipe (at least 12.7 mm [1/2 inch] diameter) that is electrically continuous through the water meter and extends at least 3048 mm (10 feet) in earth.

TABLE E
TOTAL CURRENT DRAIN

CARRIER EQUIPMENT	J87460D RECTIFIER EQUIVALENT -48V DRAIN
Control/Energy Carrier J53135AA	8 Amperes
Energy Carrier J53135AB	5 Amperes
Minirecorder, MAAP, and Alarm Panel	0.64 Amperes

- The steel frame of a steel frame building which is electrically connected to the water pipe and the power source ground.
 - The power source ground. This is the electrode to which the neutral wire of the electrical power service (entering the building) is grounded.
- (b) A No. 6 AWG conductor to the ground bar in basic or first cabinet.
- (c) A coupled bonding conductor connecting the single-point ground to the approved floor ground in a high-rise building or to an approved ground connection.

Note: Construction personnel, installing riser cables or other cables in the building, have the responsibility to provide the coupled bonding conductor up to the closet or cross-connect field, and the ECSA installers have the responsibility to extend the conductor to the single-point ground.



Ground isolation: Care should be exercised when implementing the grounding scheme. To preserve the integrity of the single-point ground arrangement, verify that neither the cabinet nor any framework on the ECSA side of the customer-provided load center is connected to (or may

be moved to inadvertently come in contact with) ground at a place other than at the single-point ground.

- 4.65** The single-point ground (bar), mounted on the side of the load center, shall be tagged with Form E-3013B. This form requests that the telephone company repair service be notified if connections are loose or if they must be removed.
- 4.66** The protector ground terminal shall be connected to an approved ground source closest to the protector. The first choice for approved ground is to the nearest point on the power service ground system. This may be the power service ground wire, grounding electrode, or the service entrance conduit.
- 4.67** Alternate choices for an approved ground are a metallic water pipe or building steel **which are bonded to the power service ground.** The alternate choices should be used when located closer than the power service ground, because it is important to keep the protector ground wire as short as possible.

Note: Refer to Section 876-300-100 for details on approved grounds.

- 4.68** When a data set is used with the ECSA system, the circuit ground of the data set must be isolated from the data set frame by opening the appropriate (screw) switch. For example, when the 113D data set is used for remote maintenance, administration, and traffic system (RMATS), apply option P (no common ground). Option P opens screw switch S1 in the data set. This isolation is necessary to ensure that lightning surges on the data set green wire ground are not transmitted to the ECSA.

PROTECTION

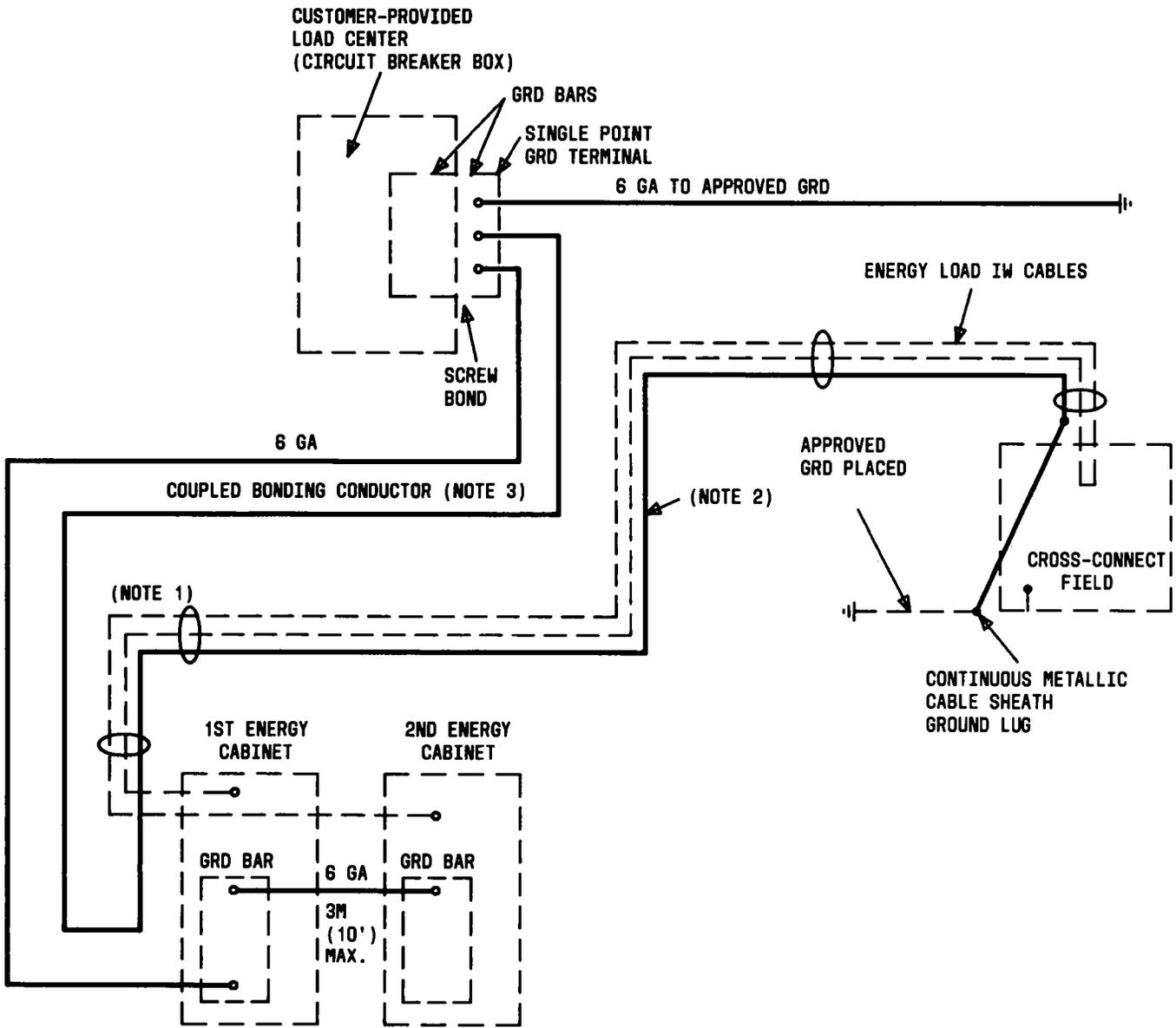
Electrical Protection

- 4.69** Whenever the ECSA is installed in an environment where it may be exposed to lightning surges or to ac power voltages (either by direct contact or by induction), refer to Section 876-300-100 to determine the exposure status of the installation and for detailed protection requirements.



TO MINIMIZE LIGHTNING SURGES AT THE PBX:

- **Always ground and bond ECSA in the prescribed manner.**



NOTES:

1. CABLE TIES SHOULD LASH ALL ENERGY LOADS IW CABLES, (FROM THE CABINETS TO THE CROSS-CONNECT FIELD) TO THE COUPLED BONDING CONDUCTOR.
2. COUPLED BONDING CONDUCTOR IS:
 - CONTINUOUS CABLE SHEATH
 - 6 GOOD CABLE PAIRS
 - 10 GA WIRE.

Fig. 14—Grounding and Bonding Diagram for ECSA

- **Verify that the cold water pipe system is bonded to the ac power service entrance ground.**
- **Verify that the metallic shield of the building entrance cable is grounded and also bonded to the protector ground terminal.**

Coupled Bonding Conductor

4.70 The coupled bonding conductor provides an electrical connection between the ECSA single-point ground and an approved ground connection. This connection is needed to reduce the difference in (electrical) potential that can appear between energy load leads and the system ground as a result of lightning surges.

4.71 For methods of providing the coupled bonding conductor in high-rise and in low, wide buildings, see Section 876-300-100.

4.72 Figure 14 is an illustration of the grounding and bonding conductors to be placed by installation personnel.

UNINTERRUPTIBLE POWER SERVICE (UPS)

4.73 Uninterruptible power service is available for use with the ECSA systems (Fig. 15). The UPS provides power holdover to the ECSA cabinets for

short-term power disruptions. Whenever a commercial power failure occurs, the battery (part of the UPS unit) assumes the ECSA load until the commercial power is restored or until the battery voltage drops to a predetermined level. The low voltage cutoff (about 42 volts) is provided to prevent battery damage. The ECSA system operations stop when the voltage cutoff is reached. When the commercial ac power is restored, the battery will fully charge in about 24 hours. The UPS arrangements are defined as **nominal holdover and extended holdover**.

4.74 The **UPS nominal holdover** arrangement is completely self-contained and is installed in ECSA cabinets in place of normal power supply units. During a power interruption, the nominal holdover equipment provides electrical power through a UPS rectifier/converter power supply. The power originates from a UPS battery pack which has been charged from commercial power by a UPS battery charger. The batteries provide approximately 48V at 5 ampere-hours (Ah). This permits the nominal holdover period to be around 5 minutes under a full load condition. Additional connecting details for UPS nominal holdover is shown in Fig. 16. The UPS nominal holdover equipment is listed as follows:

- One J87460D rectifier/converter power supply

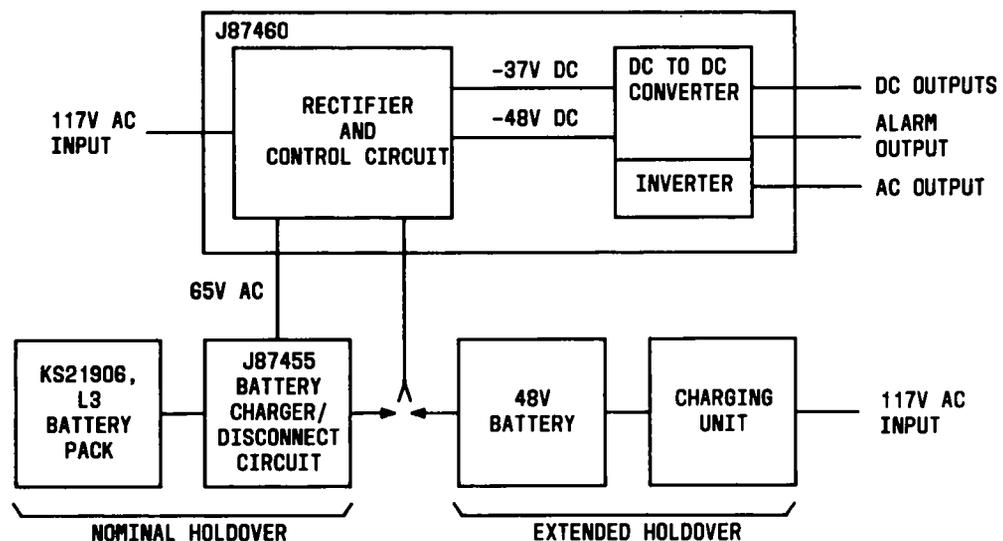


Fig. 15—Uninterruptible Power Service—Block Diagram

- One J87455A battery charger and disconnect circuit (installed in cabinet with UPS power supply)
- One KS-21906, L3, battery pack (installed in cabinet with UPS power supply)
- One J53135JA-1, L2 ac power distribution and fan assembly.

4.75 The UPS nominal holdover provides power only for the ECSA cabinets. The service does not provide power for any auxiliary devices.

4.76 The *UPS extended holdover* arrangement increases the holdover period to approximately 8 hours. The extended holdover service uses a separately housed battery plant and charging unit such as a 105E power plant. The UPS extended holdover equipment is listed as follows and is illustrated in Fig. 17:

- One customer-provided load center (or panel board ITE EQ6 typical, or approved equivalent) equipped with circuit breakers
- One 105E power plant or approved equivalent, equipped with rectifiers
- One J87460D rectifier/converter power supply
- One J53135JA-1, L2 ac power distribution and fan assembly.

4.77 The -48 volts is to be supplied to the ECSA cabinet(s) by the reserve power plant discharge circuit through a filter in the power supply. The filter output terminals are already connected to the proper power distribution terminals and require no modification. With J87460D reserve power rectifiers, lead -48RSV (A, B) is connected to the corresponding internal filter input terminal on the rectifier designated as terminal 1 on TB1. The associated ground lead GRD RSV (A, B) is connected to the corresponding cabinet ground block.

4.78 The load center must be equipped with the ITE QP1-B020 thermal-magnetic circuit breaker for each rectifier in the 105E plant.

4.79 The steady state input current values for various ECSA units (120 Vac 60 Hz) are:

- One 105E power plant rectifier = 8A (Fig. 17 shows four rectifiers connected)

- One (fully loaded) system cabinet 00 = 8A
- One (fully loaded) system cabinet 01 = 5A.

4.80 The various 105E power plant options required to be implemented are:

- Wired for negative battery
- Without CEMF cell
- With alarm circuit
- With battery on PG lead to provide combined fuse and low-voltage alarm on a single lead
- With rectifier PG lead multiplied to originating discharge circuit FA1 alarm lead
- Without separation of discharge fuse alarms and control fuse alarms
- For normal continuous loads
- Discharge ground insulated from framework
- With the rectifier wired for negative output (120 Vac 60 Hz); ie, "+" terminal tied to battery discharge ground.

4.81 The -48 Vdc drains (in amperes) used for calculating reserve power elements are shown in Table E. Unit drain for voltages is expressed in terms of the -48V direct current from the battery plant required to generate them. Only one equivalent -48 Vdc drain is listed per carrier (corresponding to a fully equipped carrier) since this value remains essentially constant.

Note: The number of 100 ampere-hour battery strings can be determined from the idle and busy-hour battery drains calculated by following standard power engineering procedures. The number of 11- to 15-ampere rectifiers provided as part of the 105E power plant should be such that they can carry the full system load and also be able to replenish the batteries in the desired time interval.

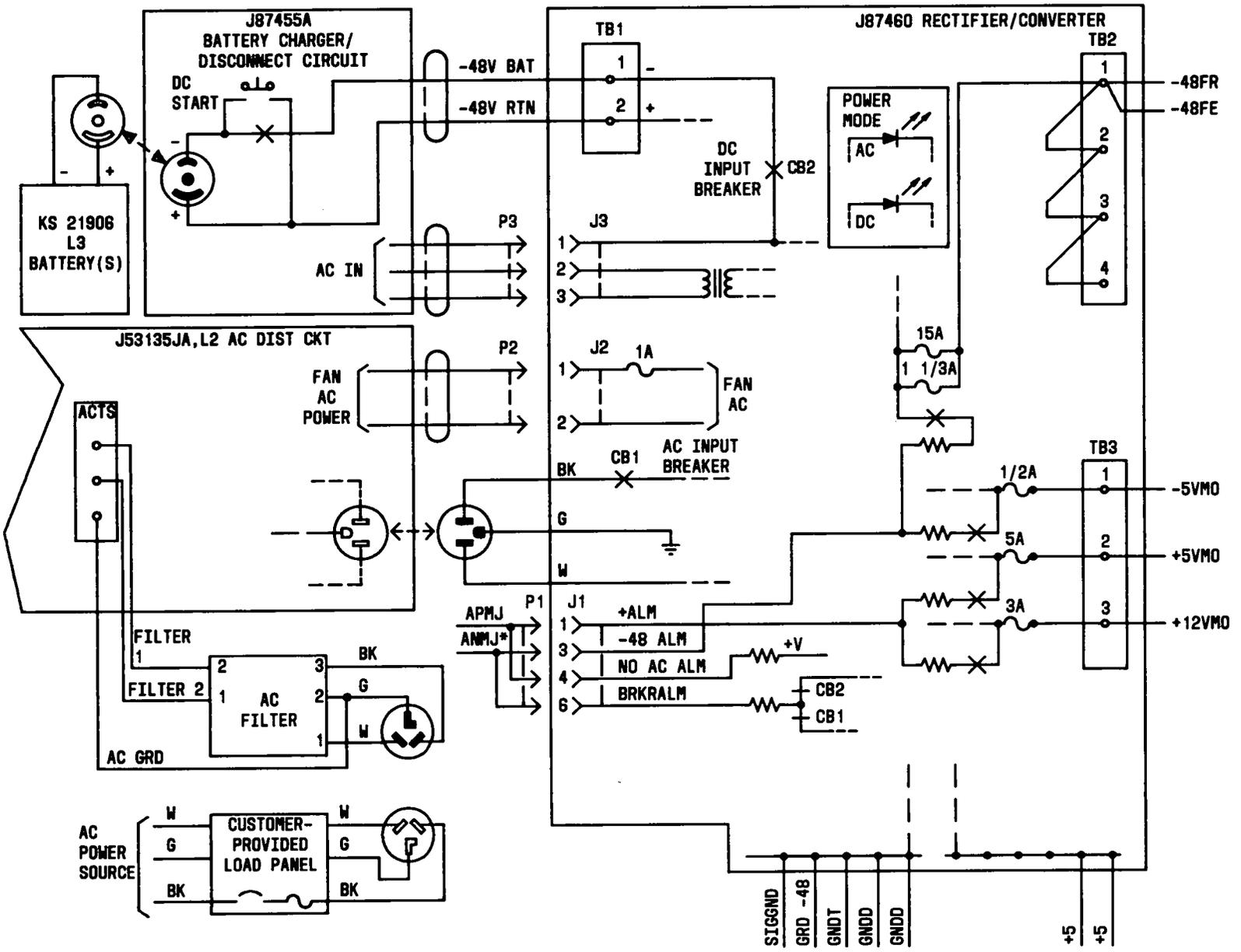


Fig. 16—Uninterruptible Power Service—Extended Holdover

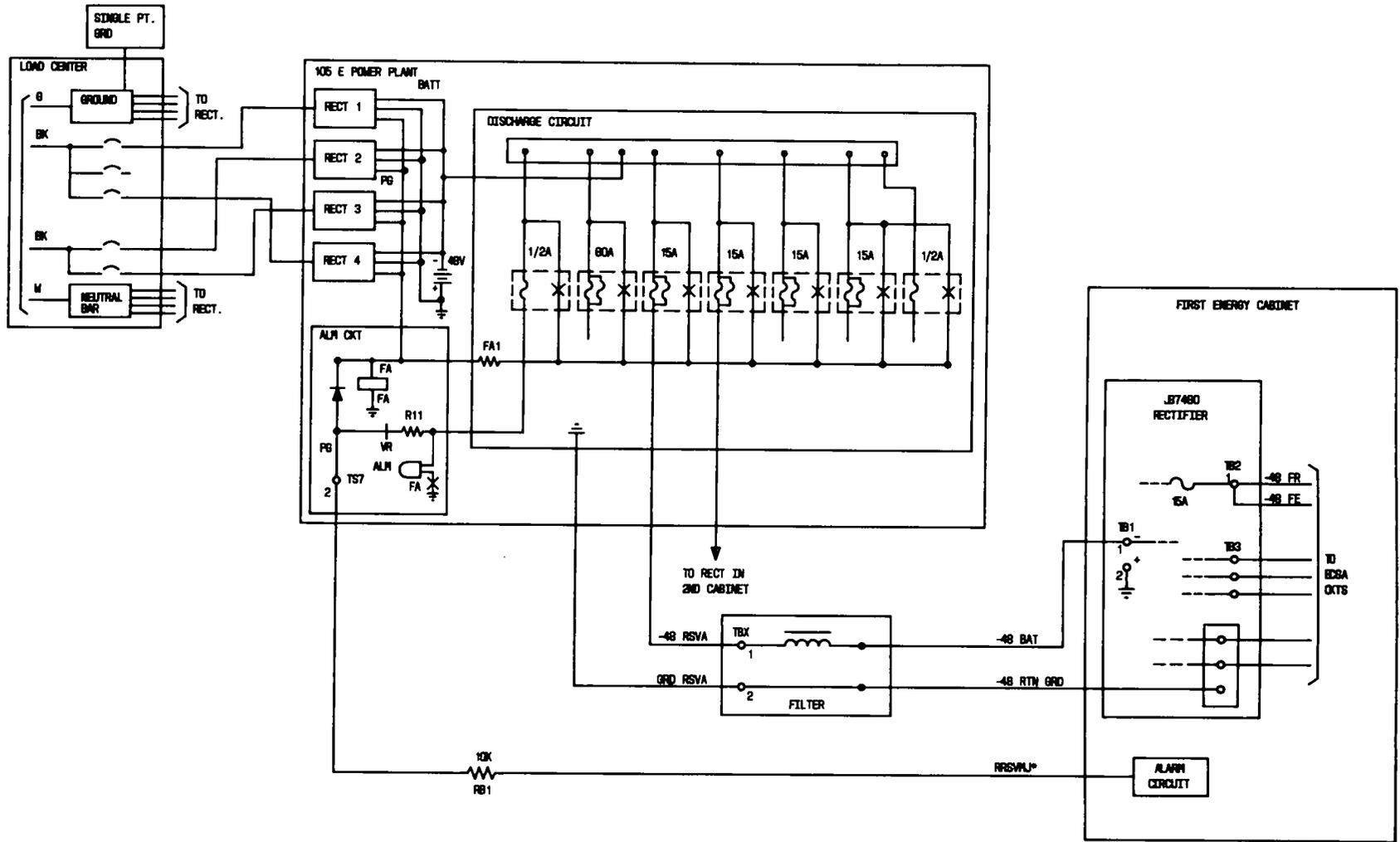


Fig. 17—Uninterruptible Power Service—Extended Holdover

CABLING

4.82 Circuits in the ECSA cabinets are connected to the loads, console(s), etc, via connector cables using KS-type plugs (Fig. 18). The cables are then cut down on the cross-connect field. They may be ordered via the Mechanized Ordering Form (E-8190). Some special cables (shielded types) are used for high-frequency data channels and carrier-to-carrier cabling.



