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AG COMMUNICATION SYSTEMS

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GTD-5® EAX

Power and Alarm Equipment

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1. GENERAL

1.7 This practice describes the organization and functional operation of the power and alarm equipment used in the Base Unit (BU), Remote Switching Unit (RSU), **and** Remote Line Unit (RLU) of the GTD-5 EAX. The information provided in this practice complements other AG Communication Systems (AGCS) and GTE practices and is not intended to replace any of them.

1.2 This practice is reissued to provide information pertinent to System Version Release (SVR) 1.7.2.1. New or updated information is indicated by revision bars. Remove the previous issue of this practice from the binder or microfiche file and replace it with this issue.

2. DIRECT CURRENT POWER

Storage Batteries

2.1 The system's dc-todc converters (power supplies) will function properly with 42 to 56 Vdc at their inputs. This voltage requirement is usually met by utilizing a 23/24-cell battery.

NOTES:

1. No matter how many cells are used to provide the 42 to 56 Vdc, the battery manufacturer's float and equalization requirements must be within the operating limits of the GTD-5 EAX unit.
2. For GTE recommended battery types and application information, refer to GTE Practice 795-100-075, *Battery Cells for 50 V-DC Powerboards – Engineering Applications.*

2.2 To meet minimum line transmission current requirements, the float voltage of the battery string must be sufficiently high to maintain 50 Vdc at the line equipment when the dc distribution losses are considered.

2.3 **Engineering Considerations.** The office battery must be sized properly with consideration given to office growth. (Refer to GTE Practice 795-100-075.) The dc distribution of the office battery should also be arranged to maximize its filtering capacity.

2.4 When a GTD-5 EAX unit shares a common power plant with other systems/units, the equalization voltage should be set to the lowest maximum operating voltage of the equipment in the complex. The GTD-5 EAX will accept an equalization voltage as high as 56 Vdc.

Battery Chargers

2.5 The battery charging equipment for the BU, RSU, and RLU consists of two or more ac-to-dc rectifier charging units that are connected for parallel operation. The chargers are sized in such a manner that failure of one unit will allow the remaining unit or units to safely carry the busy-hour office load. The chargers are installed so that the battery is electrically located between the chargers and the system power board.

Power Board

2.6 The terminals of the battery are bused or cabled to a Power Control Unit (PCU) (power board) that provides the necessary meters, shunts, alarms, and switches to monitor and control performance of the power plant.

2.7 **Power Distribution Unit (PDU).** The PDU is a subordinate unit of the PCU that is used to provide primary and/or distribution fusing for the distribution of power to the system unit.

2.8 **Disconnect Switch Unit (DSU).** A DSU is a subordinate unit of the PCU that is required when the PDU(s) is not located immediately adjacent to the power complex (meaning the length of the power cables from the battery to the local PCU exceeds 30 loop feet), or when the **PDU's** are not located in the system unit's power room.

2.9 The DSU also provides fault protection to dc power cables.

3. ALTERNATING CURRENT POWER

Commercial Alternating Current Power

3.1 All AGCS communication switching systems operate within the American National Standards Institute (ANSI) C84.1 ac voltage limits.

3.2 Due to service interruptions, load reductions, and peak transient voltages, all equipment operating on 120-Vac, 60-Hz, single-phase power must be classified in the following manner as to the reliability of required service:

(a) To operate only on commercial power. Extended outages will not degrade hardware reliability and will not hamper maintenance or repair activity.

(b) To furnish power by a single-phase inverter running on office battery. lnverter failure results in an automatic transfer to commercial or standby power. The dc-to-ac inverter is continuously running and is synchronized to, and in phase with, commercial power.

Emergency Alternating Current Power Plant

3.3 Offices should be arranged with an emergency engine-driven ac alternator unit to provide a standby source of ac power during a commercial power failure. The capacity of the unit is determined by the type and amount of ac equipment that will be connected to it during a commercial power outage.

NOTE: It is the customer's responsibility to determine capacity and whether the standby ac source will be portable or stationary.

3.4 Some of the primary items of equipment connected to the emergency unit during a commercial power outage are as follows:

(a) Battery chargers

(b) Emergency lighting

(c) Any other items deemed necessary for proper operation of the office during a commercial ac power outage

3.5 The unit must include the following primary features:

(a) A voltage regulation of ±2 percent, no load to full load

(b) A frequency of 60 Hz ±5 percent

(c) The capability for starting at expected local minimum ambient temperatures without the aid of heaters

(d) Full automatic start and stop operation, and automatic transfer of all specified services

(e) A maximum of 20 percent voltage dip upon application of full load and a maximum of two seconds recovery time

Equipment Frame Alternating Current Power

3.6 **Inverters.** It is recommended that the customer make provisions for supplying the proper class of ac power to selected equipment frames. For reliability purposes, an inverter, running on office battery with automatic load transferto commercial power, should be provided as backup for critical system ac equipment.

NOTE: It is recommended that inverters be mounted in the power area or at least six feet from any GTD-5 EAX equipment. (Refer to GTE Practice 795-805-071, *Central Office Grounding Systems – Engineering Applications.)*

3.7 **AC Receptacles.** Two types of ac receptacles may be provided as commercial ac (120-Vac, 60-Hz) outlets:

(a) Nonisolated ground receptacle, usually brown in color

(b) Isolated ground receptacle, usually orange in color

NOTE: Additional information pertaining to ac receptacles can be found in GTE Practice 795-805-072, *AC Service Grounding Engineering Applications.*

3.8 **Nonisolated Ground Receptacles.** Standard nonisolated ground ac receptacles are used as convenience outlets and must be located on or around the periphery of the equipment room (walls or columns).

NOTES:

1. Nonisolated ground ac receptacles are not to be located in the equipment lineup.
2. Nonisolated ground ac receptacles are not to be mounted in the kickplate at the base of equipment bays.

3.9 These nonisolated ground receptacles are used for non-system-related, non-electronic apparatus, such as wire-wrapping guns, hand drills, soldering irons, and floor cleaners. They should be treated as part of the building rather than associated with the equipment or equipment frames.

3.10 Any other GTD-5 EAX mounted ac-powered equipment, such as printers, power supplies, Cathode Ray Tubes (CRTs), and modems, must be served by nonisolated (brown) ac outlets of the following types:

(a) Nonmetallic ac conduits

(b) Nonmetallic receptacle or isolated metallic boxes

(c) Nonmetallic covers

(d) A green-wire ground

NOTE: If these units provide essential services to switch operation, consideration should be given to providing ac inverters to ensure operation In the event of commercial and standby ac failure.

3.11 The ac circuits and conduit runs for these receptacles should be dedicated for only the intended system-related equipment, and should not be enclosed in the same conduit with the isolated ac ground conductors. These receptacles should not be used for equipment located outside of the GTD-5 EAX area. (Refer to GTE Practice 795805072 for additional information.)

3.12 **Isolated Ground Receptacles.** Isolated ground receptacles are ac outlets with the third wire (green) protective ground isolated from conduit and frame ground. The green wire is carried to the isolated central ground point and located in the ac branch circuit cabinet, where it is extended back to the ground source of the applicable derived system or service.

3.13 Isolated ac receptacles are reserved for use with frame-mounted ac-operated equipment and for freestanding system test equipment.

3.14 Frame-mounted, ac-operated equipment receptacles should not be used for any purpose other than powering their specific system-related equipment. Additionally, branch feeders and respective fuses or circuit breakers must not be used to supply any other service.

3.15 If redundant equipment requiring ac power is provided, each equipment copy must have an individual branch circuit, preferably assigned to different phases of a three-phase network or to the opposite legs of single-phase service.

3.16 Test equipment convenience ac receptacles may be furnished and located in the equipment lineups (located in selected kickplates, both front and rear), to provide ac power outlets for equipment and other non-system-related electronic equipment such as oscilloscopes and portable test equipment.

Lighting Equipment

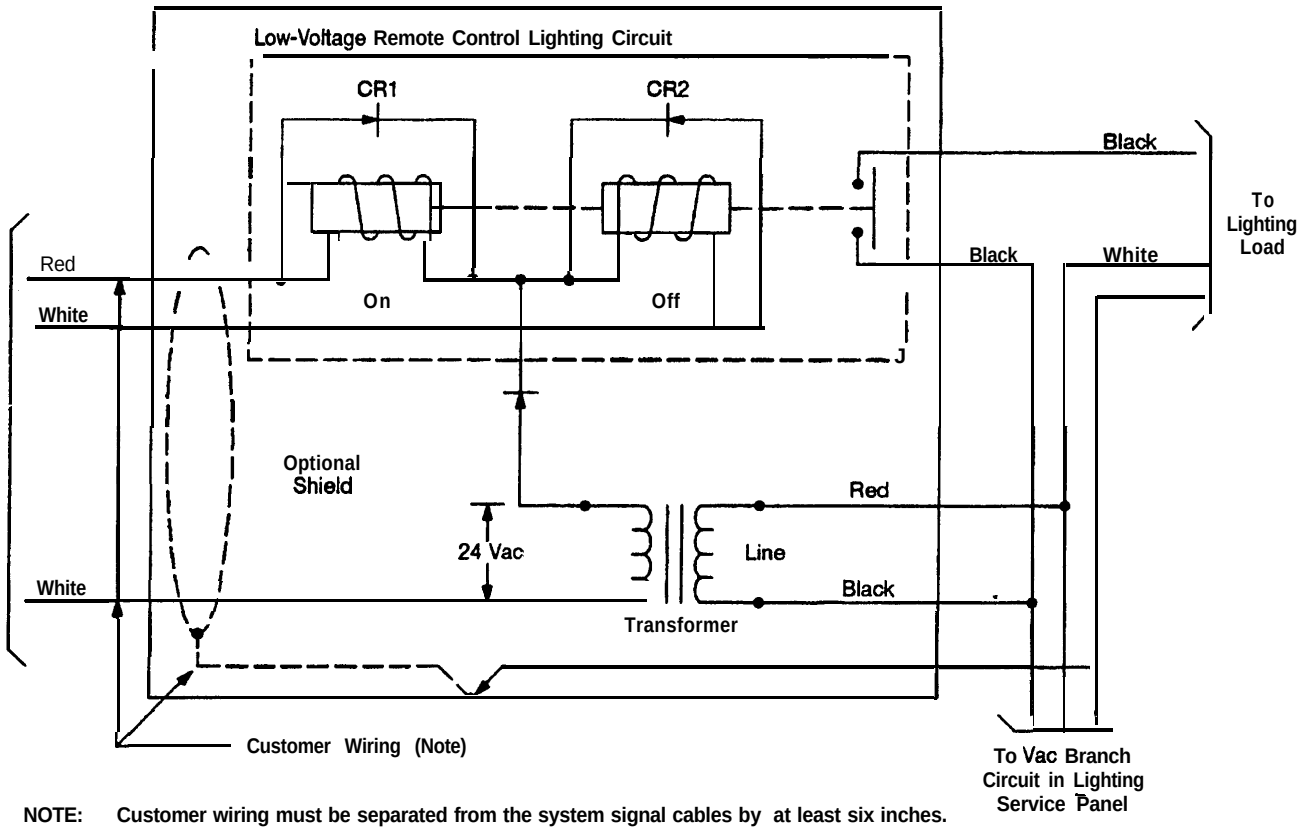
3.17 It is the responsibility of the customer to provide and install all lighting fixtures in accordance with applicable electrical codes. Approved lighting fixtures are to be provided.

3.18 A lighting plan is provided for each installation to specify where lighting fixtures should be located to provide the best illumination for all equipment frames, including the distributing frames. Fluorescent lighting fixtures are provided when aisle lighting is specified.

3.19 Lighting equipment must have a correctly sized green wire bonded to each lighting fixture and run via conduit to terminate on the ac lighting distribution panel.

3.20 **Low-Voltage Remote Switching System.** A low-voltage remote switching system can be used in conjunction with an ON/OFF nonlocking end-aisle light switch. Figure 1 shows a typical low-voltage remote control lighting circuit. The end-aisle light switches are provided as part of the equipment frame end-aisle cover and should only be placed at the main aisle end of each equipment frame lineup.

3.21 It is recommended that low-voltage control wiring furnished by the customer use shielded cable. This shielding is necessary to diminish fields around control conductors that might interfere with operation of the GTD-5 EAX.



NOTE: Customer wiring must be separated from the system signal cables by at least six inches.

Figure 1. Typical Low-Voltage Remote Control Lighting Circuit

3.22 When such shielded cable is used, the shield should be bonded only at the remote control and transformer end of the cable (Figure 1).

NOTE: Bonding the shield at the GTD-5 EAX end would defeat GTD-5 EAX frame ground isolation.

3.23 **Remote Control Relay and Transformer.** The remote control relay and transformer shown in Figure 1 should be located external to the GTD-5 EAX. The location should be at either the fluorescent fixtures or the branch panel. Low-voltage conductors should not be placed in the same conduit with high-voltage ac conductors.

3.24 Refer to Practice 256-224-216, *Cabling Methods*, and comply with zoning requirements, where possible.

4. POWER DISTRIBUTION, FUSING, AND CABLING

4.1 Figure 2 is a schematic diagram of a typical system power circuit. Power distribution to GTD-5 EAX equipment is accomplished via one of the following two methods:

(a) Co-located PDU. With the co-located PDU, all distribution fuses are located on the PCU or its equivalent panels, and serve the equipment frames directly.

(b) Remote PDU. When a remote PDU is required because of distance between the switchroom and the PCU, a single large fuse on the PCU or DSU is provided for the remote PDU, with appropriately sized conductors providing an interconnection.