Do not remove spare coaxial terminals in the KS-19820 connectors.

4.83 The A25-D type cables should be specified for connections from the cabinet to the cross-connect field. Connectors for the cables and carriers are designated by module number, carrier number, cable function, and cable number as follows:

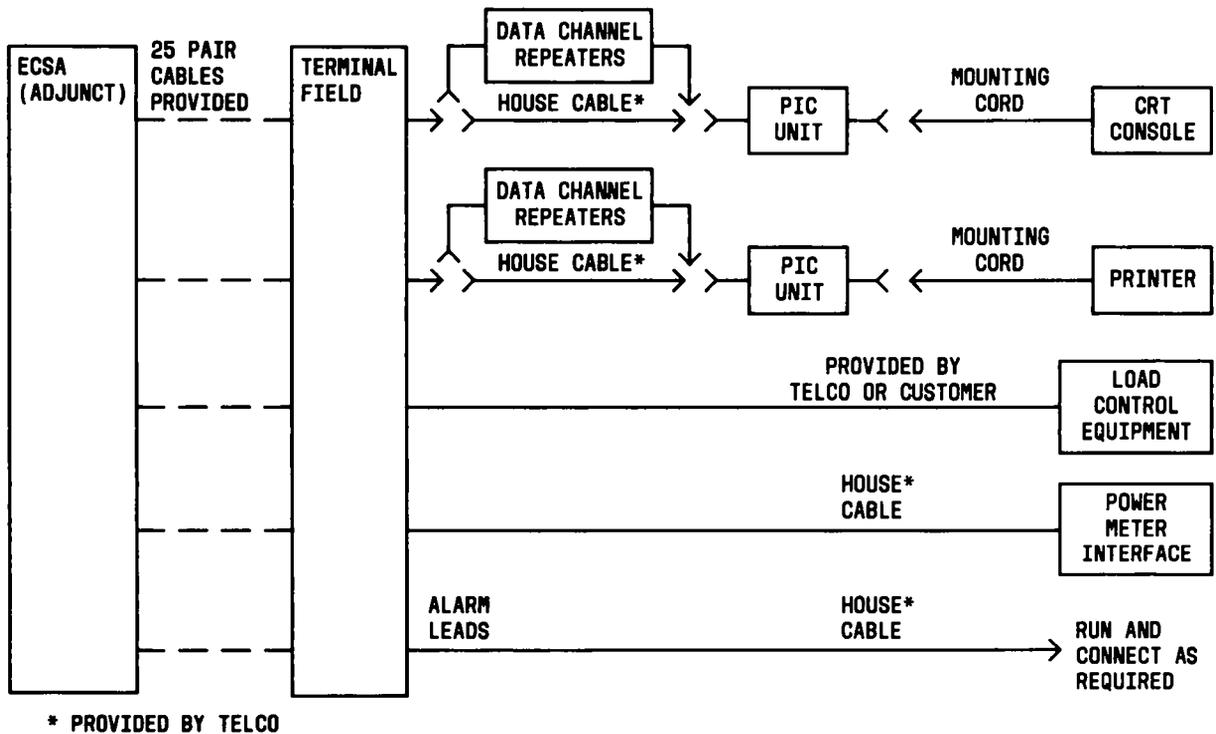
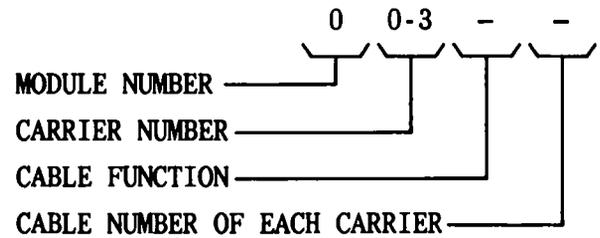


Fig. 18—Cabling From the ECSA to Peripheral Equipment via Cross-Connect Field

An example designation may be 01EB03 which indicates module 0, carrier 1, energy carrier, and the third cable from the carrier.

(a) **Carrier number:** Assigned sequentially for each carrier in the system (Fig. 6 and 7). The ECSA may contain the following carriers:

- (1) Control/energy carrier (J53135AA)—One required for each system.
- (2) Energy carrier (J53135AB)—Maximum of one allowed per each cabinet.

(b) **Cable Function:** Circuit designations on the associated backplanes associated with the cables and connectors are as follows:

- (1) AP—Alarm panel
- (2) BA, BB, BC, BHS, BRM, BX—Control/energy carrier
- (3) EB, GA, MC—Energy carrier

(c) **Cable plan to the cross-connect field** is shown in Fig. 19:

- (1) AP7 on alarm panel
- (2) BB02 through BB07 on control/energy carrier
- (3) BX01 on control/energy carrier
- (4) EB01 through EB26 on energy carrier.

CROSS-CONNECTIONS

DANGER: Hazardous foreign voltage may exist on leads extending to customer load control circuitry and power meters via the cross-connect field.

A. Cross-Connect Field

4.84 Three typical layouts for an ECSA system cross-connect field are shown in Fig. 20. The layout selected will depend on the number of energy loads associated with the system.

4.85 Colored 183-type backboards are used on the cross-connect field to identify the type circuits to be terminated at the various positions. The recommended 66-type connecting blocks are identified with the system cables which terminate on the blocks. Backboard color and type of circuits terminated are as follows:

BACKBOARD	CIRCUITS OR EQUIPMENT
COLOR	TERMINATED
Blue (183B1)	Energy load or meter circuits
Yellow (183B5)	ECSA load circuits

4.86 White 196A backboards, having stand-off type distribution rings, are used to separate the field into upper and lower sections and are intended for use when wiring and cross-connecting the various connecting blocks.

B. Cross-Connect Field Enclosures

4.87 The cross-connect field enclosure assembly (Fig. 21) may be required to satisfy FCC registration requirements. It is available in two sizes as follows:

(a) 432 mm (17 inches) wide, 686 mm (27 inches) high, and 229 mm (9 inches) deep. The 686-mm (27-inch) high assembly is used to cover one standard 432- by 508-mm (17- by 20-inch) backboard and one 196A distribution ring. This size can be expanded horizontally and vertically as required.

(b) 432 mm (17 inches) wide, 1372 mm (54 inches) high, and 229 mm (9 inches) deep. The 1372-mm (54-inch) high assembly is used to cover two standard 432- by 508-mm (17- by 20-inch) backboards and two 196A distribution rings. This size can be expanded horizontally as required.

4.88 The cross-connect field enclosures may be multiplied horizontally as needed. The top and side panels will accommodate the additional depth of

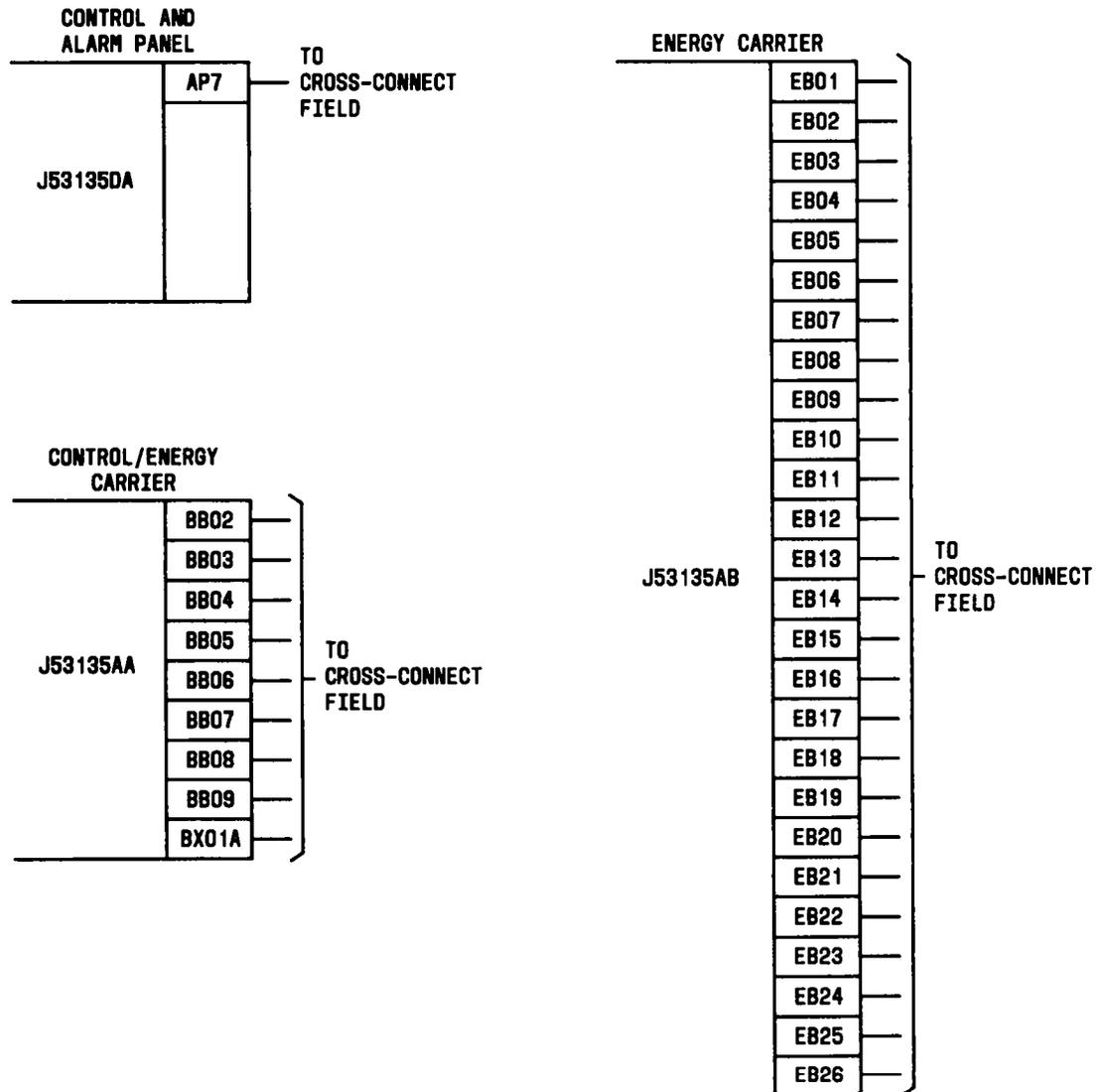


Fig. 19—Cabling Plan to Cross-Connect Field

the 19-mm (3/4-inch) backboard on which the frame assembly is mounted. If the frame assembly is mounted directly on the wall (without the wooden backboard), group 4 assembly method (ED-1E322-71, -72) of the door panel should be used. This compensates for the added depth due to the absence of the backboard.

4.89 Mount the cross-connect field enclosure assembly with the top approximately even with the top of the cabinets.

4.90 The installation of a 1372-mm (54-inch) high

cross-connect field enclosure (ED-1E322-71) to be mounted on a wooden backboard requires the following:

- One GR1 (group), consisting of basic enclosure with door, brackets, and hardware
- Two GR2 (groups), each consisting of one side panel and hardware
- Two GR3 (groups), each consisting of one top/bottom panel and hardware.

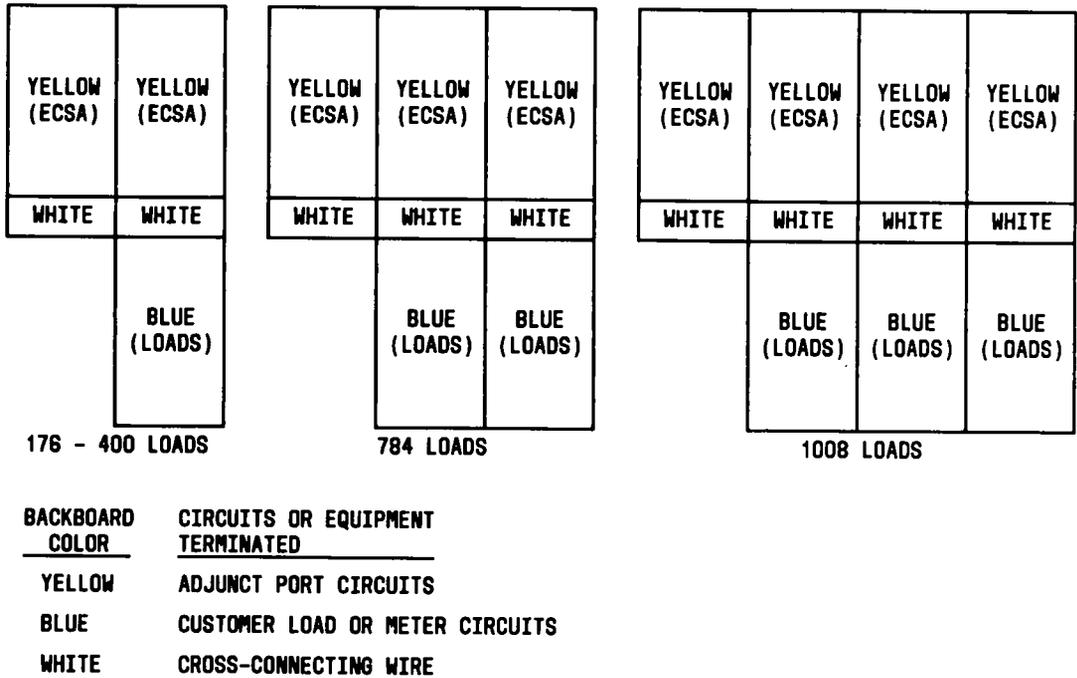


Fig. 20—Typical ECSA Cross-Connect Fields

When more than one enclosure is used (joined), GR2 side panels are required only at the ends.

4.91 The installation of a 1372-mm (54-inch) high cross-connect field enclosure (ED-1E322-71) to be mounted *flush on the wall* requires the following:

- One GR4 (group), consisting of basic enclosure with door, brackets, and hardware
- Two GR2 (groups), each consisting of one side panel and hardware
- Two GR3 (groups), each consisting of one top/bottom panel and hardware.

When more than one enclosure is used (joined), GR2 side panels are required only at the ends.

4.92 The installation of a 686-mm (27-inch) high cross-connect field enclosure (ED-1E322-72) to be mounted *on a wooden backboard* requires the following:

- GR1 (group), consisting of the basic enclosure with door, brackets, and hardware

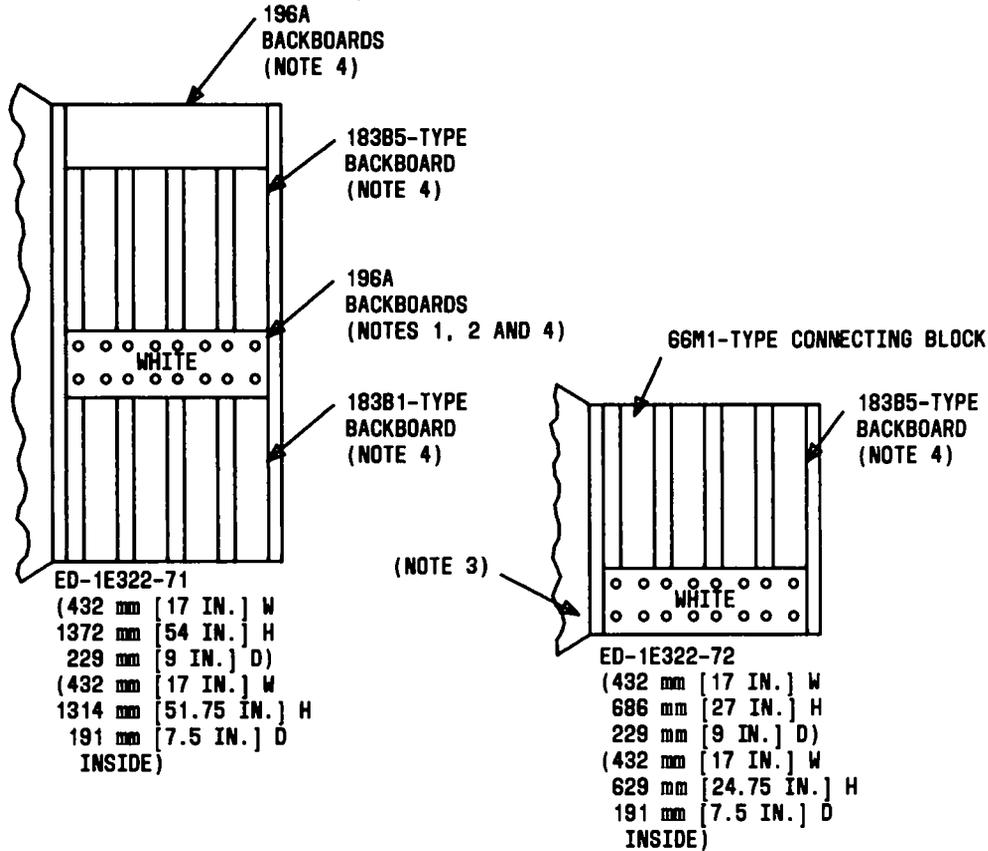
- Two GR2 (groups), each consisting of one side panel and hardware
- Two GR3 (groups), each consisting of a top/bottom panel with hardware.

When more than one enclosure is used (joined), GR2 side panels are required only at the ends.

4.93 The installation of a 686-mm (27-inch) high cross-connect field enclosure (ED-1E322-72) to be mounted *flush on the wall* requires the following:

- One GR4 (group), consisting of a basic enclosure with door, brackets, and hardware
- Two GR2 (groups), each consisting of one side panel and hardware
- Two GR3 (groups), each consisting of one top/bottom panel and hardware.

When more than one enclosure is used (joined), GR2 side panels are required only at the ends.



CODE (NOTE 4)	BACKBOARD COLOR	CIRCUITS OR EQUIPMENT TERMINATED
A	WHITE	CROSS-CONNECT
B1	BLUE	CUSTOMER LOAD OR METER CIRCUITS
B5	YELLOW	ADJUNCT PORT CIRCUITS

NOTES:

1. PLYWOOD BACKBOARD MOUNTS FOR ALL SIZES (OPTIONAL).
2. BACKBOARD ARRANGEMENTS ARE FLEXIBLE. REFER TO 518-010-101 TYPICAL LAYOUTS.
3. CABLING IN THROUGH KNOCKOUTS IN SIDE AND BOTTOM.
4. "A" SIZE = 216 mm X 508 mm (8.5" X 20"). "B" SIZE 432 mm X 508 mm (17" X 20").

Fig. 21—Cross-Connect Field Enclosure

4.94 The cross-connect field enclosures are designed to be located on customer premises and may house the following apparatus:

- 183-type backboards
- 184-type backboards
- 187B1 backboards

- 196A backboards.

Backboard ordering information is shown in Table F.

C. Cross-Connect Tables

4.95 Computer-generated cross-connect tables are delivered from the factory prior to delivery of the system. These tables should be completed and provided for installer use at the time of installation.

TABLE F

BACKBOARD DESIGNATIONS

TYPE	COLOR	SIZE IN MILLIMETERS (INCHES)	ORDERING CODE
183A5	Yellow	216 (8.5) X 508 (20)	101986446
183B1	Blue	432 (17) X 508 (20)	101412989
183B5	Yellow	432 (17) X 508 (20)	101986453
196A	White	432 (17) X 117 (4.6)	102581089
187B1	White	432 (17) X 168 (6.6)	101937944

Worksheets (similar to the cross-connect tables) for apparatus and/or equipment interconnections are located at the end of this section for use when planning the system initial configuration. Worksheets should include cross-connections from the alarm panel and the control/energy and energy carriers, and interconnections for apparatus associated with each feature. The worksheets should be retained for office records.

D. Energy Load and Power Meter Interface Cross-Connections

Note: Two electrical slots are required for a single circuit pack, and each carrier connector provides cross-connections for three electrical slots or one and one-half circuits packs. For example, connector BB02 (Fig. 22) provides leads for board in paired-slots 3 and 4, and half of board in paired-slots 5 and 6. Connector BB03 provides leads for other half of board in slots 5 and 6 as well as board in slots 7 and 8.

4.96 Energy load and power meter interface cross-connections from the control/energy carrier are shown in Fig. 22. The first 16 circuits to the cross-connect field, via the BB02 connector, are shown extended from power meter interfaces. This indicates that the LC563 circuit pack (one per system for power meter interfaces) is installed in slots 3 and 4 of the first segment (0 segment) of the control/energy carrier. The circuit pack ships in this position with each initial system configuration. However, the LC563 unit may be installed in any one of slots 3 through 16, segment 0, slots 1 through 10, segment 1, or any energy load slot in an energy carrier. The remaining slots are filled with LC562 circuit packs as required.

When the LC563 is not required, an LC562 may be installed to provide interfaces for 16 additional energy loads.

4.97 The energy load cross-connections from an energy carrier are shown in Fig. 23. Only connectors EB01 through EB10 are required for a second energy carrier when provided. The second energy carrier needs only to be partially equipped in order to reach maximum system configuration.

4.98 The lead designations for the energy load and power meter interfaces shown in Fig. 22 and 23 contain either three or four numerals. The first and last digits represent the segment and circuit numbers respectively. The one or two center digits represent the slot number. Examples are:

- (1) MR043 = Power meter interface associated with 0 segment, 4th slot, and the 3rd circuit
- (2) CID1127 = Energy load interface associated with 1st segment, 12th slot, and the 7th circuit.

4.99 Tables G and H are filled-in examples of the cross-connect worksheets for the power meter interfaces and energy loads respectively. Worksheets should provide the following information for each load or power meter interface equipped:

- Equipment location (carrier, segment, slot, etc)
- Circuit number
- Power meter interface or energy load number
- Lead designations

A25D CONNECTOR CABLES FROM CONTROL/ENERGY CARRIER CONNECTORS								AT YELLOW BACKBOARD	
LEAD DESIGNATIONS FOR LC562 OR LC563 (NOTE)								CUT LEADS DOWN ON	
BB02	SEG/SLOT	BB03	SEG/SLOT	BB04	SEG/SLOT	BB05	SEG/SLOT	LEAD COLOR	CONN BLK TERMINALS
MR030	0/3	CIG060	0/6	CIG090	0/9	CIG0120	0/12	W-BL	1
M030		CID060		CID090		CID0120		BL-W	2
MR031		CIG061		CIG091		CIG0121		W-O	3
M031		CID061		CID091		CID0121		O-W	4
MR032		CIG062		CIG092		CIG0122		W-G	5
M032		CID062		CID092		CID0122		G-W	6
MR033		CIG063		CIG093		CIG0123		W-BR	7
M033		CID063		CID093		CID0123		BR-W	8
MR034		CIG064		CIG094		CIG0124		W-S	9
M034		CID064		CID094		CID0124		S-W	10
MR035		CIG065		CIG095		CIG0125		R-BL	11
M035		CID065		CID095		CID0125		BL-R	12
MR036	CIG066	CIG096	CIG0126	R-O	13				
M036	CID066	CID096	CID0126	O-R	14				
MR037	CIG067	CIG097	CIG0127	R-G	15				
M037	CID067	CID097	CID0127	G-R	16				
MR040	0/4	CIG070	0/7	CIG100	0/10	CIG130	0/13	R-BR	17
M040		CID070		CID100		CID130		BR-R	18
MR041		CIG071		CIG101		CIG131		R-S	19
M041		CID071		CID101		CID131		S-R	20
MR042		CIG072		CIG102		CIG132		BK-BL	21
M042		CID072		CID102		CID132		BL-BK	22
MR043		CIG073		CIG103		CIG133		BK-O	23
M043		CID073		CID103		CID133		O-BK	24
MR044		CIG074		CIG104		CIG134		BK-G	25
M044		CID074		CID104		CID134		G-BK	26
MR045		CIG075		CIG105		CIG135		BK-BR	27
M045		CID075		CID105		CID135		BR-BK	28
MR046	CIG076	CIG106	CIG136	BK-S	29				
M046	CID076	CID106	CID136	S-BK	30				
MR047	CIG077	CIG107	CIG137	Y-BL	31				
M047	CID077	CID107	CID137	BL-Y	32				
CIG050	0/5	CIG080	0/8	CIG110	0/11	CIG140	0/14	Y-O	33
CID050		CID080		CID110		CID140		O-Y	34
CIG051		CIG081		CIG111		CIG141		Y-G	35
CID051		CID081		CID111		CID141		G-Y	36
CIG052		CIG082		CIG112		CIG142		Y-BR	37
CID052		CID082		CID112		CID142		BR-Y	38
CIG053		CIG083		CIG113		CIG143		Y-S	39
CID053		CID083		CID113		CID143		S-Y	40
CIG054		CIG084		CIG114		CIG144		V-BL	41
CID054		CID084		CID114		CID144		BL-V	42
CIG055		CIG085		CIG115		CIG145		V-O	43
CID055		CID085		CID115		CID145		O-V	44
CIG056	CIG086	CIG116	CIG146	V-G	45				
CID056	CID086	CID116	CID146	G-V	46				
CIG057	CIG087	CIG117	CIG147	V-BR	47				
CID057	CID087	CID117	CID147	BR-V	48				
								V-S	49
								S-V	50

SEE NOTE AT END OF FIG.

Fig. 22—Control/Energy Carrier Cross-Connections (Sheet 1 of 2)

A25D CONNECTOR CABLES FROM CONTROL/ENERGY CARRIER CONNECTORS								AT YELLOW BACKBOARD	
LEAD DESIGNATIONS FOR LC562 OR LC563 (NOTE)								CUT LEADS DOWN ON	
BB06	SEG/SLOT	BB07	SEG/SLOT	BB08	SEG/SLOT	BB09	SEG/SLOT	LEAD COLOR	CONN BLK TERMINALS
CIG0150		CIG120		CIG150		CIG180		W-BL	1
CID0150		CID120		CID150		CID180		BL-W	2
CIG0151		CIG121		CIG151		CIG181		W-O	3
CID0151		CID121		CID151		CID181		O-W	4
CIG0152		CIG122		CIG152		CIG182		W-G	5
CID0152		CID122		CID152		CID182		G-W	6
CIG0153		CIG123		CIG153		CIG183		W-BR	7
CID0153	0/15	CID123	1/2	CID153	1/5	CID183	1/8	BR-W	8
CIG0154		CIG124		CIG154		CIG184		W-S	9
CID0154		CID124		CID154		CID184		S-W	10
CIG0155		CIG125		CIG155		CIG185		R-BL	11
CID0155		CID125		CID155		CID185		BL-R	12
CIG0156		CIG126		CIG156		CIG186		R-O	13
CID0156		CID126		CID156		CID186		O-R	14
CIG0157		CIG127		CIG157		CIG187		R-G	15
CID0157		CID127		CID157		CID187		G-R	16
CIG0160		CIG130		CIG160		CIG190		R-BR	17
CID0160		CID130		CID160		CID190		BR-R	18
CIG0161		CIG131		CIG161		CIG191		R-S	19
CID0161		CID131		CID161		CID191		S-R	20
CIG0162		CIG132		CIG162		CIG192		BK-BL	21
CID0162		CID132		CID162		CID192		BL-BK	22
CIG0163		CIG133		CIG163		CIG193		BK-O	23
CID0163		CID133		CID163		CID193		O-BK	24
CIG0164	0/16	CIG134	1/3	CIG164	1/6	CIG194	1/9	BK-G	25
CID0164		CID134		CID164		CID194		G-BK	26
CIG0165		CIG135		CIG165		CIG195		BK-BR	27
CID0165		CID135		CID165		CID195		BR-BK	28
CIG0166		CIG136		CIG166		CIG196		BK-S	29
CID0166		CID136		CID166		CID196		S-BK	30
CIG0167		CIG137		CIG167		CIG197		Y-BL	31
CID0167		CID137		CID167		CID197		BL-Y	32
CIG110		CIG140		CIG170		CIG1100		Y-O	33
CID110		CID140		CID170		CID1100		O-Y	34
CIG111		CIG141		CIG171		CIG1101		Y-G	35
CID111		CID141		CID171		CID1101		G-Y	36
CIG112		CIG142		CIG172		CIG1102		Y-BR	37
CID112		CID142		CID172		CID1102		BR-Y	38
CIG113		CIG143		CIG173		CIG1103		Y-S	39
CID113		CID143		CID173		CID1103		S-Y	40
CIG114	1/1	CIG144	1/4	CIG174	1/7	CIG1104	1/10	V-BL	41
CID114		CID144		CID174		CID1104		BL-V	42
CIG115		CIG145		CIG175		CIG1105		V-O	43
CID115		CID145		CID175		CID1105		O-V	44
CIG116		CIG146		CIG176		CIG1106		V-G	45
CID116		CID146		CID176		CID1106		G-V	46
CIG117		CIG147		CIG177		CIG1107		V-BR	47
CID117		CID147		CID177		CID1107		BR-V	48
								V-S	49
								S-V	50

NOTE: LEAD DESIGNATIONS SHOWN ARE FOR LC562 EXCEPT MR AND M LEADS IN SLOTS 3 AND 4, SEGMENT 0. THESE LEADS ARE FOR LC563 AND MAY BE SUBSTITUTED FOR CIG AND CID, RESPECTIVELY, WHEN INSTALLED IN ANY OTHER SLOT SHOWN.

Fig. 22—Control/Energy Carrier Cross-Connections (Sheet 2 of 2)

A25D CONNECTOR CABLES FROM ENERGY CARRIER CONNECTORS								AT YELLOW BACKBOARD	
LEAD DESIGNATIONS FOR LC562 OR LC563 (NOTE)								CUT LEADS DOWN ON	
--_EB01	SEG/SLOT	--_EB02	SEG/SLOT	--_EB03	SEG/SLOT	--_EB04	SEG/SLOT	LEAD COLOR	CONN BLK TERMINALS
MR010		CIG040		CIG070		CIG0100		W-BL	1
MO10		CID040		CID070		CID0100		BL-W	2
MR011		CIG041		CIG071		CIG0101		W-O	3
MO11		CID041		CID071		CID0101		O-W	4
MR012		CIG042		CIG072		CIG0102		W-G	5
MO12		CID042		CID072		CID0102		G-W	6
MR013		CIG043		CIG073		CIG0103		W-BR	7
MO13	0/1	CID043	0/4	CID073	0/7	CID0103	0/10	BR-W	8
MR014		CIG044		CIG074		CIG0104		W-S	9
MO14		CID044		CID074		CID0104		S-W	10
MR015		CIG045		CIG075		CIG0105		R-BL	11
MO15		CID045		CID075		CID0105		BL-R	12
MR016		CIG046		CIG076		CIG0106		R-O	13
MO16		CID046		CID076		CID0106		O-R	14
MR017		CIG047		CIG077		CIG0107		R-G	15
MO17		CID047		CID077		CID0107		G-R	16
MR020		CIG050		CIG080		CIG0110		R-BR	17
MO20		CID050		CID080		CID0110		BR-R	18
MR021		CIG051		CIG081		CIG0111		R-S	19
MO21		CID051		CID081		CID0111		S-R	20
MR022		CIG052		CIG082		CIG0112		BK-BL	21
MO22		CID052		CID082		CID0112		BL-BK	22
MR023		CIG053		CIG083		CIG0113		BK-O	23
MO23		CID053		CID083		CID0113		O-BK	24
MR024	0/2	CIG054	0/5	CIG084	0/8	CIG0114	0/11	BK-G	25
MO24		CID054		CID084		CID0114		G-BK	26
MR025		CIG055		CIG085		CIG0115		BK-BR	27
MO25		CID055		CID085		CID0115		BR-BK	28
MR026		CIG056		CIG086		CIG0116		BK-S	29
MO26		CID056		CID086		CID0116		S-BK	30
MR027		CIG057		CIG087		CIG0117		Y-BL	31
MO27		CID057		CID087		CID0117		BL-Y	32
CIG030		CIG060		CIG090		CIG0120		Y-O	33
CID030		CID060		CID090		CID0120		O-Y	34
CIG031		CIG061		CIG091		CIG0121		Y-G	35
CID031		CID061		CID091		CID0121		G-Y	36
CIG032		CIG062		CIG092		CIG0122		Y-BR	37
CID032		CID062		CID092		CID0122		BR-Y	38
CIG033		CIG063		CIG093		CIG0123		Y-S	39
CID033		CID063		CID093		CID0123		S-Y	40
CIG034	0/3	CIG064	0/6	CIG094	0/9	CIG0124	0/12	V-BL	41
CID034		CID064		CID094		CID0124		BL-V	42
CIG035		CIG065		CIG095		CIG0125		V-O	43
CID035		CID065		CID095		CID0125		O-V	44
CIG036		CIG066		CIG096		CIG0126		V-G	45
CID036		CID066		CID096		CID0126		G-V	46
CIG037		CIG067		CIG097		CIG0127		V-BR	47
CID037		CID067		CID097		CID0127		BR-V	48
								V-S	49
								S-V	50

SEE NOTE AT END OF FIG.

Fig. 23—Energy Carrier Cross-Connections (Sheet 1 of 7)

A25D CONNECTOR CABLES FROM ENERGY CARRIER CONNECTORS								AT YELLOW BACKBOARD	
LEAD DESIGNATIONS FOR LC562 OR LC563 (NOTE)								CUT LEADS DOWN ON	
--_EB05	SEG/SLOT	--_EB06	SEG/SLOT	--_EB07	SEG/SLOT	--_EB08	SEG/SLOT	LEAD COLOR	CONN BLK TERMINALS
CIG0130		CIG0160		CIG130		CIG160		W-BL	1
CID0130		CID0160		CID130		CID160		BL-W	2
CIG0131		CIG0161		CIG131		CIG161		W-O	3
CID0131		CID0161		CID131		CID161		O-W	4
CIG0132		CIG0162		CIG132		CIG162		W-G	5
CID0132		CID0162		CID132		CID162		G-W	6
CIG0133	0/13	CIG0163	0/16	CIG133	1/3	CIG163	1/6	W-BR	7
CID0133		CID0163		CID133		CID163		BR-W	8
CIG0134		CIG0164		CIG134		CIG164		W-S	9
CID0134		CID0164		CID134		CID164		S-W	10
CIG0135		CIG0165		CIG135		CIG165		R-BL	11
CID0135		CID0165		CID135		CID165		BL-R	12
CIG0136		CIG0166		CIG136		CIG166		R-O	13
CID0136		CID0166		CID136		CID166		O-R	14
CIG0137		CIG0167		CIG137		CIG167		R-G	15
CID0137		CID0167		CID137		CID167		G-R	16
CIG0140		CIG110		CIG140		CIG170		R-BR	17
CID0140		CID110		CID140		CID170		BR-R	18
CIG0141		CIG111		CIG141		CIG171		R-S	19
CID0141		CID111		CID141		CID171		S-R	20
CIG0142		CIG112		CIG142		CIG172		BK-BL	21
CID0142		CID112		CID142		CID172		BL-BK	22
CIG0143		CIG113		CIG143		CIG173		BK-O	23
CID0143		CID113		CID143		CID173		O-BK	24
CIG0144	0/14	CIG114	1/1	CIG144	1/4	CIG174	1/7	BK-G	25
CID0144		CID114		CID144		CID174		G-BK	26
CIG0145		CIG115		CIG145		CIG175		BK-BR	27
CID0145		CID115		CID145		CID175		BR-BK	28
CIG0146		CIG116		CIG146		CIG176		BK-S	29
CID0146		CID116		CID146		CID176		S-BK	30
CIG0147		CIG117		CIG147		CIG177		Y-BL	31
CID0147		CID117		CID147		CID177		BL-Y	32
CIG0150		CIG120		CIG150		CIG180		Y-O	33
CID0150		CID120		CID150		CID180		O-Y	34
CIG0151		CIG121		CIG151		CIG181		Y-G	35
CID0151		CID121		CID151		CID181		G-Y	36
CIG0152		CIG122		CIG152		CIG182		Y-BR	37
CID0152		CID122		CID152		CID182		BR-Y	38
CIG0153		CIG123		CIG153		CIG183		Y-S	39
CID0153		CID123		CID153		CID183		S-Y	40
CIG0154	0/15	CIG124	1/2	CIG154	1/5	CIG184	1/8	V-BL	41
CID0154		CID124		CID154		CID184		BL-V	42
CIG0155		CIG125		CIG155		CIG185		V-O	43
CID0155		CID125		CID155		CID185		O-V	44
CIG0156		CIG126		CIG156		CIG186		V-G	45
CID0156		CID126		CID156		CID186		G-V	46
CIG0157		CIG127		CIG157		CIG187		V-BR	47
CID0157		CID127		CID157		CID187		BR-V	48
								V-S	49
								S-V	50

SEE NOTE AT END OF FIG.