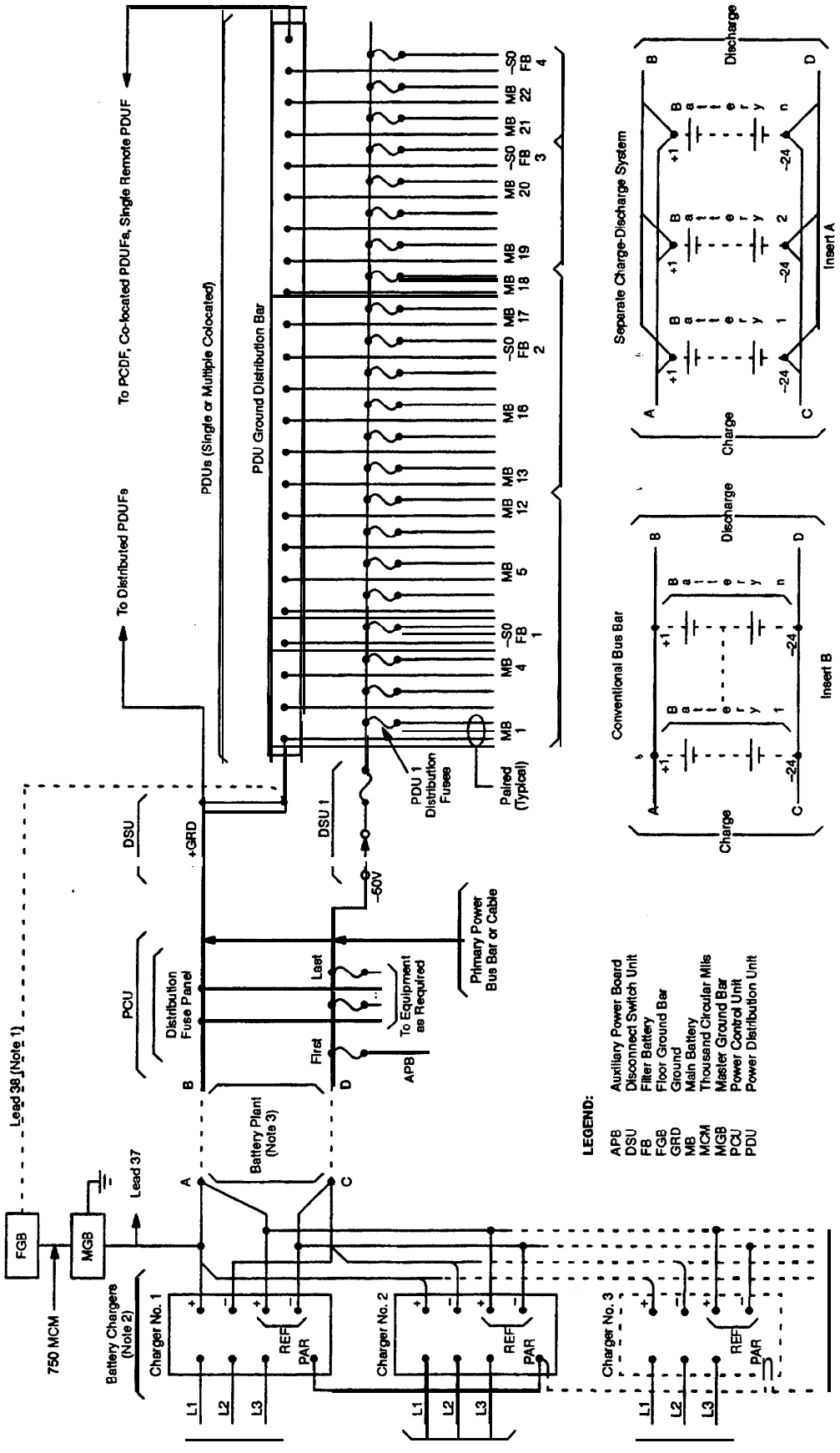


Figure 2. Typical System Power Circuit

4.2 More than one PDU (either co-located or remote) may be required, each with its own upstream distribution fuse or disconnect switch fuse on the DSU.

Fusing

4.3 All distribution fuses should be of the high-interrupt current capacity, silver-sand type, except for the small indicating alarm fuses. All fuses should be capable of safely interrupting the maximum short-circuit current available at their location, and must be electrically coordinated from the power room complex to the frame circuit fuse.

4.4 All fuses should be sized in accordance with the requirements provided in GTE Practice 795-001-070, *Switching Systems Power Cabling and Fusing – Engineering Applications.* Distribution fuses directly serving equipment frames should not exceed a 60-ampere rating, and should not be required to carry more than 80 percent of the rating under normal load conditions.

4.5 All battery feeders are fused. Such fusing is electrically coordinated to clear overload conditions in a safe manner before the upstream distribution fuse opens. The power alarm fuses provide outputs to activate local lamp indicators and miscellaneous sense points.

Cabling

4.6 A centralized method of cabling is used to distribute power and its associated ground directly from the power source to the equipment frame.

4.7 Power distribution cables are engineered with reference to the battery complex. The maximum calculated voltage drop between the battery plant and the equipment frames should not exceed 1.5 Vdc (1.0 for voltage drop and 0.5 for connection losses).

NOTES:

1. The calculated voltage always includes the loop length (battery and return) footage.
2. All power distribution cables must be paired and tightly coupled.

4.8 For additional information on cabling, refer to GTE Practice 256-050-206, *Cabling Methods Power Cable – Running and Securing.*

5. EQUIPMENT ISOLATION AND GROUNDING REQUIREMENTS

5.1 The GTD-5 EAX equipment circuits require isolation from the grounding of the Central Office (CO) building that houses the system. The details and requirements for CO grounding are described in detail in GTE Practices 795-805-071 and 795-805-072.

5.2 The GTD-5 EAX uses three basic grounding systems:

(a) An isolated ground system

(b) An integrated ground system

(c) A Line Circuit Protection Ground (LPG) system

Isolated Ground System

5.3 The isolated ground system consists of copper ground planes, located in electronic frames/equipment that are connected to a single point in the system with Low-Voltage-Ground (LVG) conductors.

5.4 Insulation details on the equipment frames are installed to aid the user in locating fault conditions that may have occurred between the isolated ground system and the integrated ground systems.

NOTE: The isolated ground system is only allowed to contact the integrated ground system at the single point called the ground window.

5.5 Under normal operating conditions, the GTD-5 EAX operates satisfactorily with ground faults existing, but under external influences, such as lightning or ground potential shifts, the effect of a ground fault may degrade the electronic system.

5.6 **Standard Hardware Electronic Systems (SHES) and Queen-Sized Frames.** The feet of an SHES or queen-sized frame are isolated from the floor and from contact with any building steel via the floor anchor bolts (refer to Drawing H-440000-K, Equipment *lsolation details for Electronic Switching Systems).*

5.7 The top of the frame is isolated from the runway and from contact with any other grounds, such as ac distribution conduit, building steel, and water pipes.

5.8 **AC Receptacles.** The ac receptacles within the equipment area are isolated to avoid a frame-to-frame metallic contact. This is accomplished by using nonmetallic conduit ac receptacle boxes and covers.

5.9 An isolated green wire ground is required to bond the ac receptacle terminals to ground. This requirement meets the National Electrical Code (NEC) standard, when plastic conduit, boxes, and fittings are used.