Fig. 23—Energy Carrier Cross-Connections (Sheet 2 of 7)

A25D CONNECTOR CABLES FROM ENERGY CARRIER CONNECTORS								AT YELLOW BACKBOARD	
LEAD DESIGNATIONS FOR LC562 OR LC563 (NOTE)								CUT LEADS DOWN ON	
_ _EB09	SEG/SLOT	_ _EB10	SEG/SLOT	_ _EB11	SEG/SLOT	_ _EB12	SEG/SLOT	LEAD COLOR	CONN BLK TERMINALS
CIG190		CIG1120		CIG1150		CIG220		W-BL	1
CID190		CID1120		CID1150		CID220		BL-W	2
CIG191		CIG1121		CIG1151		CIG221		W-O	3
CID191		CID1121		CID1151		CID221		O-W	4
CIG192		CIG1122		CIG1152		CIG222		W-G	5
CID192		CID1122		CID1152		CID222		G-W	6
CIG193		CIG1123		CIG1153		CIG223		W-BR	7
CID193	1/9	CID1123	1/12	CID1153	1/15	CID223	2/2	BR-W	8
CIG194		CIG1124		CIG1154		CIG224		W-S	9
CID194		CID1124		CID1154		CID224		S-W	10
CIG195		CIG1125		CIG1155		CIG225		R-BL	11
CID195		CID1125		CID1155		CID225		BL-R	12
CIG196		CIG1126		CIG1156		CIG226		R-O	13
CID196		CID1126		CID1156		CID226		O-R	14
CIG197		CIG1127		CIG1157		CIG227		R-G	15
CID197		CID1127		CID1157		CID227		G-R	16
CIG1100		CIG1130		CIG1160		CIG230		R-BR	17
CID1100		CID1130		CID1160		CID230		BR-R	18
CIG1101		CIG1131		CIG1161		CIG231		R-S	19
CID1101		CID1131		CID1161		CID231		S-R	20
CIG1102		CIG1132		CIG1162		CIG232		BK-BL	21
CID1102		CID1132		CID1162		CID232		BL-BK	22
CIG1103		CIG1133		CIG1163		CIG233		BK-O	23
CID1103		CID1133		CID1163		CID233		O-BK	24
CIG1104	1/10	CIG1134	1/13	CIG1164	1/16	CIG234	2/3	BK-G	25
CID1104		CID1134		CID1164		CID234		G-BK	26
CIG1105		CIG1135		CIG1165		CIG235		BK-BR	27
CID1105		CID1135		CID1165		CID235		BR-BK	28
CIG1106		CIG1136		CIG1166		CIG236		BK-S	29
CID1106		CID1136		CID1166		CID236		S-BK	30
CIG1107		CIG1137		CIG1167		CIG237		Y-BL	31
CID1107		CID1137		CID1167		CID237		BL-Y	32
CIG1110		CIG1140		CIG210		CIG240		Y-O	33
CID1110		CID1140		CID210		CID240		O-Y	34
CIG1111		CIG1141		CIG211		CIG241		Y-G	35
CID1111		CID1141		CID211		CID241		G-Y	36
CIG1112		CIG1142		CIG212		CIG242		Y-BR	37
CID1112		CID1142		CID212		CID242		BR-Y	38
CIG1113		CIG1143		CIG213		CIG243		Y-S	39
CID1113		CID1143		CID213		CID243		S-Y	40
CIG1114	1/11	CIG1144	1/14	CIG214	2/1	CIG244	2/4	V-BL	41
CID1114		CID1144		CID214		CID244		BL-V	42
CIG1115		CIG1145		CIG215		CIG245		V-O	43
CID1115		CID1145		CID215		CID245		O-V	44
CIG1116		CIG1146		CIG216		CIG246		V-G	45
CID1116		CID1146		CID216		CID246		G-V	46
CIG1117		CIG1147		CIG217		CIG247		V-BR	47
CID1117		CID1147		CID217		CID247		BR-V	48
								V-S	49
								S-V	50

SEE NOTE AT END OF FIG.

Fig. 23—Energy Carrier Cross-Connections (Sheet 3 of 7)

A25D CONNECTOR CABLES FROM ENERGY CARRIER CONNECTORS								AT YELLOW BACKBOARD	
LEAD DESIGNATIONS FOR LC562 OR LC563 (NOTE)								CUT LEADS DOWN ON	
_ _EB13	SEG/SLOT	_ _EB14	SEG/SLOT	_ _EB15	SEG/SLOT	_ _EB16	SEG/SLOT	LEAD COLOR	CONN BLK TERMINALS
CIG250		CIG280		CIG2110		CIG2140		W-BL	1
CID250		CID280		CID2110		CID2140		BL-W	2
CIG251		CIG281		CIG2111		CIG2141		W-O	3
CID251		CID281		CID2111		CID2141		O-W	4
CIG252		CIG282		CIG2112		CIG2142		W-G	5
CID252		CID282		CID2112		CID2142		G-W	6
CIG253		CIG283		CIG2113		CIG2143		W-BR	7
CID253	2/5	CID283	2/8	CID2113	2/11	CID2143	2/14	BR-W	8
CIG254		CIG284		CIG2114		CIG2144		W-S	9
CID254		CID284		CID2114		CID2144		S-W	10
CIG255		CIG285		CIG2115		CIG2145		R-BL	11
CID255		CID285		CID2115		CID2145		BL-R	12
CIG256		CIG286		CIG2116		CIG2146		R-O	13
CID256		CID286		CID2116		CID2146		O-R	14
CIG257		CIG287		CIG2117		CIG2147		R-G	15
CID257		CID287		CID2117		CID2147		G-R	16
CIG260		CIG290		CIG2120		CIG2150		R-BR	17
CID260		CID290		CID2120		CID2150		BR-R	18
CIG261		CIG291		CIG2121		CIG2151		R-S	19
CID261		CID291		CID2121		CID2151		S-R	20
CIG262		CIG292		CIG2122		CIG2152		BK-BL	21
CID262		CID292		CID2122		CID2152		BL-BK	22
CIG263		CIG293		CIG2123		CIG2153		BK-O	23
CID263		CID293		CID2123		CID2153		O-BK	24
CIG264	2/6	CIG294	2/9	CIG2124	2/12	CIG2154	2/15	BK-G	25
CID264		CID294		CID2124		CID2154		G-BK	26
CIG265		CIG295		CIG2125		CIG2155		BK-BR	27
CID265		CID295		CID2125		CID2155		BR-BK	28
CIG266		CIG296		CIG2126		CIG2156		BK-S	29
CID266		CID296		CID2126		CID2156		S-BK	30
CIG267		CIG297		CIG2127		CIG2157		Y-BL	31
CID267		CID297		CID2127		CID2157		BL-Y	32
CIG270		CIG2100		CIG2130		CIG2160		Y-O	33
CID270		CID2100		CID2130		CID2160		O-Y	34
CIG271		CIG2101		CIG2131		CIG2161		Y-G	35
CID271		CID2101		CID2131		CID2161		G-Y	36
CIG272		CIG2102		CIG2132		CIG2162		Y-BR	37
CID272		CID2102		CID2132		CID2162		BR-Y	38
CIG273		CIG2103		CIG2133		CIG2163		Y-S	39
CID273		CID2103		CID2133		CID2163		S-Y	40
CIG274	2/7	CIG2104	2/10	CIG2134	2/13	CIG2164	2/16	V-BL	41
CID274		CID2104		CID2134		CID2164		BL-V	42
CIG275		CIG2105		CIG2135		CIG2165		V-O	43
CID275		CID2105		CID2135		CID2165		O-V	44
CIG276		CIG2106		CIG2136		CIG2166		V-G	45
CID276		CID2106		CID2136		CID2166		G-V	46
CIG277		CIG2107		CIG2137		CIG2167		V-BR	47
CID277		CID2107		CID2137		CID2167		BR-V	48
								V-S	49
								S-V	50

SEE NOTE AT END OF FIG.

Fig. 23—Energy Carrier Cross-Connections (Sheet 4 of 7)

A25D CONNECTOR CABLES FROM ENERGY CARRIER CONNECTORS								AT YELLOW BACKBOARD	
LEAD DESIGNATIONS FOR LC562 OR LC563 (NOTE)								CUT LEADS DOWN ON	
__EB17	SEG/SLOT	__EB18	SEG/SLOT	__EB19	SEG/SLOT	__EB20	SEG/SLOT	LEAD COLOR	CONN BLK TERMINALS
CIG310		CIG340		CIG370		CIG3100		W-BL	1
CID310		CID340		CID370		CID3100		BL-W	2
CIG311		CIG341		CIG371		CIG3101		W-O	3
CID311		CID341		CID371		CID3101		O-W	4
CIG312		CIG342		CIG372		CIG3102		W-G	5
CID312		CID342		CID372		CID3102		G-W	6
CIG313		CIG343		CIG373		CIG3103		W-BR	7
CID313	3/1	CID343	3/4	CID373	3/7	CID3103	3/10	BR-W	8
CIG314		CIG344		CIG374		CIG3104		W-S	9
CID314		CID344		CID374		CID3104		S-W	10
CIG315		CIG345		CIG375		CIG3105		R-BL	11
CID315		CID345		CID375		CID3105		BL-R	12
CIG316		CIG346		CIG376		CIG3106		R-O	13
CID316		CID346		CID376		CID3106		O-R	14
CIG317		CIG347		CIG377		CIG3107		R-G	15
CID317		CID347		CID377		CID3107		G-R	16
CIG320		CIG350		CIG380		CIG3110		R-BR	17
CID320		CID350		CID380		CID3110		BR-R	18
CIG321		CIG351		CIG381		CIG3111		R-S	19
CID321		CID351		CID381		CID3111		S-R	20
CIG322		CIG352		CIG382		CIG3112		BK-BL	21
CID322		CID352		CID382		CID3112		BL-BK	22
CIG323		CIG353		CIG383		CIG3113		BK-O	23
CID323		CID353		CID383		CID3113		O-BK	24
CIG324	3/2	CIG354	3/5	CIG384	3/8	CIG3114	3/11	BK-G	25
CID324		CID354		CID384		CID3114		G-BK	26
CIG325		CIG355		CIG385		CIG3115		BK-BR	27
CID325		CID355		CID385		CID3115		BR-BK	28
CIG326		CIG356		CIG386		CIG3116		BK-S	29
CID326		CID356		CID386		CID3116		S-BK	30
CIG327		CIG357		CIG387		CIG3117		Y-BL	31
CID327		CID357		CID387		CID3117		BL-Y	32
CIG330		CIG360		CIG390		CIG3120		Y-O	33
CID330		CID360		CID390		CID3120		O-Y	34
CIG331		CIG361		CIG391		CIG3121		Y-G	35
CID331		CID361		CID391		CID3121		G-Y	36
CIG332		CIG362		CIG392		CIG3122		Y-BR	37
CID332		CID362		CID392		CID3122		BR-Y	38
CIG333		CIG363		CIG393		CIG3123		Y-S	39
CID333		CID363		CID393		CID3123		S-Y	40
CIG334	3/3	CIG364	3/6	CIG394	3/9	CIG3124	3/12	V-BL	41
CID334		CID364		CID394		CID3124		BL-V	42
CIG335		CIG365		CIG395		CIG3125		V-O	43
CID335		CID365		CID395		CID3125		O-V	44
CIG336		CIG366		CIG396		CIG3126		V-G	45
CID336		CID366		CID396		CID3126		G-V	46
CIG337		CIG367		CIG397		CIG3127		V-BR	47
CID337		CID367		CID397		CID3127		BR-V	48
								V-S	49
								S-V	50

SEE NOTE AT END OF FIG.

Fig. 23—Energy Carrier Cross-Connections (Sheet 5 of 7)

A25D CONNECTOR CABLES FROM ENERGY CARRIER CONNECTORS								AT YELLOW BACKBOARD	
LEAD DESIGNATIONS FOR LC562 OR LC563 (NOTE)								CUT LEADS DOWN ON	
_ _EB21	SEG/SLOT	_ _EB22	SEG/SLOT	_ _EB23	SEG/SLOT	_ _EB24	SEG/SLOT	LEAD COLOR	CONN BLK TERMINALS
CIG3130		CIG3160		CIG430		CIG460		W-BL	1
CID3130		CID3160		CID430		CID460		BL-W	2
CIG3131		CIG3161		CIG431		CIG461		W-O	3
CID3131		CID3161		CID431		CID461		O-W	4
CIG3132		CIG3162		CIG432		CIG462		W-G	5
CID3132		CID3162		CID432		CID462		G-W	6
CIG3133	3/13	CIG3163	3/16	CIG433	4/3	CIG463	4/6	W-BR	7
CID3133		CID3163		CID433		CID463		BR-W	8
CIG3134		CIG3164		CIG434		CIG464		W-S	9
CID3134		CID3164		CID434		CID464		S-W	10
CIG3135		CIG3165		CIG435		CIG465		R-BL	11
CID3135		CID3165		CID435		CID465		BL-R	12
CIG3136		CIG3166		CIG436		CIG466		R-O	13
CID3136		CID3166		CID436		CID466		O-R	14
CIG3137		CIG3167		CIG437		CIG467		R-G	15
CID3137		CID3167		CID437		CID467		G-R	16
CIG3140		CIG410		CIG440		CIG470		R-BR	17
CID3140		CID410		CID440		CID470		BR-R	18
CIG3141		CIG411		CIG441		CIG471		R-S	19
CID3141		CID411		CID441		CID471		S-R	20
CIG3142		CIG412		CIG442		CIG472		BK-BL	21
CID3142		CID412		CID442		CID472		BL-BK	22
CIG3143		CIG413		CIG443		CIG473		BK-O	23
CID3143		CID413		CID443		CID473		O-BK	24
CIG3144	3/14	CIG414	4/1	CIG444	4/4	CIG474	4/7	BK-G	25
CID3144		CID414		CID444		CID474		G-BK	26
CIG3145		CIG415		CIG445		CIG475		BK-BR	27
CID3145		CID415		CID445		CID475		BR-BK	28
CIG3146		CIG416		CIG446		CIG476		BK-S	29
CID3146		CID416		CID446		CID476		S-BK	30
CIG3147		CIG417		CIG447		CIG477		Y-BL	31
CID3147		CID417		CID447		CID477		BL-Y	32
CIG3150		CIG420		CIG450		CIG480		Y-O	33
CID3150		CID420		CID450		CID480		O-Y	34
CIG3151		CIG421		CIG451		CIG481		Y-G	35
CID3151		CID421		CID451		CID481		G-Y	36
CIG3152		CIG422		CIG452		CIG482		Y-BR	37
CID3152		CID422		CID452		CID482		BR-Y	38
CIG3153		CIG423		CIG453		CIG483		Y-S	39
CID3153		CID423		CID453		CID483		S-Y	40
CIG3154	3/15	CIG424	4/2	CIG454	4/5	CIG484	4/8	V-BL	41
CID3154		CID424		CID454		CID484		BL-V	42
CIG3155		CIG425		CIG455		CIG485		V-O	43
CID3155		CID425		CID455		CID485		O-V	44
CIG3156		CIG426		CIG456		CIG486		V-G	45
CID3156		CID426		CID456		CID486		G-V	46
CIG3157		CIG427		CIG457		CIG487		V-BR	47
CID3157		CID427		CID457		CID487		BR-V	48
								V-S	49
								S-V	50

SEE NOTE AT END OF FIG.

Fig. 23—Energy Carrier Cross-Connections (Sheet 6 of 7)

A25D CONNECTOR CABLES FROM ENERGY CARRIER CONNECTORS							AT YELLOW BACKBOARD	
LEAD DESIGNATIONS FOR LC562 OR LC563 (NOTE)							CUT LEADS DOWN ON	
_ _EB25	SEG/SLOT	_ _EB26	SEG/SLOT				LEAD COLOR	CONN BLK TERMINALS
CIG490		CIG4120					W-BL	1
CID490		CID4120					BL-W	2
CIG491		CIG4121					W-O	3
CID491		CID4121					O-W	4
CIG492		CIG4122					W-G	5
CID492		CID4122					G-W	6
CIG493		CIG4123					W-BR	7
CID493	4/9	CID4123	4/12				BR-W	8
CIG494		CIG4124					W-S	9
CID494		CID4124					S-W	10
CIG495		CIG4125					R-BL	11
CID495		CID4125					BL-R	12
CIG496		CIG4126					R-O	13
CID496		CID4126					O-R	14
CIG497		CIG4127					R-G	15
CID497		CID4127					G-R	16
CIG4100							R-BR	17
CID4100							BR-R	18
CIG4101							R-S	19
CID4101							S-R	20
CIG4102							BK-BL	21
CID4102							BL-BK	22
CIG4103							BK-O	23
CID4103							O-BK	24
CIG4104	4/10						BK-G	25
CID4104							G-BK	26
CIG4105							BK-BR	27
CID4105							BR-BK	28
CIG4106							BK-S	29
CID4106							S-BK	30
CIG4107							Y-BL	31
CID4107							BL-Y	32
CIG4110							Y-O	33
CID4110							O-Y	34
CIG4111							Y-G	35
CID4111							G-Y	36
CIG4112							Y-BR	37
CID4112							BR-Y	38
CIG4113							Y-S	39
CID4113							S-Y	40
CIG4114	4/11						V-BL	41
CID4114							BL-V	42
CIG4115							V-O	43
CID4115							O-V	44
CIG4116							V-G	45
CID4116							G-V	46
CIG4117							V-BR	47
CID4117							BR-V	48
							V-S	49
							S-V	50

NOTE: LEAD DESIGNATIONS SHOWN ARE FOR LC562 EXCEPT FOR MR AND M LEADS IN SLOTS 1 AND 2, SEGMENT 0. THESE LEADS ARE FOR LC563 AND MAY BE SUBSTITUTED FOR CIG AND CID, RESPECTIVELY, WHEN INSTALLED IN ANY OTHER SLOT SHOWN.