NOTES:

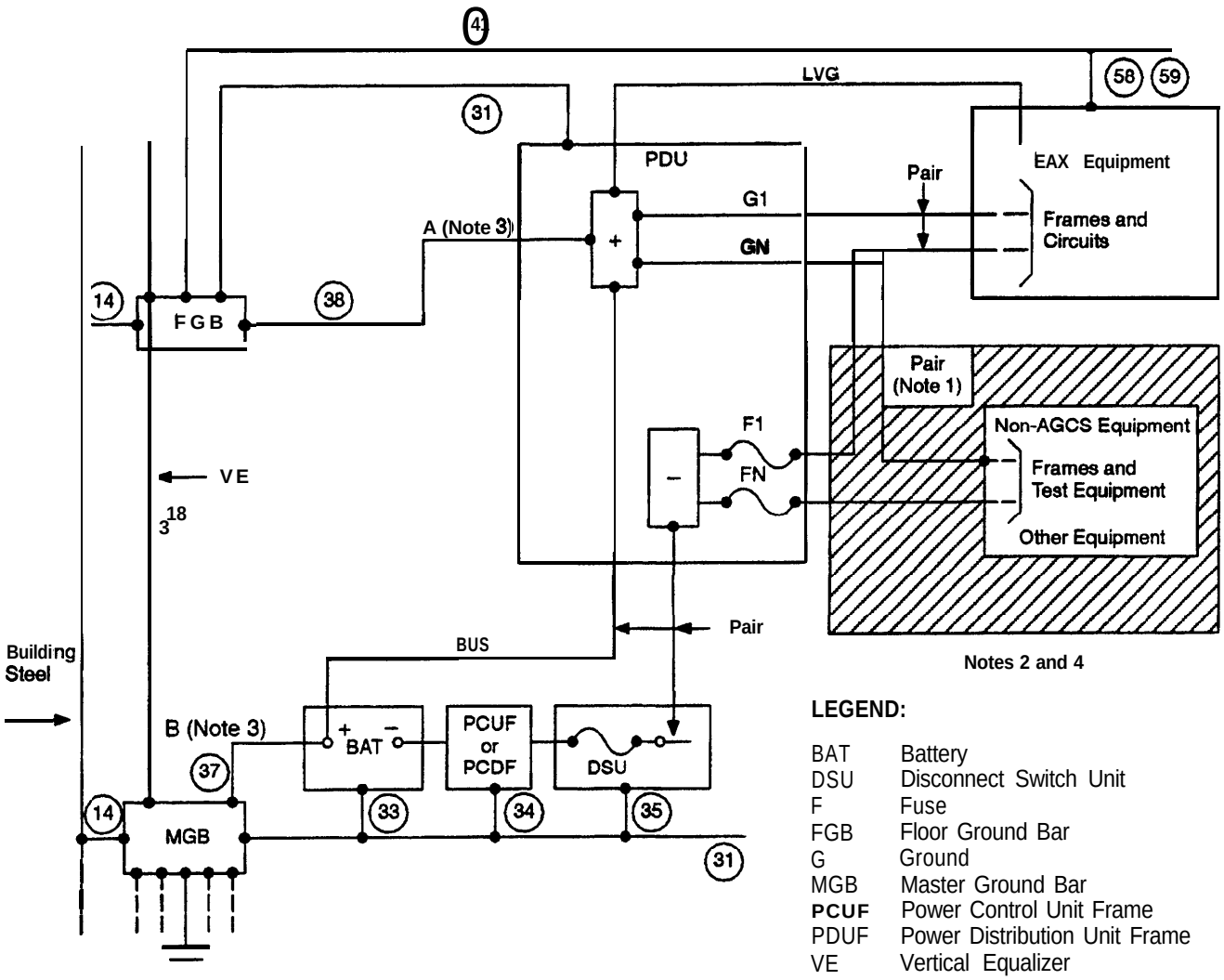
1. The isolated ground ac receptacle circuit wiring and its associated green wire ground lead are not to be enclosed in a conduit pipe with any other ac service wiring. The isolated ac ground must have its green wire extended back to the ground source of the applicable derived system or service.
2. The nonisolated ground ac receptacle wiring in the GTD-5 EAX area may not be enclosed with the isolated ac ground wiring. The nonisolated ground conductor must be insulated and extended without contact to the metal conduit or fittings until it is bonded to the branch ac panel.
3. An ac circuit serving the GTD-5 EAX cannot serve any equipment or receptacles outside the GTD-5 EAX equipment area and must have dedicated circuit breakers.

5.10 **Non-AGCS Manufactured Equipment.** All non-AGCS manufactured, dc-powered electrical equipment, purchased from outside sources and mounted in the GTD-5 EAX area, require the following special precautions:

(a) The equipment must be isolated from the frame. Refer to paragraph 5.14(b).

(b) The equipment must be isolated from any metallic contact with other equipment in the frame. If the equipment has either the positive bus or electronic ground common with the chassis, it should be isolated per Figure 3.

NOTE: Refer to Practice 237-224-214, *Engineering and Installation of Ground lsolation,* for test and grounding methods.



NOTES:

1. When possible, a separation of 12 inches should be maintained between the GTD-5 EAX and the other equipment power distribution feeders.
2. The isolation details are recommended in new offices where the other equipment is not in position and must be installed. See Figure 4 for the alternate method.
3. A or B, but not both.
4. Non GTD-5 EAX equipment shall be configured to the customer's standards. For GTE Standards, refer to GTE Practice 795-305-073, *Transmission Equipment – Central Office Grounding.*

Figure 3. Typical Central Office Grounding Arrangement (Preferred)

5.11 Any electrical equipment of the type mentioned in paragraph 5.10 that also requires ac power requires the following additional precautions:

(a) The ac power must be provided from a source that is separate from the isolated ac ground source.

(b) The equipment must be isolated from the frame and from other equipment in the frame.

(c) The dc power for the equipment must not originate from the same PDU bus that powers other GTD-5 EAX equipment. This is required only if the ac ground and the dc positive bus or the electronic ground are common on the chassis.

5.12 Any non-AGCS manufactured, ac-powered electrical equipment that is to be mounted in the GTD-5 EAX equipment area requires the following mounting precautions:

(a) The ac power is provided from a source that is separate from the isolated ground ac source.

(b) The equipment is isolated from the frame and from other equipment in the frame.

5.13 Any electrical equipment purchased as a complete frame or panel from non-AGCS sources, with either the positive bus or electronic ground on the chassis, requires the following precautions:

(a) If the office is completely new, the equipment frame or panel is to be isolated as a unit from all other ground contact.

(b) If the equipment is classed as an Additions and Maintenance (A&M) item, the equipment frame or panel is mounted in the same way as other frames of similar type.

NOTES:

1. If equipment is mounted as described in paragraph 5.13 (b), the dc power is provided from a different PDU bus, and should not originate from the same PDU bus that powers other GTD-5 EAX equipment.
2. If it is not feasible to isolate this equipment per Figure 3, the alternate grounding method (Figure 4) must be used.

5.14 When non-GTD.5 EAX manufactured equipment is mounted in a GTD-5 EAX frame with isolation material, the following conditions may exist:

(a) Positive ground of the unit is not isolated from the unit chassis and the unit itself provides the chassis safety ground. In this case, the isolation from the GTD-5 EAX frame must not be bridged.

(b) Positive ground return is isolated from the chassis via a removable unit strap. In this case, once the unit strap is removed, the GTD-5 EAX frame to unit isolation should be bridged with an external ground strap sized to the unit's power input. This provides the chassis ground path that was removed when the positive ground strap was removed.

NOTE: At installation time, a check should be made to ensure that no current flow occurs on the GTD-5 EAX frame to unit chassis grounding strap.