Fig. 23—Energy Carrier Cross-Connections (Sheet 7 of 7)

- Connector designations
- Color code of the connector cable
- Connector block designation and terminal number in the yellow field
- Terminal number to which the cross-connection is made in the blue field.

4.100 Figure 24 shows energy loads connected through the cross-connect field to the energy and control/energy carriers. The distance between the ECSA system and the customer load control is dependant on the coil resistance and operating voltage of the customer control relay, the interconnecting wire gauge, and the supply voltage. The distance is unlimited as long as the load control relay operates properly.

E. Control Lead Cross-Connections

4.101 The control input/output (I/O) leads are extended to the cross-connect field via the BX01 connector on the control/energy carrier. The control leads are extended over the low-speed data channels provided by the LC366B circuit packs. The assignment of I/O leads to a particular device is not restricted by software or hardware.

4.102 The control I/O cross-connections are shown in Fig. 25. Eight data channels, 04 through 11, are provided. An additional low-speed data channel (02) is available (control carrier, segment 0, slot 18) when SMDR is not provided and an LC171B circuit pack is installed in slot 18. The data channel is wired to both the BX01 terminals and the BX07 connector. **Do not** connect to both channel connections at the same time.

F. Alarm and Control Lead Cross-Connections

4.103 Alarm and control leads are extended to the cross-connect field via the AP7 cable connector. The control and alarm panel cross-connections are shown in Fig. 26. The alarm leads (AMJ* and AMN*) can be extended to remote alarm circuitry.

5. EQUIPMENT ASSOCIATED WITH FEATURES

5.01 Additional hardware and/or equipment is required to implement certain features or optional features available with the ECSA system. The optional features are described as follows:

- Data channel repeater
- Peripheral interface circuit (J58882 GA)
- Remote maintenance, administration and traffic system (RMA1-1).

DATA CHANNEL REPEATER

5.02 The data channel repeater is a self-contained unit that provides range extension and/or lightning protection for the low-speed data channels. It is connected in series with the data channel to repeat data pulses and to provide isolation between input and output pairs.

5.03 The repeater detects and reconstructs incoming modified biphasic (bipolar) data pulses to eliminate any pulse attenuation or distortion as well as to increase data channel range.

5.04 The repeater circuit is designed to operate in unexposed environments without additional protection and in exposed environments with standard 3-mil carbon block protection.

5.05 Typical applications for the data channel repeater are the ECSA CRT console and system printers via the peripheral interface circuit unit.

A. Housing and Mounting

5.06 The repeater circuitry is housed in a modified key service unit (Fig. 27) with a capacity for two data channel repeater circuits.

5.07 The unit is designed to be wall-mounted near a 120V 60-Hz outlet. Power cords are available in 610-, 1220-, 1830-, or 3660-mm (2-, 4-, 6-, and 12-foot) lengths (J58879KC, Lists A, B, C, and D, respectively).

B. Range Extension and Lightning Protection

5.08 A *single-channel repeater with range extension* (Fig. 28) consists of the following equipment:

- One J58879KC, List 1—Assembly, wiring, and equipment, including a 28D2 power supply unit
- One J58879KC, List 2—Rectifier and timing reference circuit card (AE-49)

TABLE G
A FILLED-IN EXAMPLE OF A CONTROL/ENERGY
CARRIER CROSS-CONNECT WORKSHEET

CONTROL/ENERGY CARRIER 0 CONNECTOR 00BB02					CONN CABLE COLOR CODE	CROSS-CONNECT	
SEGMENT NO.	SLOT NO.	CIRCUIT NO.	POWER METER OR ENERGY LOAD NO.	LEAD DESIG		FROM	TO
						00BB02 CONN BLK (YELLOW)	CONN BLK (BLUE)
0	3	0	1	MR	W-BL	1	BLK 2-1
				R	BL-W	2	2
		1	2	MR	W-O	3	3
				R	O-W	4	4
		2	3	MR	W-G	5	5
				R	G-W	6	6
		3	4	MR	W-BR	7	7
				R	BR-W	8	8
		4	5	MR	W-S	9	9
				R	S-W	10	10
		5	6	MR	R-BL	11	11
				R	BL-R	12	12
		6	7	MR	R-O	13	13
				R	O-R	14	14
		7	8	MR	R-G	15	15
				R	G-R	16	16
	4	0	9	MR	R-BR	17	17
				R	BR-R	18	18
		1	10	MR	R-S	19	19
				R	S-R	20	20
		2	11	MR	BK-BL	21	21
				R	BL-BK	22	22
		3	12	MR	BK-O	23	23
				R	O-BK	24	24
		4	13	MR	BK-G	25	25
				R	G-BK	26	26
		5	14	MR	BK-BR	27	27
				R	BR-BK	28	28
		6	15	MR	BK-S	29	29
				R	S-BK	30	30
		7	16	MR	Y-BL	31	31
				R	BL-Y	32	32

TABLE H
A FILLED-IN EXAMPLE OF A ENERGY
CARRIER CROSS-CONNECT WORKSHEET

ENERGY CARRIER 1 CONNECTOR 01EB01					CONN CABLE COLOR CODE	CROSS-CONNECT	
SEGMENT NO.	SLOT NO.	CIRCUIT NO.	POWER METER OR ENERGY LOAD NO.	LEAD DESIG		FROM	TO
						01EB01 CONN BLK (YELLOW)	CONN BLK (BLUE)
0	1	0	0177	CIG	W-BL	1	BLK 8-17
				CID	BL-W	2	18
		1	0178	CIG	W-O	3	19
				CID	O-W	4	20
		2	0179	CIG	W-G	5	21
				CID	G-W	6	22
		3	0180	CIG	W-BR	7	23
				CID	BR-W	8	24
		4	0181	CIG	W-S	9	25
				CID	S-W	10	26
		5	0182	CIG	R-BL	11	27
				CID	BL-R	12	28
		6	0183	CIG	R-O	13	29
				CID	O-R	14	30
	7	0184	CIG	R-G	15	31	
			CID	G-R	16	32	
	2	0	0185	CIG	R-BR	17	33
				CID	BR-R	18	34
		1	0186	CIG	R-S	19	35
				CID	S-R	20	36
		2	0187	CIG	BK-BL	21	37
				CID	BL-BK	22	38
		3	0188	CIG	BK-O	23	39
				CID	O-BK	24	40
		4	0189	CIG	BK-G	25	41
				CID	G-BK	26	42
		5	0190	CIG	BK-BR	27	43
				CID	BR-BK	28	44
		6	0191	CIG	BK-S	29	45
				CID	S-BK	30	46
	7	0192	CIG	Y-BL	31	47	
			CID	BL-Y	32	48	

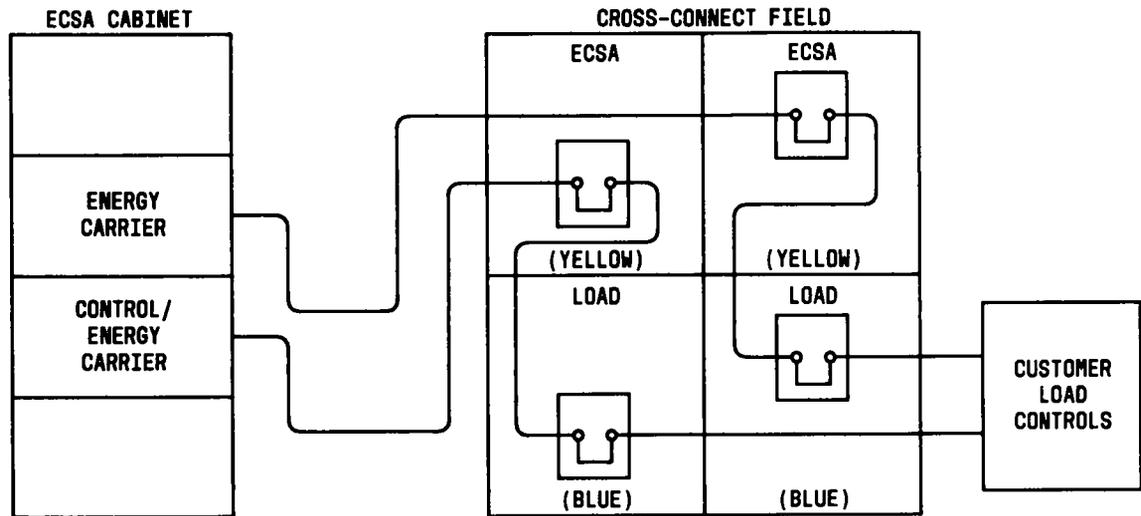


Fig. 24—Load Control to Carrier Through Cross-Connect Field

- Two J58879KC, List 3—Unidirectional repeater circuit cards (AE-48) for each repeater.

A maximum of four repeaters can be cascaded for the purpose of extending the distance between the ECSA and peripheral to 3353m (11,000 feet).

5.09 A dual channel repeater with range extension (Fig. 29) consists of the following equipment:

- One J58879KC, List 1—Assembly, wiring, and equipment, including a 28D2 power supply unit
- One J58879KC, List 2—Rectifier and timing reference circuit card (AE-49)
- Four J58879KC, List 3—Unidirectional repeater circuit cards (AE-48) for each repeater.

5.10 When the data channel repeater is used for **lightning protection only** (Fig. 28 and 29), the equipment required is as follows:

- Two (single-channel) or four (dual-channel) J58879KC, List 4—Data link, buffer circuit card (WJ3)
- One J58879KC, List 5—Assembly, wiring, and equipment, excluding the 28D2 power supply unit.

C. Installation

5.11 The repeater connections and a typical application are discussed in the following paragraphs.

5.12 A block diagram of a single-channel repeater with and without range extension with some internal wiring is shown in Fig. 28. The required connections consist of data pair terminations to connecting block TB1.

5.13 When operating in the ECSA to peripheral data direction, the repeater input pair is connected to terminals 1A and 2A of TB1. The output pair appears on terminals 1B and 2B.

5.14 When operating in the peripheral to ECSA data direction, the repeater input pair is connected to terminals 3B and 4B. The output pair is tied to terminals 3A and 4A.

5.15 The tip leads of the data pairs are connected to the odd-numbered terminals, and the ring leads of the data pairs are tied to even-numbered terminals.

5.16 The equipment required for a dual channel repeater to an off-premises peripheral is shown in Fig. 30. The connections for the two data channels are provided in Fig. 29. The channel 1 connections are identical to the single repeater channel

A25D CONNECTOR CABLE FROM CONTROL/ENERGY CARRIER CONNECTOR			AT YELLOW BACKBOARD		
LEAD DESIGNATIONS FOR LC366B			CUT LEADS DOWN ON		
BX01A	DATA CHANNEL	SLOT	LEAD COLOR	CONN BLK TERMINALS	
IOXB00 IOXA00 IORB00 IORA00	04	20/21B	W-BL	1	
			BL-W	2	
			W-O	3	
			O-W	4	
	IOXB00 IOXA00 IORB00 IORA00			W-G	5
				G-W	6
				W-BR	7
				BR-W	8
				W-S	9
				S-W	10
				R-BL	11
				BL-R	12
IOXB00 IOXA00 IORB00 IORA00	05	20/21B	R-O	13	
			O-R	14	
			R-G	15	
			G-R	16	
IOXB00 IOXA00 IORB00 IORA00	08	22/23B	R-BR	17	
			BR-R	18	
			R-S	19	
			S-R	20	
IOXB00 IOXA00 IORB00 IORA00	09	22/23B	BK-BL	21	
			BL-BK	22	
			BK-O	23	
			O-BK	24	
IOXB00* IOXA00* IORB00* IORA00*	02	18B	BK-G	25	
			G-BK	26	
			BK-BR	27	
			BR-BK	28	
IOXB00 IOXA00 IORB00 IORA00	10	22/23B	BK-S	29	
			S-BK	30	
			Y-BL	31	
			BL-Y	32	
IOXB00 IOXA00 IORB00 IORA00	11	22/23B	Y-O	33	
			O-Y	34	
			Y-G	35	
			G-Y	36	
IOXB00 IOXA00 IORB00 IORA00	06	20/21B	Y-BR	37	
			BR-Y	38	
			Y-S	39	
			S-Y	40	
IOXB00 IOXA00 IORB00 IORA00	07	20/21B	V-BL	41	
			BL-V	42	
			V-O	43	
			O-V	44	
IOXB00 IOXA00 IORB00 IORA00			V-G	45	
			G-V	46	
			V-BR	47	
			BR-V	48	
			V-S	49	
			S-V	50	

*THESE LEADS ARE ALSO CONNECTED TO BX07A. ONLY ONE SET OF LEADS SHOULD BE USED AT ONE TIME.

Fig. 25—Control I/O Data Channel Cross-Connections

A25D CONNECTOR CABLE FROM CONTROL AND ALARM PANEL CONNECTOR	AT YELLOW BACKBOARD	
AP7	CUT LEADS DOWN ON	
LEAD DESIGNATIONS	LEAD COLOR	CONN BLK TERMINALS
MJR	W-BL	1
MJ	BL-W	2
MNR	W-O	3
MN	O-W	4
AMJ*	W-G	5
	G-W	6
AMN*	W-BR	7
	BR-W	8
	W-S	9
	S-W	10
	R-BL	11
	BL-R	12
	R-O	13
	O-R	14
	R-G	15
	G-R	16
ARSVPR*	R-BR	17
	BR-R	18
	R-S	19
	S-R	20
	BK-BL	21
	BL-BK	22
	BK-O	23
	O-BK	24
	BK-G	25
	G-BK	26
	BK-BR	27
	BR-BK	28
	BK-S	29
	S-BK	30
	Y-BL	31
	BL-Y	32
	Y-O	33
	O-Y	34
	Y-G	35
	G-Y	36
	Y-BR	37
	BR-Y	38
	Y-S	39
	S-Y	40
	V-BL	41
	BL-V	42
GRDD	V-O	43
-48PX	O-V	44
GRDD	V-G	45
-48PX	G-V	46
GRDD	V-BR	47
-48PX	BR-V	48
GRDD	V-S	49
-48PX	S-V	50

TO REMOTE
ALARM
CIRCUITRY
(IF REQUIRED)