5.15 **Non-GTD-5 EAX Electronic-System-Type Frames.** Any non-GTD-5 EAX electronic-system-type frames, such as the following, may be isolated at the top and bottom of the frame in a manner similar to the SHES and queen-sized-type frames:

(a) Power Control and Distribution Frame (PCDF)

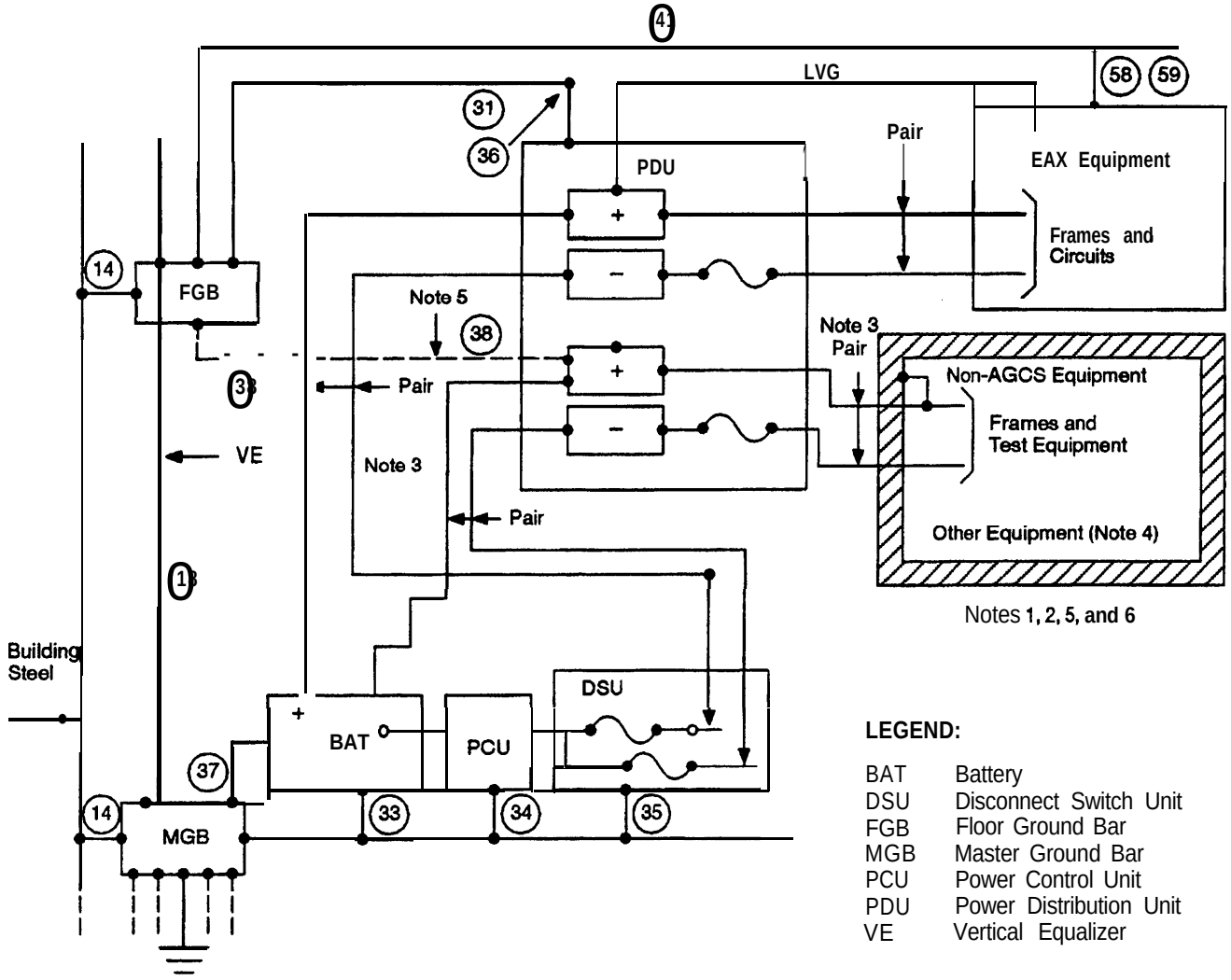
(b) Power Distribution Unit Frame (PDUF)

(c) Disconnect Switch Unit Frame (DSUF)

(d) Combined Distributing Frame (CDF) or Main Distributing Frame (MDF)

(e) Protector Distribution Frame (PDF)

NOTE: The ac isolation requirements outlined in paragraphs 5.8 through 5.14 also apply.



NOTES:

1. This ground and power distribution system should be used when it is not feasible to install the isolation details of Figure 3.
2. The split bus PDU shown or a second PCU, or equivalent is required.
3. When possible, a separation of 12 inches should be maintained between the GTD-5 EAX and the other equipment power distribution feeders.
4. Any equipment having the positive bus (battery positive and electronic ground) common to its equipment frame *or* chassis.
5. Refer to Practice GTE 795-805-071, Central *Office Grounding Systems – Engineering Applications,* for lead requirements.
6. Non GTD-5 EAX equipment shall be configured to the customer's standards. For GTE Standards, refer to GTE Practice 795-805-073, *Transmission Equipment – Central Office Grounding.*

Figure 4. Typical Central Office Grounding Arrangement (Alternate)

5.16 Miscellaneous Equipment. Equipment such as a cable grid assembly must be isolated from the SHES and non-SHES-type frames.

5.17 Consoles containing circuits that interface with the GTD-5 EAX must be isolated so that the console is not in casual contact with any other building ground, such as being pushed up against a steel beam, water pipe, or ac conduit, or resting on a metal ac service duct cover in the floor.

5.18 **Low-Voltage-Ground (LVG) Configurations.** The dc-to-dc converters used for electronic low-voltage supplies maintain an output LVG that is electrically isolated from the 50-Vdc input ground except at a single point. Three LVG configurations are feasible:

(a) When a PCDF stands alone or is co-located with PDUFs for GTD-5 EAX power distribution, the LVG is arranged per Figure 5.

(b) When one PDU or multiple co-located PDUFs are powered from one DSU, the LVG distribution is arranged per Figure 6.

(c) When multiple remote PDUFs are used, the LVG distribution is arranged per Figure 7.

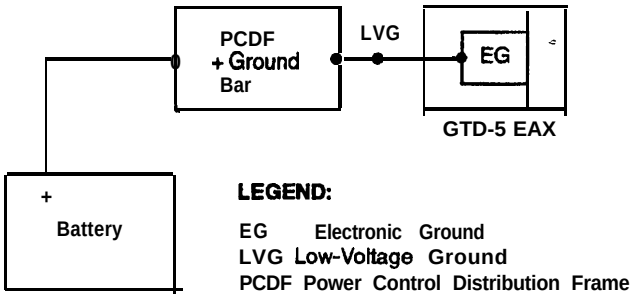


Figure 5. LVG for PCDF and Co-located PDUFs (Single Bus Only)

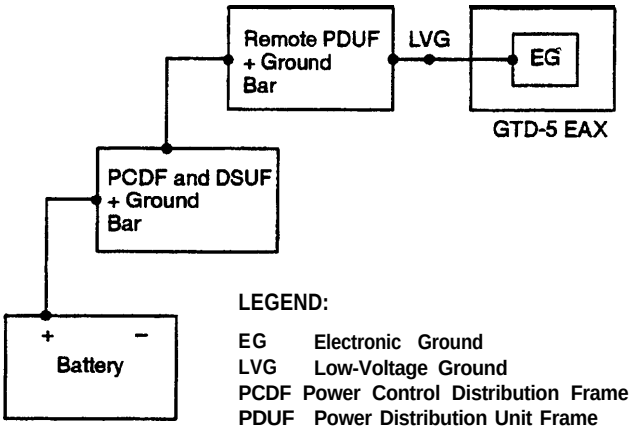


Figure 6. LVG Arrangement for Single Remote PDUF

5.19 In all three cases, the LVG should be connected to the positive bus point that is the last common to all GTD-5 EAX ground distribution.

Line Circuit Protection Ground System

5.20 An LPG system provides a low-impedance ground for anticipated lightn ing strikes on line circuits associated with outside cables.

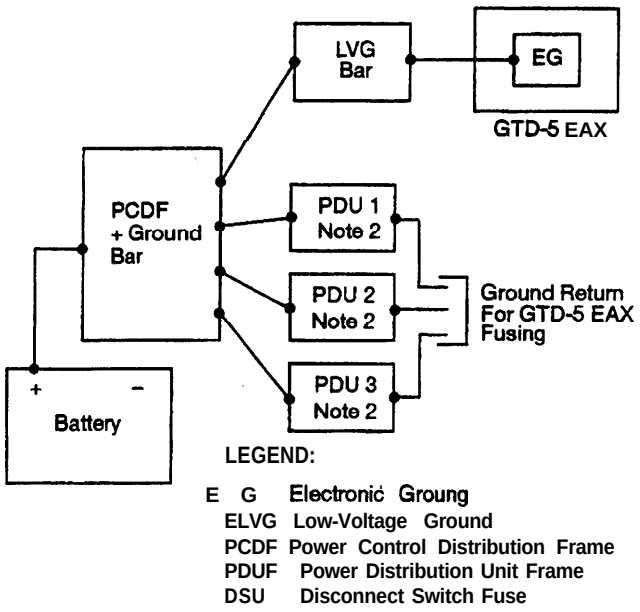


Figure 7. LVG Arrangement for Distributed PDUFs

Integrated Ground System

5.21 An integrated ground system is comprised of equipment safety grounds and all other incidental CO grounds, such as the water pipe, building steel, ac conduit, and structural rods.

6. GROUND SYSTEM LEAKAGE CURRENTS

6.1 Fault conditions between the electronic isolated ground plane and frame ground, or between frame ground and the positive bus of the 50-Vdc battery, will result in dc leakage current paths and ground loops. The equipment ground isolation details described in Part **5** of this practice assist the user in locating the area in which the fault exists.

6.2 The exact method of locating the fault condition is defined in Handbooks CH **224-001,** *GTD-5 EAX Installation Handbook,* and CH 224-002, *GTD-5 EAX Installation Test Handbook;* Practice 237-224-214; and GTE Practices 795-805-071 and 795-805-072.

7. CONTACT POTENTIAL DIFFERENCES

7.1 Hazardous ground system conditions may exist when building steel and equipment frames are at different voltage potentials. This hazardous potential must be avoided by following the requirements described in GTE Practices 795-805-071 and 795-805-072.

8. POWER APPARATUS

Electronic Power Supplies

8.1 Low-voltage, dc-to-dc converters have been developed for use in the GTD-5 EAX electronic frames that incorporate monitoring and control functions within the converter package. Table 1 provides a tabular description of the power supplies. Refer to Practice 224-017-020, *Product* Line Reference ***Guide,*** for application of power supplies.

Table 1. Electronic Power Supplies

Part Number	Description (Refer to Note)	Mnemonic	Voltage (Vdc)	Maximum Power Output (Watts)
FB-16301 FB-16301-B	Power supply left Power supply right	PS1L PS1R	+5 +5	200 200
FB-16302 FB-16302-B	Power supply left Power supply right	PS2L PS2R	+5, –5, +12 +5, -5, +12	225 225
FB-16303 FB-16303-B	Power supply left Power supply right	PS3L PS3R	+5, -12, +12 +5, -12, +12	200 200
FB-16304 FB-16304-2B	Power supply left Power supply right	PS4L PS4R	+5, -5, +12 +5, -5, +12	225 225
FB-16305	Power supply left	PS5L	+5, -12, +12	250, 45, 50
FB-16307-B	Power supply right	PS7R	+15, -15	72
FB-16308	Power supply left, Winchester Disk power supply	PS8L	-12, +24	305
FB-16902 FB-16902-B	Power supply left Power supply right	PS2LA PS2RA	+5, -5, +12 +5, -5, +12	225
FB-16904 FB-16904-B	Power supply left Power supply right	PS4LA PS4RA	+5, -5, +12 +5, -5, +12	225
FB-16909 FB-16909-B	Power supply left Power supply right	PS9LA PS9RA	+5, +12 +5, +12	205

NOTE: As seen from the front of the frame.

Ringing Plant

8.2 The purpose of the ringing generator is to provide a source of power for standard signaling functions. The standard system uses negative-battery-connected generators and up to five frequencies of bridged or divided ringing. A superimposed ringing scheme that requires +/-38 Vdc supplies may be supplied as a customer option.

8.3 The primary ringing frequencies in a central office are provided by an F1 generator. Secondary ringing frequencies are provided by generators F2 through F5. The frequencies to be used in each installation are determined by the customer.

NOTE: The generator designated as F1, is the generator with the largest quantity of lines (ringing assignments) assigned to it.

8.4 Table 2 lists the standard and superimposed ringing frequencies that may be provided through ringing generators F1 through F5. Table 3 lists the nominal voltage levels to which frequency generators F1 through F5 can be adjusted.

NOTE: Other values may be specified by the customer.

Table 2. Standard and Superimposed Ringing Frequencies

Frequency Generator	Harmonic Ringing Frequency	Synchromonic Ringing Frequency		Decimonic Ringing Frequency	Superimposed Ringing Frequency
		(A)	(B)		
F1	25 Hz	20 Hz	30 Hz	20 Hz	20 Hz
F2	33-1/3 Hz	30 Hz	42 Hz	30 Hz	20 Hz (-38)
F3	50 Hz	42 Hz	54 Hz	40 Hz	20 Hz (+38)
F4	66-2/3 Hz	54 Hz	66 Hz	50 Hz	
F5	16-1/3 Hz	66 Hz	16Hz	60 Hz	

8.5 **Digitally Controlled Ringing Plants.** The GTD-5 EAX is arranged to work with digitally controlled ringing plants having internal monitoring and transfer arrangements. Malfunctions are readily reported to maintenance personnel via system software.

8.6 **Monitor and Control Circuits.** In a digitally controlled ringing plant (Figure 8), the monitor and control circuits are located in the Facility Test Unit (FTU) of the BU.

8.7 In the case of the remote units, the monitor and control circuits are located as follows:

(a) In the Remote Test Unit (RTU) or Small Facility Test Unit (SFT) of the RSU

(b) In the RTU of the RLU

8.8 The sense points and the control points, located in the BUs Input/Output Module (IOM), monitor performance of the ringing generators via the ringing monitor and control circuit in the FTU. For remote units, the RSCC and the RTU or SFT provide a similar function. These points also control the transfer circuitry when required.

8.9 An FTU can be arranged with circuits that can monitor and control up to five ringing generators. In offices having multiparty ringing schemes and more than 16 line frames, the ringing scheme for additional F1 generators must be arranged via additional monitor and control circuits in other FTUs.

8.10 **Ringing Generator Arrangements.** One 50-watt ringing generator may be used to provide the primary ringing frequency (largest quantity of ringing assignments) for a maximum of 16 line frames. Therefore, in offices with more than 16 line frames or in a multiparty ringing arrangement (Figure 8), additional ringing generators will be required.