* THIS LEAD IS ACTIVE IN LOW STATE

Fig. 26—Control and Alarm Panel Cross-Connections

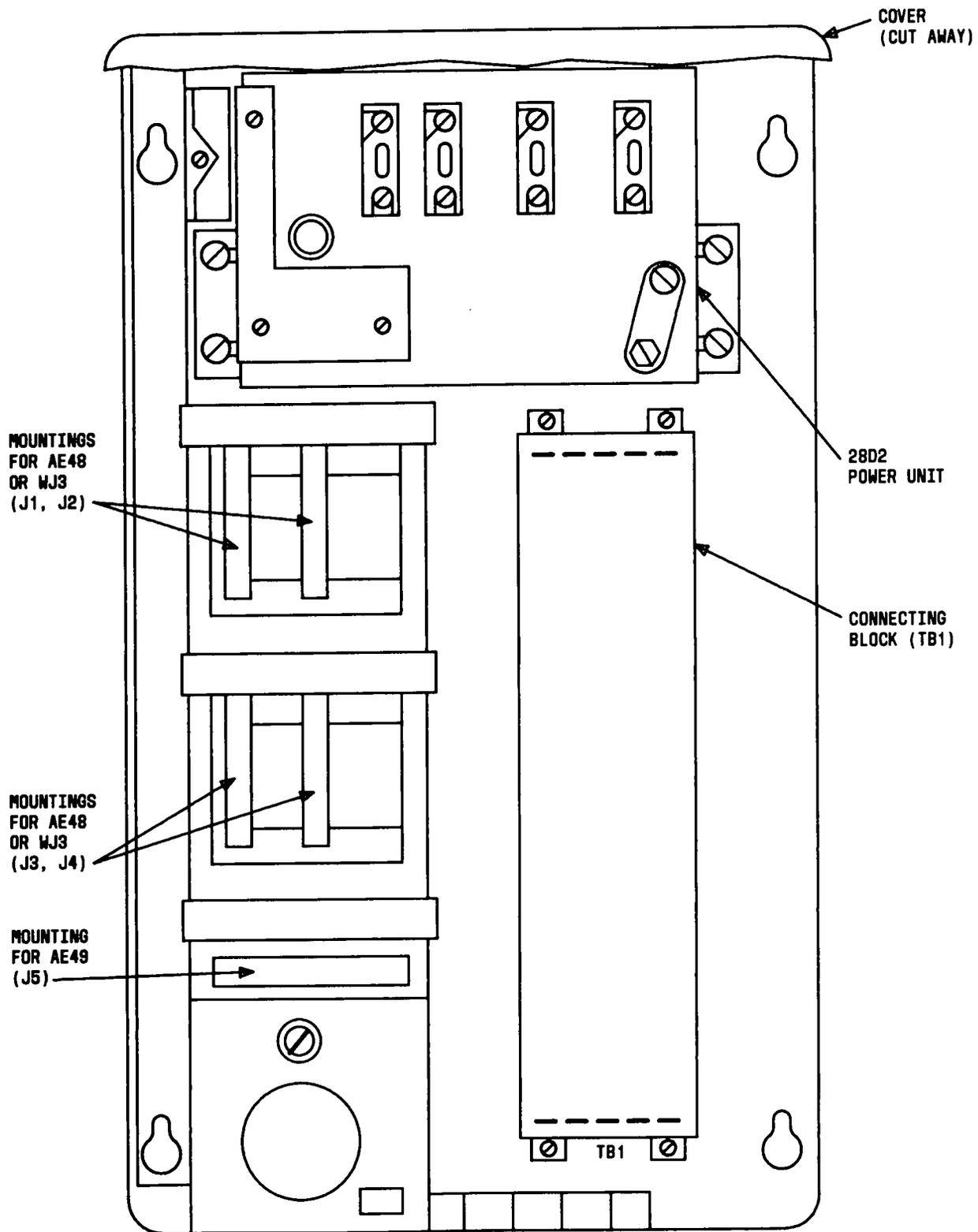
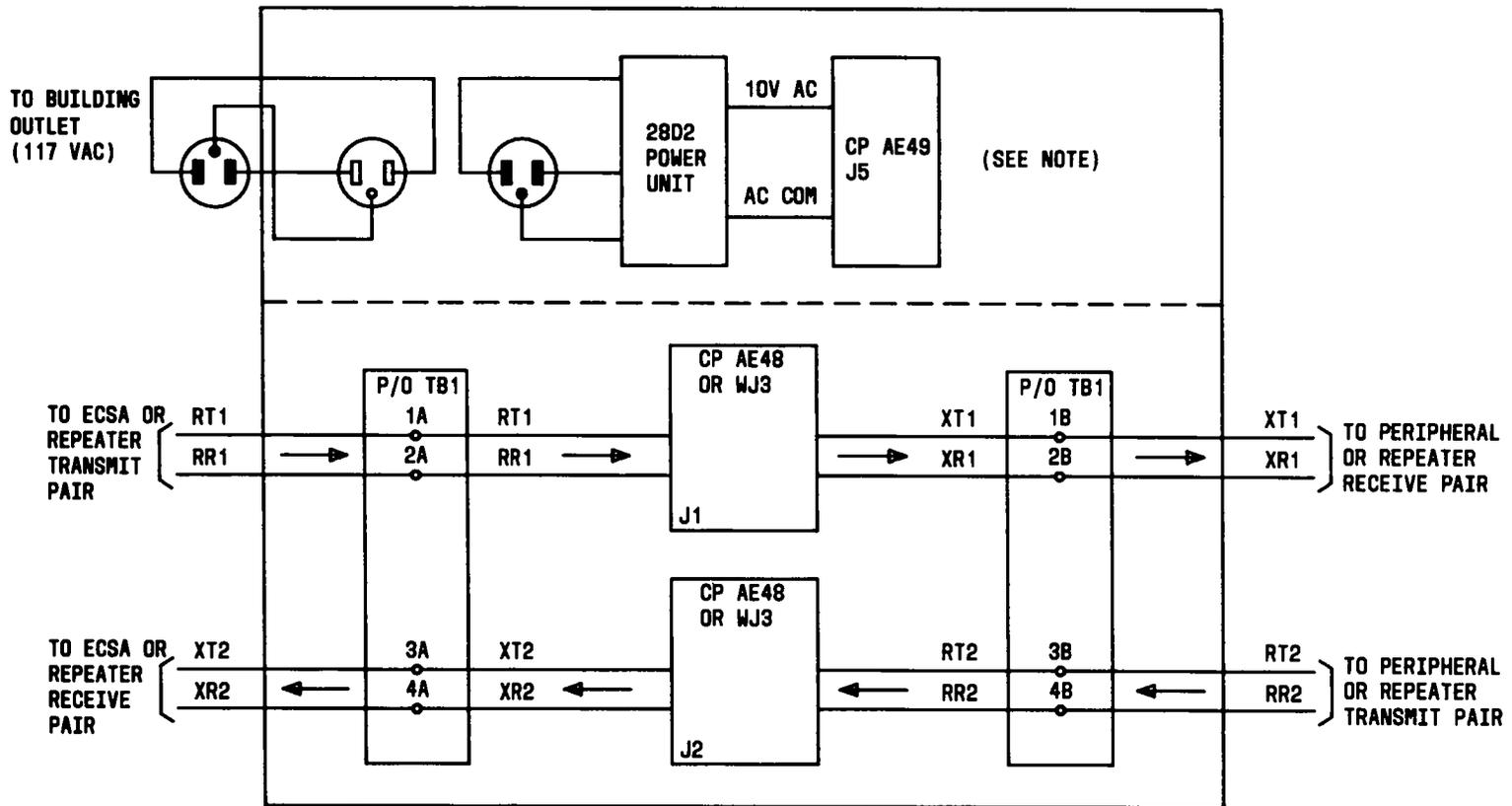
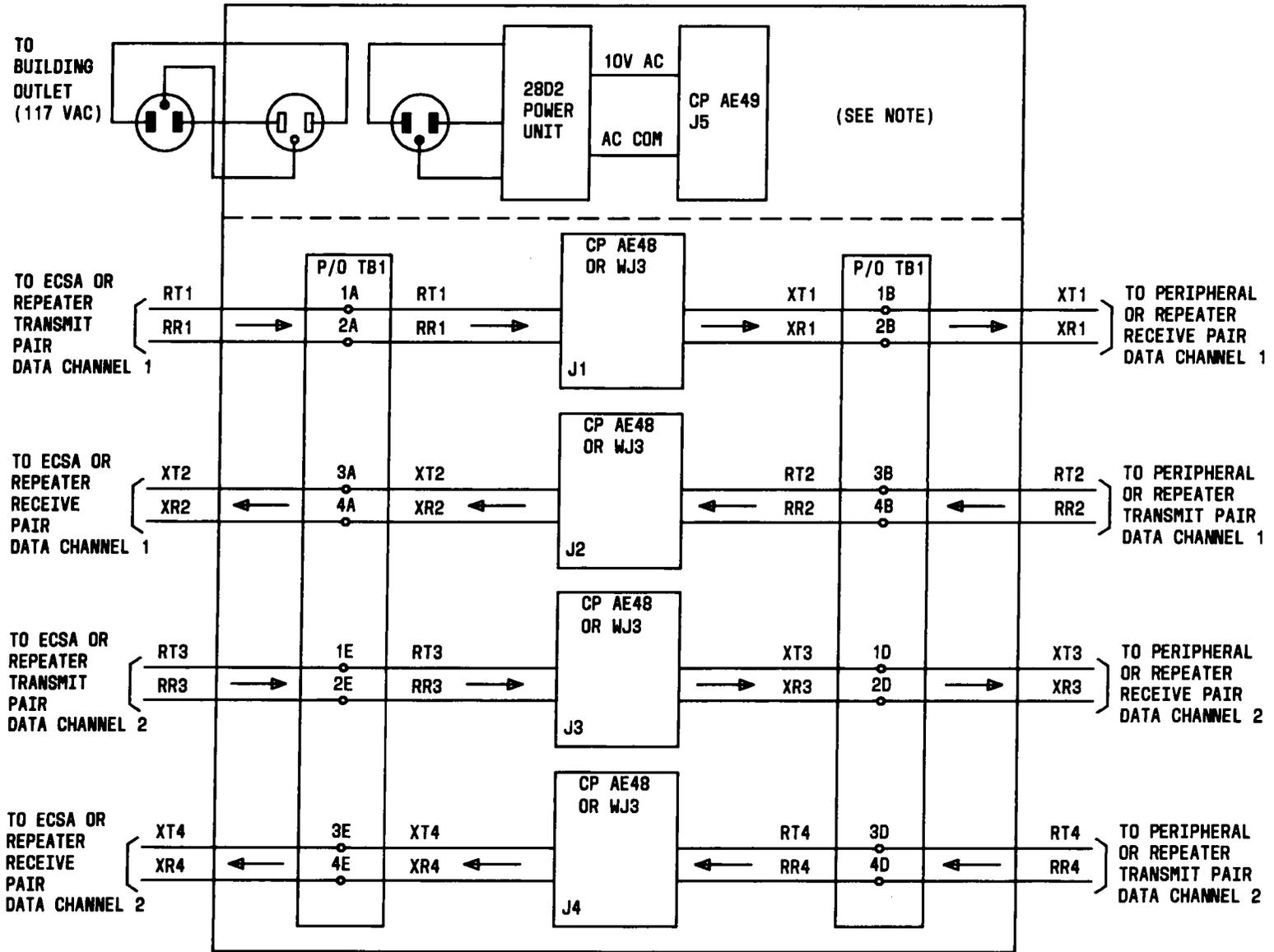


Fig. 27—Data Channel Repeater (J58879KC)



NOTE:
THE POWER SUPPLY UNIT AND CP AE49 ARE NOT REQUIRED WHEN THE WJ3 CIRCUIT IS USED.

Fig. 28—Single-Channel Repeater With Range Extension (AE-48) or Without Range Extension (WJ-3)



NOTE:
THE POWER SUPPLY UNIT AND CP AE49 ARE NOT REQUIRED WHEN THE WJ3 CIRCUIT CARD IS USED.

Fig. 29—Dual-Channel Repeaters With Range Extension (AE-48) or Without Range Extension (WJ-3)

connections. The channel 2 repeater circuit cards in J3 and J4 are used in conjunction with rows D and E of terminal block 1.

D. Data Range

5.17 The use of data channel repeaters can extend the maximum distance between the ECSA and the peripheral unit to 3350m (11,000 feet) as follows:

- 305m (1000 feet) between the PBX and one repeater
- 914m (3000 feet) between the first and second repeater
- 914m (3000 feet) between the second and third repeater
- 914m (3000 feet) between the third and fourth repeater
- 305m (1000 feet) between the fourth repeater and the peripheral unit.

5.18 Worksheet 1 is to be used in providing cross-connection information on the data channel repeater and cascaded repeater connections from a control/energy carrier. Connections from a repeater to a second repeater or to a peripheral device are given in fill-in Worksheet 2.

5.19 Data link range is a function of cable attenuation and receiver sensitivity. The repeater-to-repeater range is 914m (3000 feet) for No. 24 AWG cable. The ECSA-to-repeater and repeater-to-peripheral data link range is limited to 305m (1000 feet) by receiver sensitivity.

5.20 The data range is limited by the cable attenuation and round trip propagation delay and may not exceed 3353m (11,000 feet) from the ECSA to the peripheral unit, regardless of cable wire gauge.

5.21 The range for one direction of a data link may be estimated by the following formula.

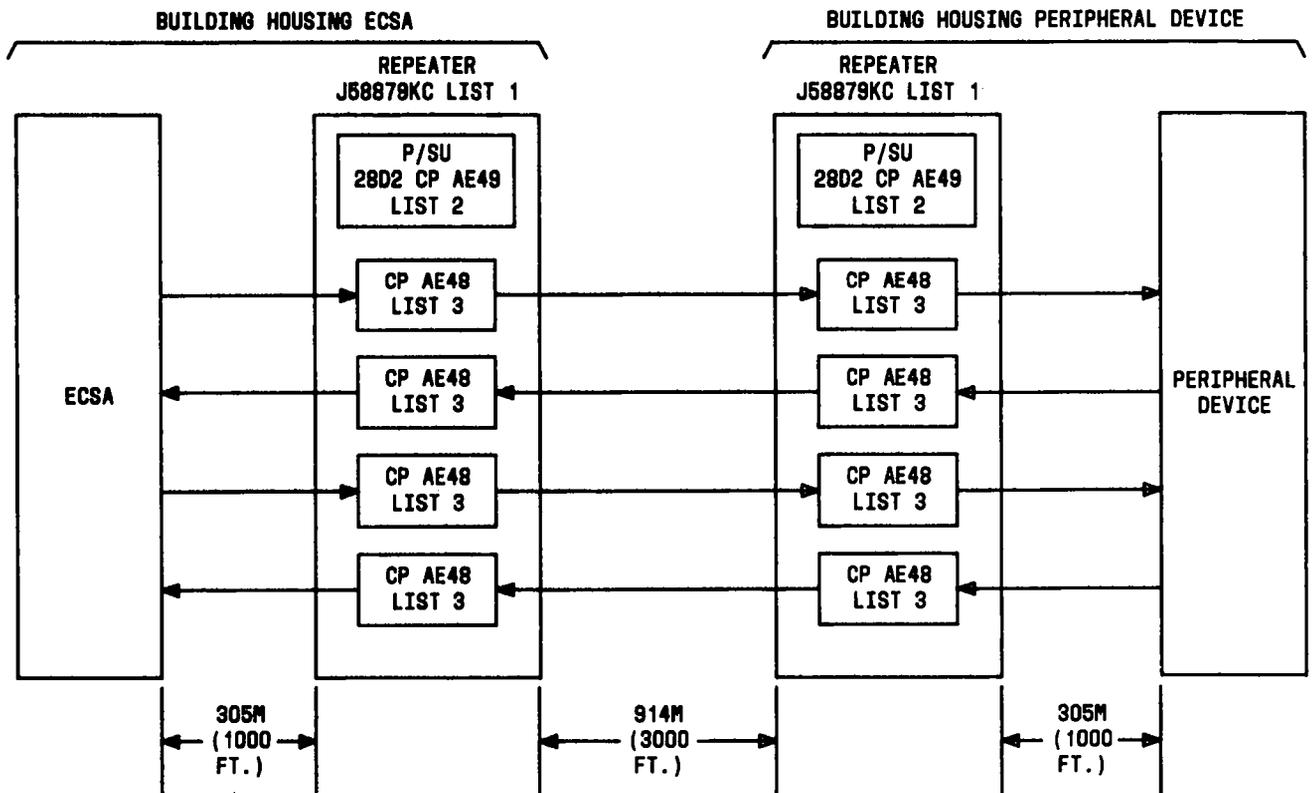


Fig. 30—Dual-Channel Repeaters for Off-Premises Use

$$R = \frac{20 \text{ LOG}_{10} \left(\frac{XL}{RS} \right)}{\alpha (\text{dB/UNIT LENGTH})}$$

Where:

XL = Transmit level of sender

RS = Receive sensitivity of receiver

α = Cable attenuation

Both directions must be measured to determine the data link range.

5.22 The transmit level is the magnitude of the transmitted biphasic pulse; for the repeater, XL = 5 volts.

5.23 The receiver sensitivity is the minimum magnitude of biphasic pulse required by the receiver circuit for detection; for the repeater, RS = 0.7 volt. For other circuits, the sensitivity depends upon the circuit pack code and vintage.

5.24 The cable attenuation is a function of the cable type and temperature; for No. 24 AWG, A = 5.5 dB per 305m (1000 feet).

5.25 The previously mentioned values can be substituted into the following range formula:

$$R = \frac{20 \text{ LOG}_{10} \frac{5.0}{0.7}}{5.5/305\text{m} (1000 \text{ FEET})} = 947\text{M} (3105 \text{ FEET})$$



The cable attenuation formula may be applied to individual cable runs between units. However, the total cable distance between the ECSA and the peripheral device MUST NOT exceed 3353m (11,000 feet).

E. Propagation Delay

5.26 The maximum data range is limited in software by the time allowed for a data channel

response. The maximum response time permitted by software is 160 μ s, allowing four repeaters to be cascaded for a maximum range of 3353m (11,000 feet) using 24 AWG wire. Range extension increases the data response due to repeater delay and cable propagation.

5.27 Each unidirectional repeater circuit (AE-48) has a 2.4 μ s delay. In an application employing two repeaters, a total of four repeater circuits are inserted in the loop for a total delay of 9.6 μ s.

5.28 Cable delay is approximately 1.7 μ s per 305m (1000 feet). For example, when a 1524m (5,000-foot) maximum range is used, the total cable length is 3048m (10,000 feet) resulting in a cable delay of 17 μ s.

5.29 In an application where four repeaters are used, a total of eight circuits are inserted in the loop for a total delay of 19.2 μ s.

5.30 Additional elements in the data response time are:

- Time required to shift out the data (92 μ s)
- Time required by the peripheral to respond to each bit (2 μ s)
- Time for the ECSA receiver to respond (1 μ s).

5.31 The above application (employing four repeater circuits and a range of 1524 meters [5000 feet]) requires the software to allow 122 μ s for a data channel response.

PERIPHERAL INTERFACE CIRCUIT (PIC)

5.32 The PIC is a stand-alone unit containing a controller which converts bipolar ECSA signals into an Electronic Industries Association (EIA) RS232C format which can drive an input/output peripheral device. The unit also contains a power supply, a 25-pin EIA serial data connectors (SX02), and an interface circuit. The PIC is required with the ECSA to provide a communication link between the LC366C circuit pack in the ECSA and the CRT console and/or the system printers. One PIC is required for each peripheral device.

5.33 The unit is mounted in a data set housing and requires the associated cord assemblies as

shown in Fig. 31. The main terminal connections for SX02 and SR01 are provided in Fig. 32. Worksheet 3 is a fill-in worksheet to be used to provide connections to a PIC unit.

REMOTE MAINTENANCE, ADMINISTRATION, AND TRAFFIC SYSTEM (RMATS-1)

5.34 Remote access to the logic and memory of ECSA systems is provided by RMATS-1. This capability allows certain maintenance and administrative routines to be performed remotely.

5.35 Various studies and structures may be flexibly administered in the ECSA and automatically polled by the RMATS-1 central facility (Fig. 33).

5.36 In order to function with the RMATS-1 central facility, the ECSA must be equipped with an LC171B (with slow-speed option), an LC172B cir-

cuit pack, and one low-speed automatic answering data set. An optional telephone set may be used if voice communication over the data link is required. The LC171B and LC172B circuit packs must be installed in control carrier, segment 0, slots 18 and 17, respectively. A dual in-line package (DIP) base containing strap wires is inserted into the DIP socket on LC171B to allow selection of data control rate (300 or 1200 baud) for data transmission.

5.37 The RMATS-1 interface equipment required for an ECSA system includes the following:

- One 113D or 113DR data set
- One 47-type data set mounting
- One LC171B circuit pack
- One LC172B circuit pack.