Table 3. Ringing Frequencies and Voltage Ranges

Frequency Generator	Hertz Adjustment	Center Voltage Range (Note)			
		Programmable Standby			F1 – F5
		Low	Middle	High	Standard
16	0.33	90	105	120	90
16-2/3	0.33	90	105	120	90
20	0.33	90	105	120	95
25	0.33	95	110	125	100
30	0.33	95	110	125	105
33-1/3	0.33	100	115	130	110
40	0.33	100	115	130	115
42	0.33	100	115	130	115
50	0.50	110	125	140	125
54	0.50	110	125	140	125
60	0.60	125	140	155	135
66	0.60	125	140	155	140
66-2/3	0.60	125	140	155	140

NOTE: All voltages for frequency generators F1 through F5 must be adjusted to within 5 volts of the listed values.

8.11 In the arrangement shown in Figure 8, one F1 generator and as required, additional generators (F2 through F5) are backed up by a single remotely programmable standby ringing generator. (Also refer to Drawing ECD-17006-008, Ringing and Coin Battery Equipment Cabling.)

8.12 Figure 9 is a block diagram of an arrangement that can be used for offices requiring more than one F1 generator and/or for offices utilizing one- and two-party ringing only.

8.13 In this application, up to five F1 generators are backed up by a single programmable standby ringing generator. The output voltage of the standby generator is preprogrammed within the manufacturers design limits specified in Table 3; therefore, the standby generator is able to assume any failed generator's frequency.

8.14 Applications such as these allow for normal office operation while a failed ringing generator is repaired or replaced.

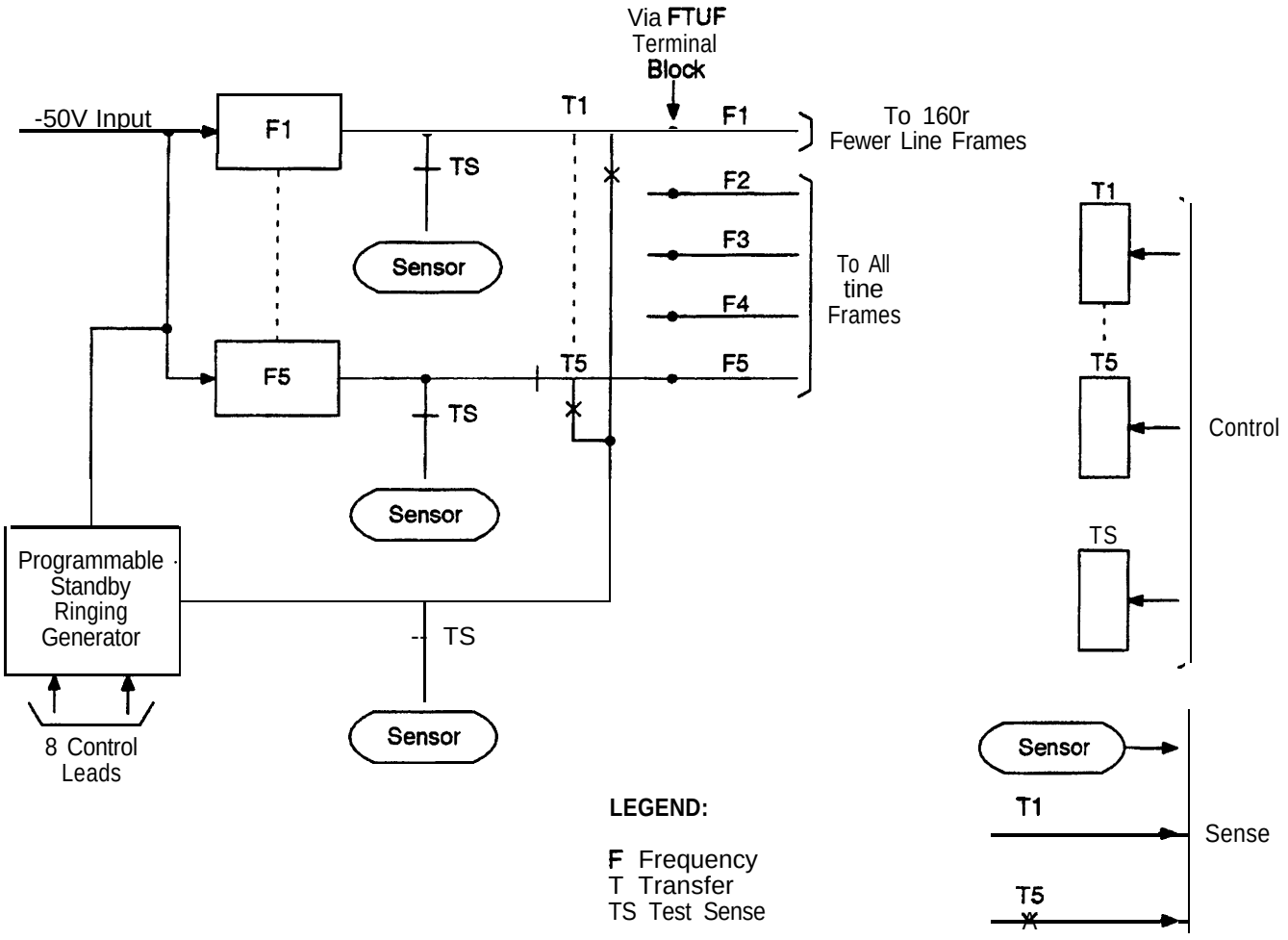


Figure 8. Multiparty Ringing Scheme

8.15 **Programmable Standby Generator Adjustment.** The programmable standby generator has a voltage adjustment potentiometer that may be used to set the output voltage to any level within the defined limits. Once it is adjusted, the generator automatically adjusts its output voltage proportionally to the appropriate frequency range.

8.16 With this design, if the standby generator is installed and the output voltage is adjusted to 90 Root-Mean-Square (RMS) volts at 16 Hz, the standby generator provides the following voltages when assuming the load:

(a) 30 Hz ——> 95 V

(b) 40 Hz ——> 100 V

(c) 54 Hz ——> 110 v

(d) 66 Hz ——> 125 V

8.17 The AGCS standard installation policy is to adjust the programmable standby generator to the midrange voltage at the midrange ringing frequency for any given office.

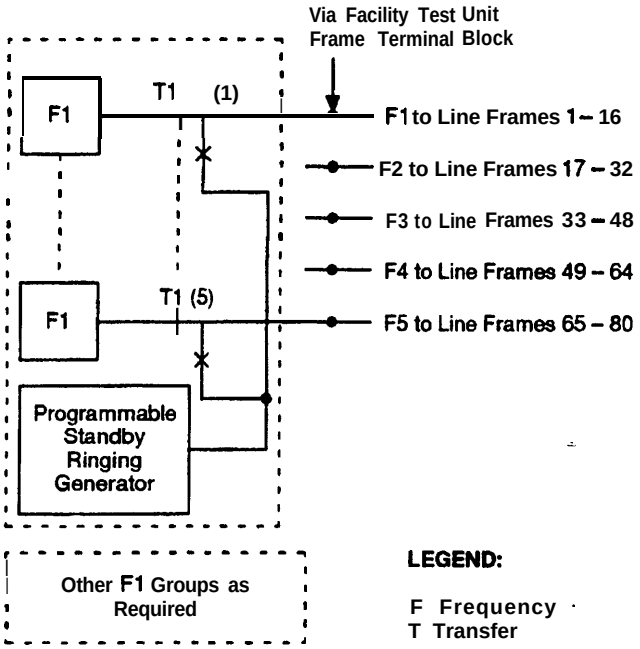


Figure 9. One- and Two-Party Ringing Scheme

8.18 Generator Designation. It should be noted that the generator designation (for example, F1 , F2) has no real correlation to the frequency assigned, as demonstrated in the following example applications:

(a) The F1 generator provides 20 Hz and the F2 generator provides 33 Hz; therefore, adjust the standby programmable generator to 105 volts at 20 Hz.