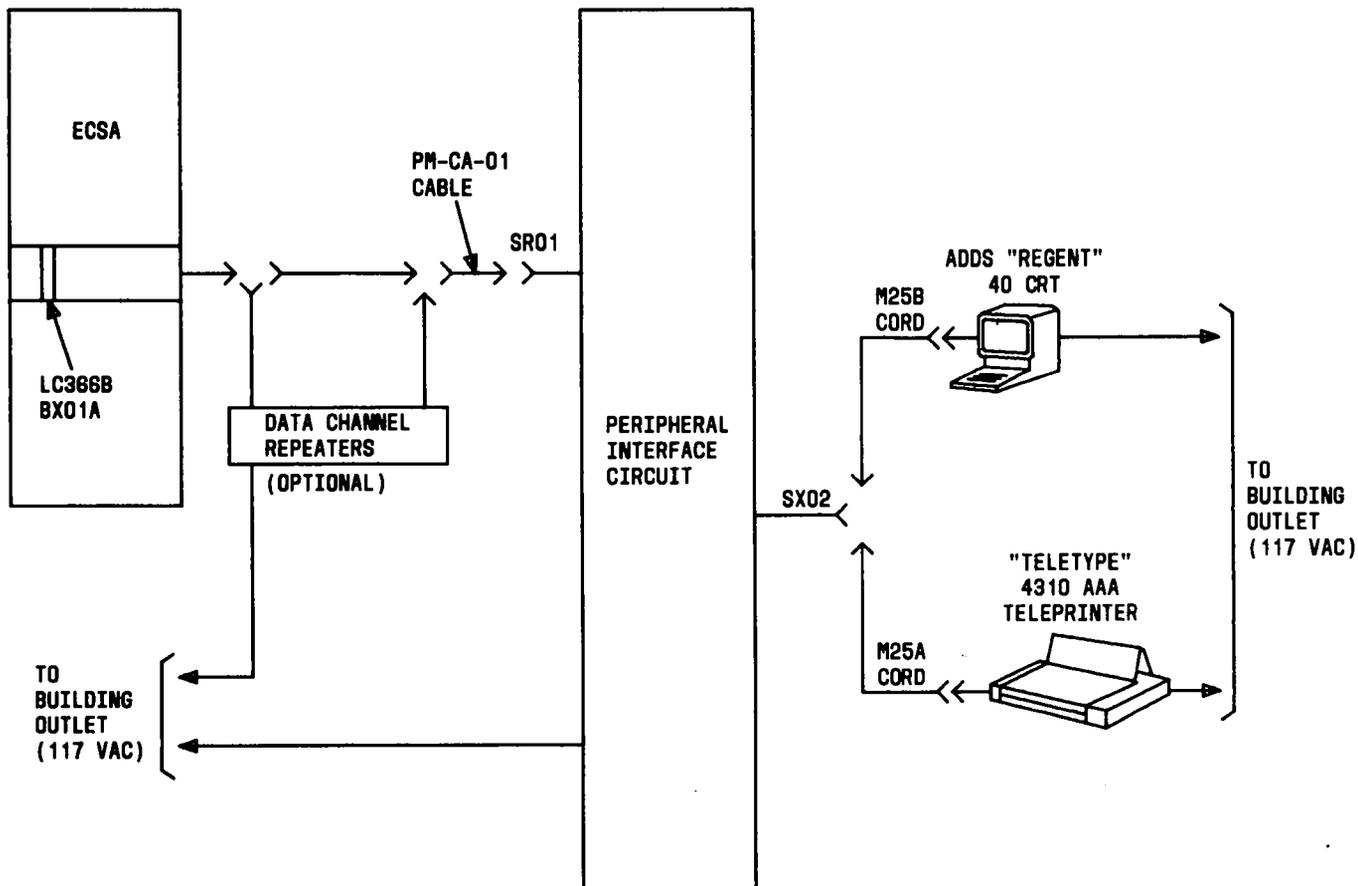


Fig. 31—Peripheral Interface Circuit (PIC) and Typical Connections

CONNECTOR	PIN	LEAD DESIG	DESTINATION
SR01 (CONN BURNDY SMS6R-1)	1	IOXB	BX01 (LC366B)
	2	IOXA	
	3	IORB	
	4	IORA	
SX02	1	RXD TXD	"TELETYPE" 4310 AAA TELEPRINTER, OR ADDS "REGENT" 40 CATHODE RAY TUBE
	2		
	3		
	4	DTR DTR	
	5		
	6		
	7	SIG GRD	
	8	DSR	
	20	DSR	

Fig. 32—Peripheral Connectors SX02 and SR01

5.38 The data set and data mounting should be located no more than 46 cable meters (150 cable feet) from the ECSA. The location should permit connection of the interface cable to the processor as well as 120-Vac 60-Hz power to the data set. Interface equipment for RMATS is shown in Fig. 34. For additional RMATS information, refer to Section 554-010-130.

6. CIRCUIT PACKS AND OPTIONS

6.01 The ECSA is shipped complete with circuit packs installed. However, engineering an ECSA installation requires knowledge of the circuit pack locations in the equipment cabinets (Fig. 5 through 7).

6.02 Plug-in printed wiring boards contain the circuitry to control operation of the ECSA system. Special marking is used to designate circuit pack vintages which must be chosen for installation in specific systems. This marking is a lettered suffix forming a part of the circuit pack code number. When a circuit pack code specified includes a lettered suffix, only that circuit pack code (or a later version indicated by a higher lettered suffix) should be used.



An LC366 circuit pack should NOT be used if an LC366B circuit pack is specified, but an LC366 can be used if either an LC366C or LC366B circuit pack is specified.

6.03 Standard circuit packs are required for normal system operation. Optional strappings or

other circuit packs may be required to implement additional features. Other strappings, working limits, etc, are provided for the following units to assist in system planning:

- Data control circuit (LC171B)
- Data transfer circuit (LC172B)
- Digital network buffer circuit (LC561)
- Dual-speed serial data channel (LC366B)
- Energy load control circuit (LC562)
- I/O and memory control (LC133 and LC133B)
- Network clock (LC121B)
- Power monitor and feedback circuit (LC563)
- Time-of-day clock (LC144).

A. Data Control Circuit (LC171B)

6.04 Circuit pack LC171B is used in conjunction with the RMATS. Each circuit pack contains two circuits, 0 and 1, and is installed in the control carrier, segment 0, slot 31. One circuit (1) of the LC171B circuit pack connects to the external data set which communicates with the RMATS. The second circuit (0) is a typical high-speed link which functions similarly to an LC366C channel. The LC171B circuit pack with speed control option blocks is shown in Fig. 35.

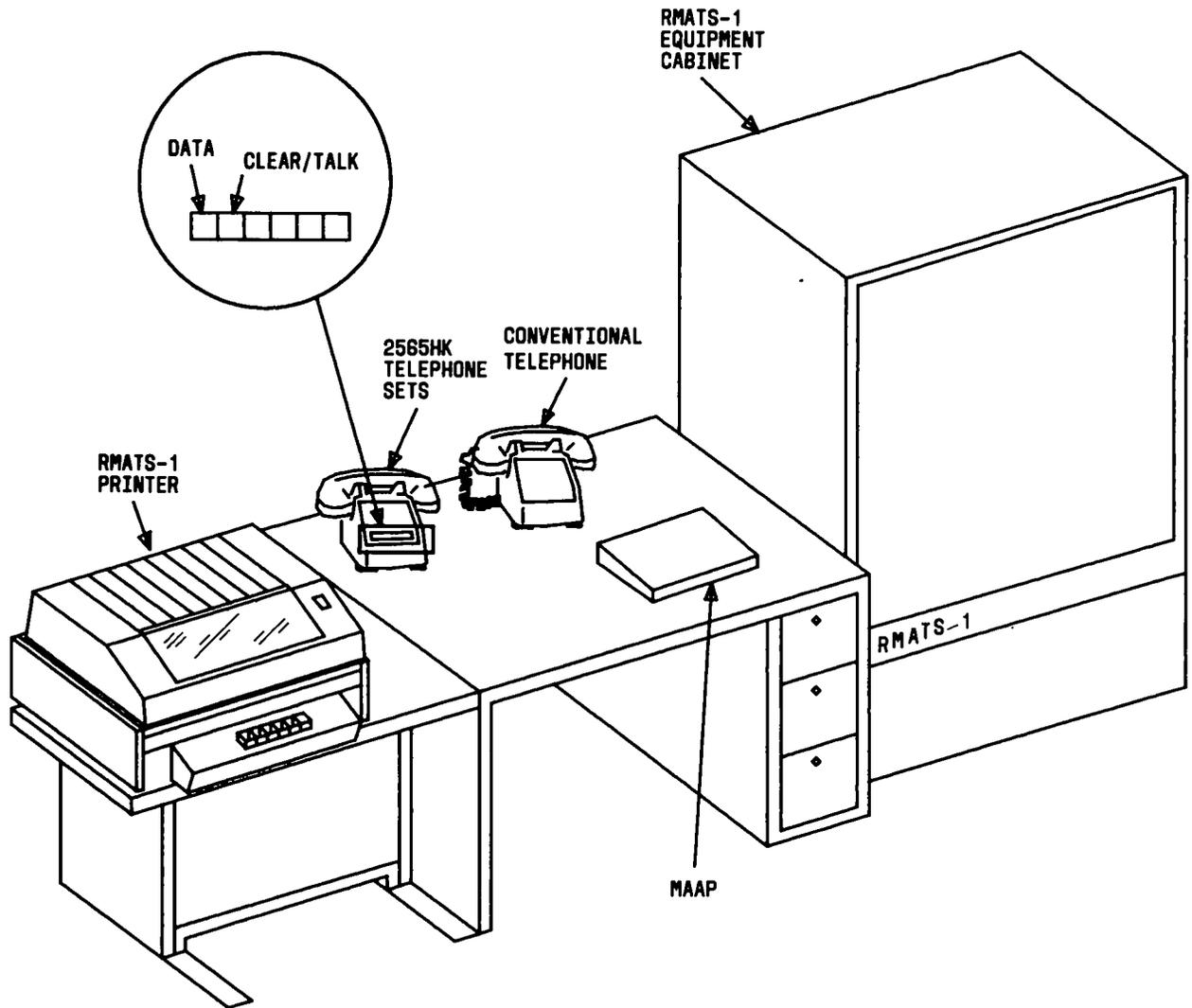


Fig. 33—RMATS-1 Equipment

B. Data Transfer Circuit (LC172B)

6.05 Circuit pack LC172B is required for RMATS in conjunction with LC171B. This circuit provides a data channel between the ECSA processor and the MAAP. The LC172B circuit pack (Fig. 36) contains an option block to be set for option G, required for the ECSA system.

C. Digital Network Buffer Circuit (LC561)

6.06 The LC561 provides control, and board and port decoders for the energy load circuits. The circuit pack provides the signaling for two electrical carriers or two segments. One LC561 is required for each control/energy carrier, and two or three are

required in each energy carrier. One of the LC561s required for the energy carrier must always be installed in slot 17 of segment 4. The unit provides maintenance control for the network control circuit packs in slots 18 through 21 as well as control for any LC562 load interface that may be installed in segment 4.

D. Dual-Speed Serial Data Channel (LC366B)

6.07 Circuit pack LC366B contains four input/output serial data channels. One channel (circuit 0) is a dual-speed (185 or 833 kilobits per second) channel. The three remaining channels can be used only for low-speed (185 kilobits per second) opera-

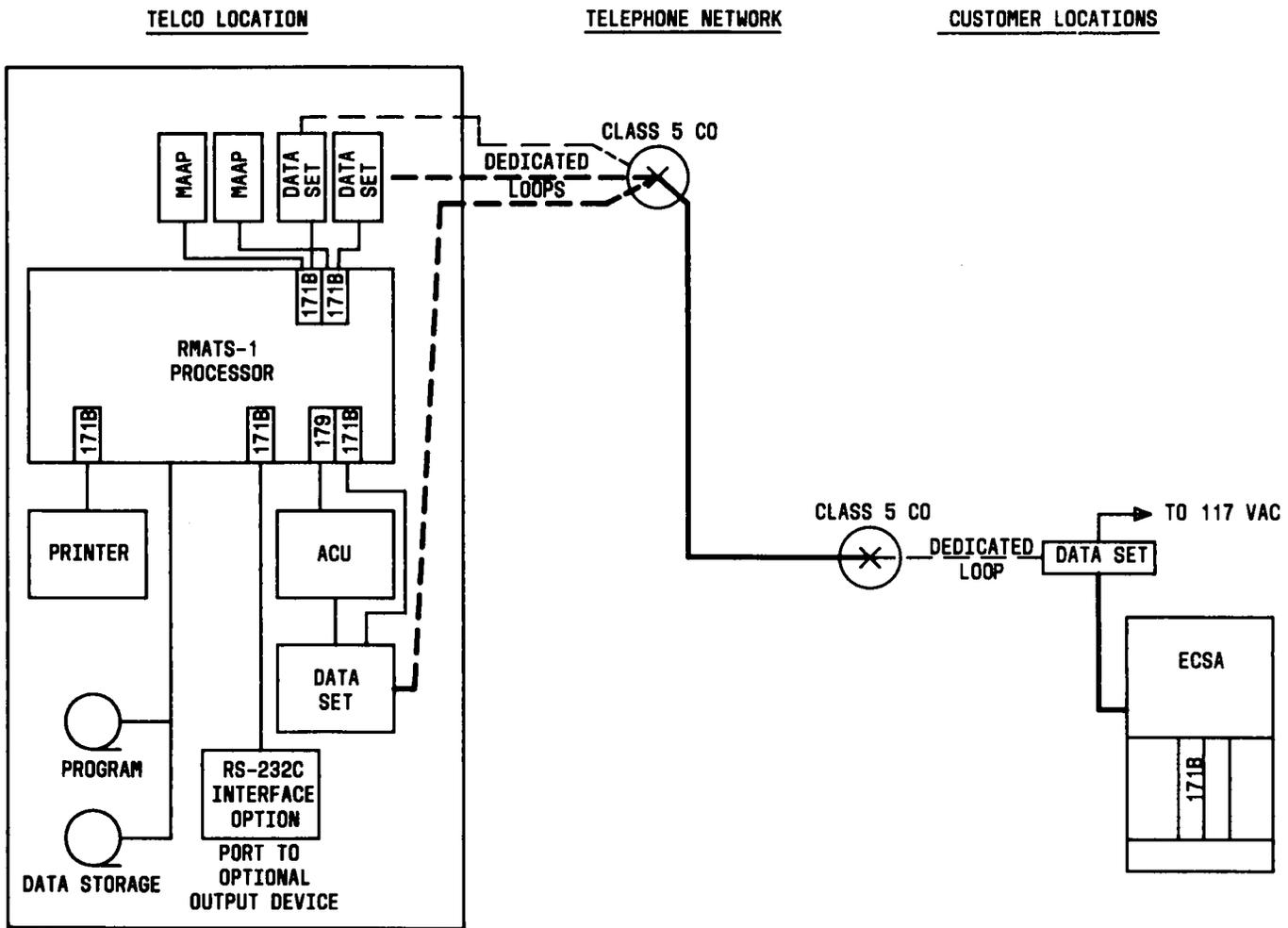


Fig. 34—RMATS-1 Functional Block Diagram

tion. Each LC366B circuit pack provides four data channels for use in the control/energy carrier. These channels are used for connection to the system console and printers. The circuit pack is installed in the control carrier, segment 0, slots 20/21 and 22/23. The low-speed/high-speed option for circuit 0 is selected via DIP socket J2 (Fig. 37). Dual in-line package socket J1 is used to select the type of system in which the LC366B is installed (eg, ECSA system).

E. Energy Load Control Circuit (LC562)

DANGER: Hazardous voltages may accidentally be applied to the ECSA system via the LC562 energy load interface leads which extend to the customer through the cross-connect field for connection to load control circuitry.

6.08 The LC562 provides contacts for controlling customer energy loads. Each unit has 16 contact circuits. Up to eight circuit packs may be installed in each segment of an energy carrier.



The working limits for the contacts on the LC562 should not be exceeded.

6.09 The working limits of the circuit pack contacts are as follows:

MAXIMUM DC VOLTAGE	MAXIMUM DC CURRENT	MAXIMUM POWER
130V	1A	25 VA

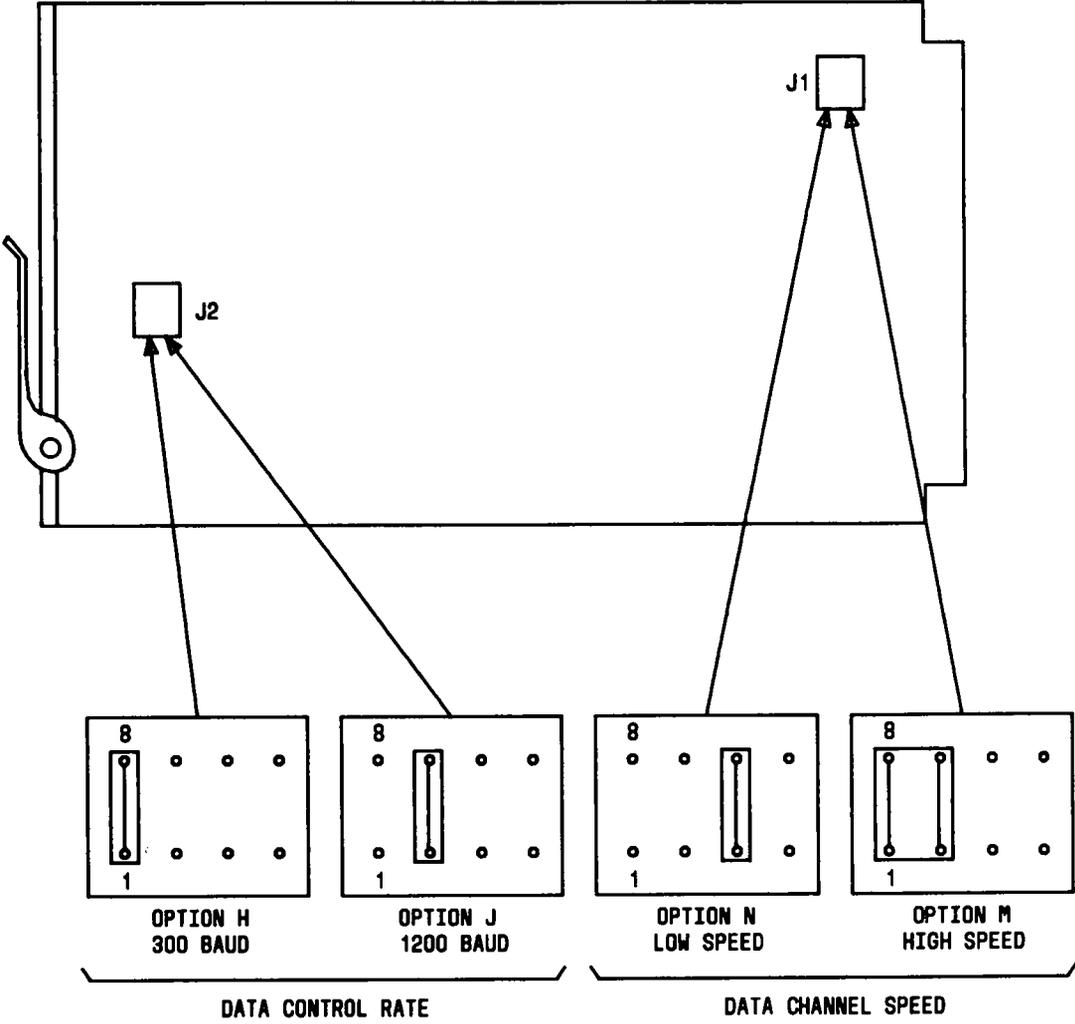
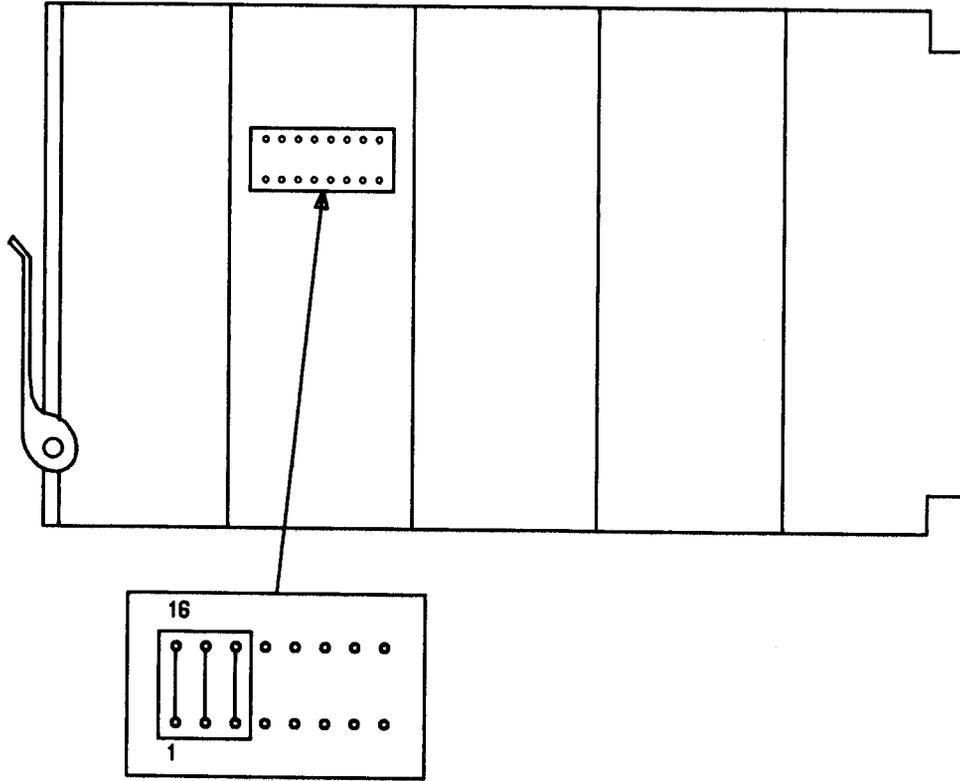


Fig. 35—LC171B Circuit Pack Options



NOTE:
BLOCK SET FOR OPTION G (REQUIRED
FOR ECSA SYSTEM)

Fig. 36—LC172B Circuit Pack Showing Shorting Block Set for Option G

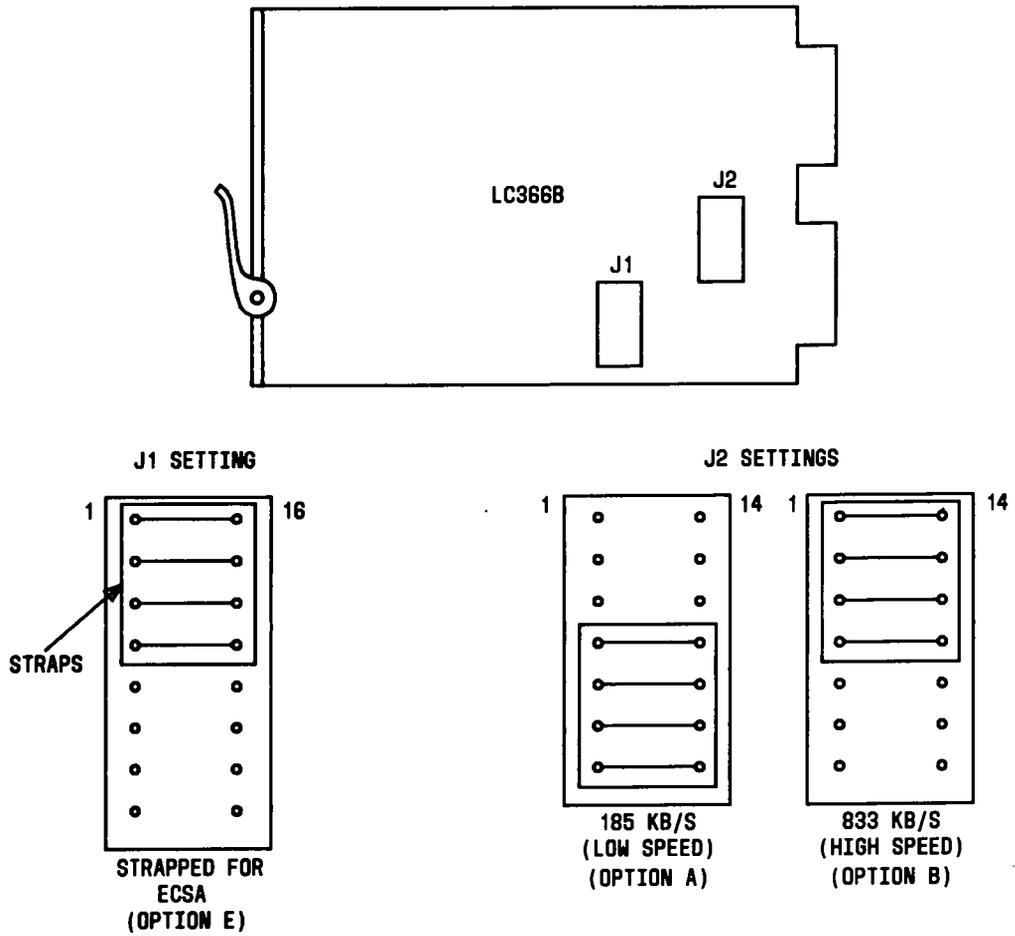


Fig. 37—LC366B Circuit Pack Options

6.10 Power is calculated as the open circuit voltage across contacts times the closed circuit current through the contacts. Typical examples for energy load circuits are as follows:

<u>DC VOLTAGE</u>	<u>DC CURRENT</u>	<u>POWER</u>
130V	0.19A	25 VA
50V	0.5A	25 VA
25V	1A	25 VA
12A	1A	12 VA
6A	1A	6 VA

6.11 The range limitations between the ECSA system and the customer load control relay may be calculated (when using 26-gauge wire) as follows with *RC* equal to the relay coil resistance in ohms, *VO* equal to relay operating voltage in volts, and *VS* equal to supply voltage in volts:

$$\text{DISTANCE (FEET)} = 12.19 \times RC \times (VS/VO - 1)$$

F. I/O and Memory Control Circuits (LC133B)

6.12 The I/O and memory decoder circuit pack, LC133B, contains a movable shorting block in a dual in-line package which provides options for the memory pack size used in the random access memory. The block shall be set to option W as shown in Fig. 38 (64K memory boards).

G. Network Clock Circuit (LC121B)

6.13 The network clock circuit pack (LC121B) provides all functional timing for the ECSA system. One LC121B is required for each energy carrier in slot 18.

6.14 The circuit pack contains a switchable circuit which must be positioned as shown in Fig. 39.

H. Power Monitor and Feedback Circuit (LC563)

6.15 The LC563 detects pulse signals from power meters or other pulse-type circuits. A maxi-

mum of 400 pulses per minute can be detected. The circuit pack contains 16 pulse detecting circuits. Only one circuit pack per system is used to interface power meters. This circuit pack may be installed in any energy load slot in the control/energy and energy carriers.

6.16 In addition, a second LC563 is provided for maintenance use to test the LC562 circuit packs. Slots 1 and 2 of segment 0 in the control/energy carrier is reserved for the LC563 used for testing. A set of special cables (groups 601, 602, and 603) are provided to connect between the LC563 (carrier connector BB01) and the connector(s) associated with the LC562 under test.

I. Time-of-Day Clock Circuit (LC144)

6.17 This common-control circuit pack provides an improved hardware clock recommended for billing accuracy. It is installed in slot 19, segment 0 of the control carrier. The H-606-113, G1 battery pack provides power for the LC144 in the event of commercial power failure.

7. REFERENCES

7.01 The following *sections* are associated with the ECSA and, when available, may be used for additional information:

<u>SECTION</u>	<u>TITLE</u>
461-130-100	Backboards—Identification and Installation
554-000-000	DIMENSION PBX Numerical Index (refer to this index for TOP Documents)
554-000-100	DIMENSION PBX Miscellaneous Documentation Index (refer to this index for Administration and Maintenance Manuals)
554-010-101	DIMENSION Type PBXs—Input/Output, Interface, and Auxiliary Circuits—Maintenance Support Information
554-010-102	Peripheral Interface Circuit
554-010-130	DIMENSION PBX—Remote Maintenance, Administration,

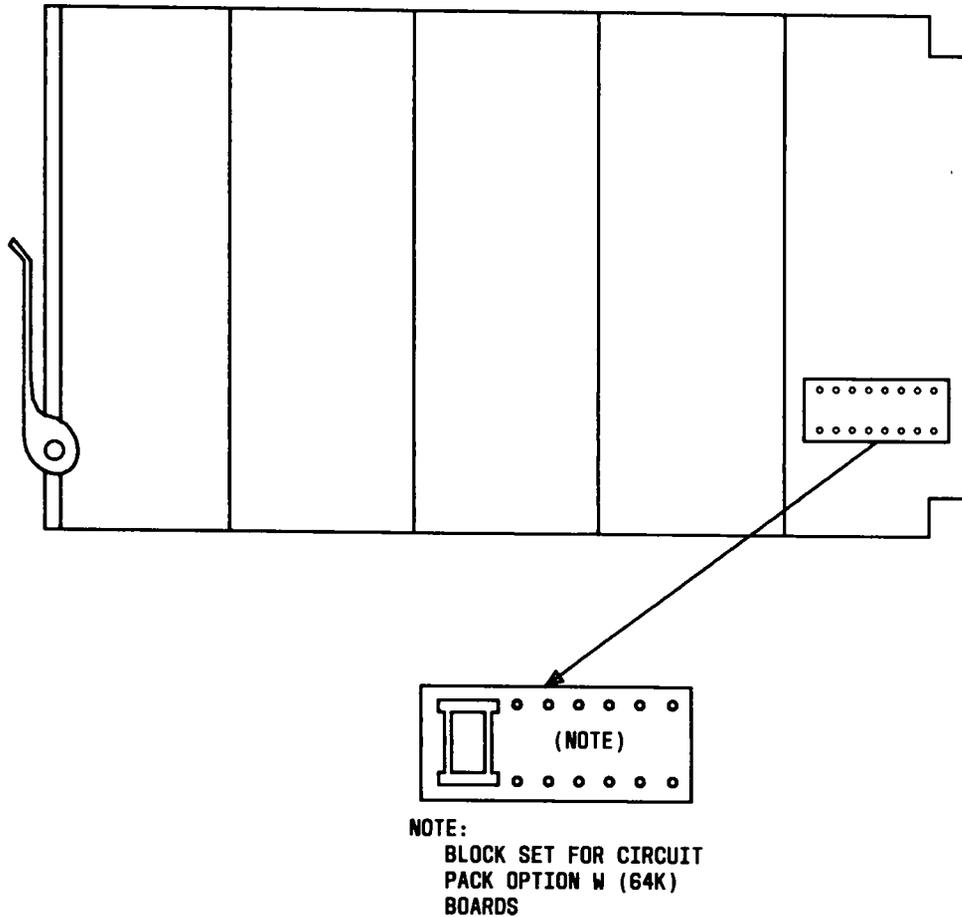
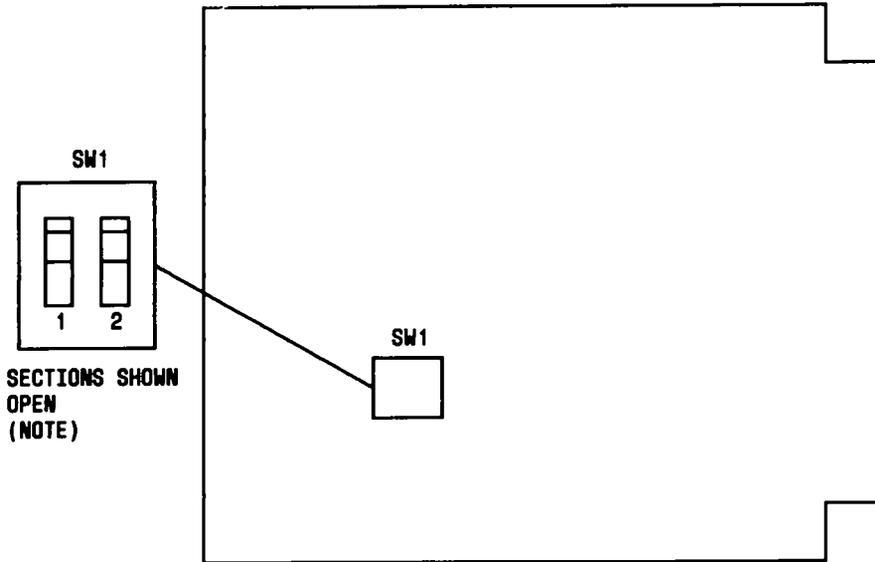


Fig. 38—Circuit Pack LC133B Shorting Block Set for Option W

SECTION	TITLE	DRAWING	TITLE
	and Traffic System (RMATS-1)—Description and Operation		
554-106-100	Energy Communication Service Adjunct—System Description	SD-1E460-01	PBX System CSS201 Data Channel Repeater (Issue 3D)
554-191-100	DIMENSION PBX—Feature Document Reference Guide	SD-1E467-01	Peripheral Interface Circuit (Issue 5D)
809-002-100	PBX Equipment Space Requirements	SD-1E482-01	Maintenance and Administration Panel—(MAAP)—(Issue 6D)
876-300-100	Electrical Protection—Station and PBX	SD-1E483-01	AC Distribution, Fan Assembly and Frequency Generator Circuit (Issue 13D)



NOTE: SECTION 2 OF SWITCH MUST ALWAYS BE IN OPEN POSITION. SECTION 1 IS A SPARE AND MAY BE PLACED IN EITHER POSITION.

Fig. 39—LC121B Circuit Pack Switch Location and Options

DRAWING	TITLE	DRAWING	TITLE
SD-1E499-01	Energy Communications Service Adjunct (Issue W1E)	J53135JA-1	AC Power Distribution, Fan Assembly, and Mini-Recorder (Issue 1W)
SD-97736-01	KS-21447 Minirecorder (Issue 2B)	J53135TA	Stored Program Memory (Issue 1)

7.03 The following *J-drawings* are associated with the PBX and may be referred to for additional information:

DRAWING	TITLE
J53135A-1	Basic Small Cabinet (Issue 1W2)
J53135AA-1	Control/Energy Carrier (Issue 1W2)
J53135AB-1	Energy Carrier (Issue 1W1)
J53135DA-1	Control and Alarm Panel (Issue 1W1)

J58882DC-1

MAAP (Issue 10W)

7.04 The following *equipment drawings (EDs)* are associated with the PBX and may be referred to for additional information:

DRAWING	TITLE
ED-1E301-01	Environmental Requirements (Issue 6)
ED-1E432	Three-Carrier Capacity Cabinet Assembly (Issue 1W)
ED-1E433	Three-Carrier Cabinet Front Cover Assembly (Issue 1W)
ED-1E446	Cabling Information (Issue 1)

8. FILL-IN WORKSHEETS

8.01 The following fill-in worksheets should be reproduced locally and the originals kept with the section for use in planning future changes.

	WORKSHEET	TITLE
	2	Connections for a Data Channel From Repeater to Repeater or Repeater to Peripheral Device
	3	Peripheral Interface Circuit Connections
1		Data Channel Repeater From Control/Energy Carrier Cross-Connections

WORKSHEET 1

DATA CHANNEL REPEATER FROM CONTROL/ENERGY CARRIER
CROSS-CONNECTIONS

MODULE 0 CARRIER 0 SEGMENT 0			CONN CABLE COLOR CODE	CROSS-CONNECT		REPEATER TERMINALS				
CONN. NO.	CP SLOT NO.	CKT NO.		LEAD DESIGNATION	CONN BLOCK		CONN BLOCK			
BX01A	20/21B	0	IOXB0004	W-BL	1					
			IOXA0004	BL-W	2					
			IORB0004	W-O	3					
			IORA0004	O-W	4					
					W-G	5				
					G-W	6				
					W-BR	7				
					BR-W	8				
					W-S	9				
					S-W	10				
					R-BL	11				
					BL-R	12				
				20/21B	1		IOXB0005	R-O	13	
							IOXA0005	O-R	14	
	IORB0005	R-G	15							
	IORA0005	G-R	16							
	22/23B	0		IOXB0008	R-BR	17				
				IOXA0008	BR-R	18				
				IORB0008	R-S	19				
				IORA0008	S-R	20				
		1			IOXB0009	BK-BL	21			
					IOXA0009	BL-BK	22			
					IORB0009	BK-O	23			
					IORA0009	O-BK	24			
					BK-G	25				
					G-BK	26				
					BK-BR	27				
					BR-BK	28				
	18B	0		IOXB0002*	BK-S	29				
				IOXA0002*	S-BK	30				
				IORB0002*	Y-BL	31				
				IORA0002*	BL-Y	32				
	22/23B	2		IOXB0010	Y-O	33				
				IOXA0010	O-Y	34				
				IORB0010	Y-G	35				
				IORA0010	G-Y	36				
		3			IOXB0011	Y-BR	37			
					IOXA0011	BR-Y	38			
					IORB0011	Y-S	39			
					IORA0011	S-Y	40			
	20/21B	2		IOXB0006	V-BL	41				
				IOXA0006	BL-V	42				
				IORB0006	V-O	43				
				IORA0006	O-V	44				
		3			IOXB0007	V-G	45			
					IOXA0007	G-V	46			
					IORB0007	V-BR	47			
					IORA0007	BR-V	48			
					V-S	49				
					S-V	50				

* THESE LEADS ARE ALSO CONNECTED TO BX07 - ONLY ONE SET OF LEADS SHOULD BE USED AT ONE TIME.

WORKSHEET 2

**CONNECTIONS FOR A DATA CHANNEL REPEATER FROM
REPEATER TO REPEATER OR REPEATER TO PERIPHERAL DEVICE**

MOD 0 CARR 0 SEG 0		PBX LEADS FROM BX01A	1ST REPEATER		2ND, 3RD, OR 4TH REPEATER		LEAD DESIG	PERIPH TERM.
			TO PBX	TO SUCCEEDING REPEATER OR PERIPHERAL	TO PRECEDING REPEATER	TO SUCCEEDING REPEATER OR PERIPHERAL		
LC34B	TB1 TERM. NO.		TB1 TERM. NO.	TB1 TERM. NO.	TB1 TERM. NO.			
SLOT	CIRCUIT							
	0/2	IOXA_ _ _ _	1A	1B	1A	1B	XT1	
		IOXB_ _ _ _	2A	2B	2A	2B	XR1	
		IORA_ _ _ _	3A	3B	3A	3B	RT2	
		IORB_ _ _ _	4A	4B	4A	4B	RR2	
	1/3	IOXA_ _ _ _	1E	5B	1E	5B	XT3	
		IOXB_ _ _ _	2E	6B	2E	6B	XR3	
		IORA_ _ _ _	3E	7B	3E	7B	RT4	
		IORB_ _ _ _	4E	8B	4E	8B	RR4	

WORKSHEET 3

PERIPHERAL INTERFACE CIRCUIT CONNECTIONS

SLOT_ _ LC366B CKT NO.	LEAD DESIG	OOBX01A CONN BLK TERM.	PIC CONN CABLE	
			COLOR CODE	LEAD DESIG
	IOXB00_ _		W-BL	IOXB
	IOXA00_ _		BL-W	IOXA
	IORB00_ _		W-O	IORB
	IORA00_ _		O-W	IORA