(b) The F1 generator provides 16 Hz, the F2 generator provides 66 Hz, and the F3 generator provides 30 Hz; therefore, adjust the standby programmable generator to 110 volts at 30 Hz.

(c) The F1 generator provides 33-1/3 Hz, the F2 generator provides 16-1/3 Hz, the F3 generator provides 25 Hz, the F4 generator provides 50 Hz, and the F5 generator provides 66-2/3 Hz; therefore, adjust the standby programmable generator to 115 volts at 33-l /3 Hz.

8.19 Existing Ringing Plant. The system may also be arranged to use an existing ringing plant. This is done at the customer's request only. In this case, the ringing plant is considered a power room item with a monitoring and transfer arrangement external to the system.

8.20 **Maintenance.** Arrangements must be made to have ringing plant malfunctions reported via the power room or the miscellaneous alarm facility. The output of the ringing plant is bused to the FTUs, and then to the fine frames.

8.21 When a failure occurs in any one of the ringing generators in the system, the Administrative Processor Complex (APC), via the IOM sense points and control points, and the Ring and Coin Battery Monitor (RCBM) circuitry, transfer the standby generator to pick up the load of the failed generator until the failure is corrected.

Coin and Dual Tone Multifrequency Pad Disable Batteries

8.22 A block diagram of a coin and pad disable battery circuit is shown in Figure 10. In offices with prepay coin stations, a source of positive and negative 130 Vdc is required for coin collect and coin return functions.

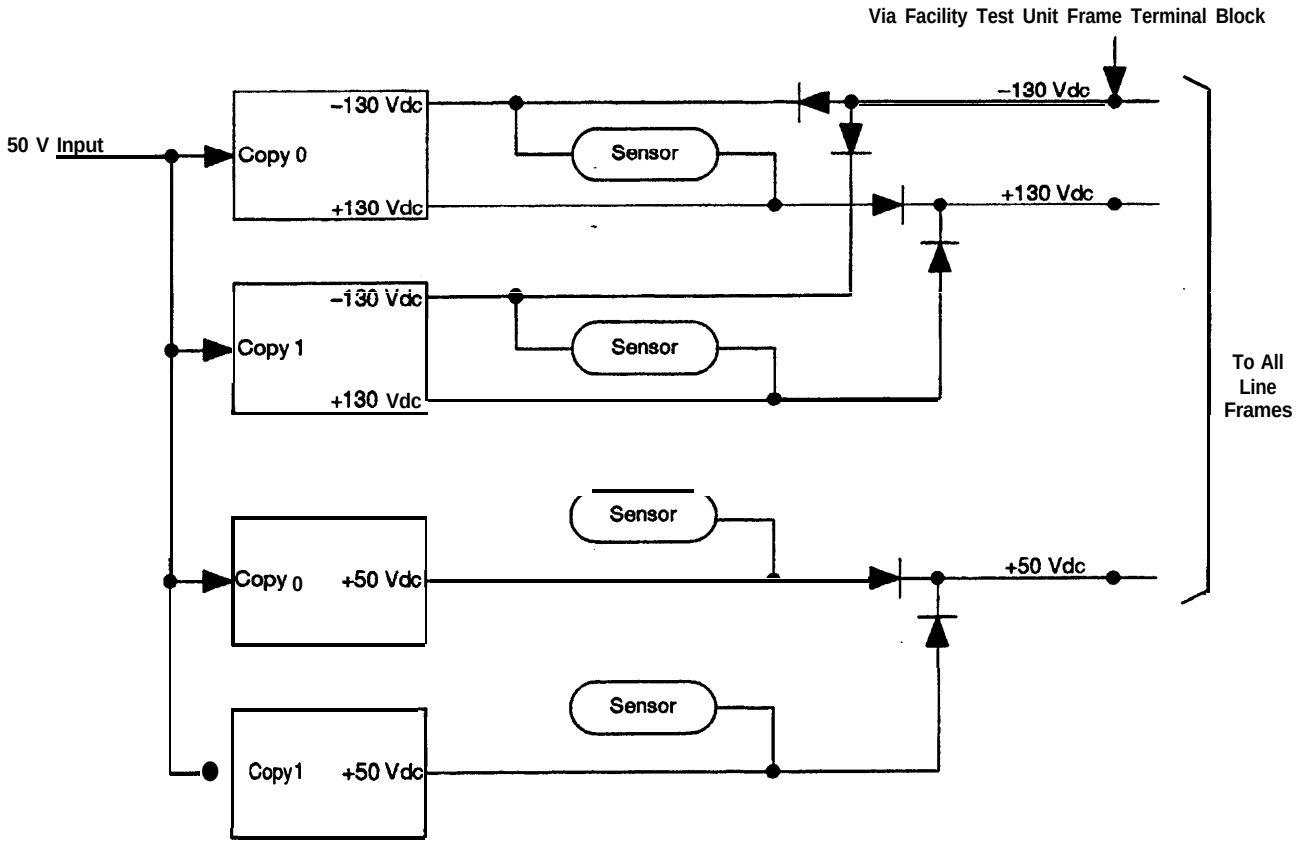


Figure 10. Coin and Pad Disable Batteries

8.23 When prepay coin stations use Dual Tone Multifrequency (DTMF) pads instead of rotary dial, a source of nominal positive 50 Vdc is required.

8.24 Coin line circuits are arranged with a capability for transferring the ring conductor battery feed from its normal negative 50 Vdc to the positive 50 Vdc. This disables the DTMF oscillator in the coin station. The DTMF pad disable battery converters are rated at two amperes per converter.

8.25 Coin battery, ±130 Vdc, is supplied by dc-todc converters powered by negative 50-Vdc office battery. Each converter provides both positive and negative outputs.

8.26 Coin battery converters are available in the following two sizes:

(a) A capacity of 0.5 ampere per output converter. This size is rated to meet the requirements of offices with 600 coin lines.

(b) A capacity of three amperes per converter output for larger offices.

8.27 Both coin battery supply and pad disable batteries are provided in a duplicate configuration. Monitoring of these battery supplies is performed by the APC via IOM sense points and control points, and the RCBM circuit located in the FTU. Monitoring in remote units is performed by the RSU or RLU, via the SFT or RTU.

Transmission Battery Filter

8.28 Electrically quiet battery is obtained by circuitry on certain system frames. Battery filters are required for battery feed devices in the following equipment:

(a) Analog lines

(b) Analog trunks

(c) Facility Test Unit (FTU)

(d) Peripheral Test Console (PTC)

(e) Remote Test Unit (RTU)

(f) Small Facility Test Unit (SFT)

Fanpacks

8.29 Fanpacks may optionally be installed to lower the ambient operating temperature in a number of frames. The fanpacks are located in the baffle area of the frames.

NOTE: Fanpacks are installed in most system frame assemblies when system frame assemblies are enclosed within cabinets.

8.30 Auxiliary sense points are used for monitoring the fanpacks associated with the frames. Fanpack failure is reported to the user via alarms that indicate the type, location, and alarm level of the fanpack in a frame.

9. POWER FAILURE INDICATORS AND ALARMS

9.1 Power problems, as a rule, generate the following outputs:

(a) Activate a visual indication at the local unit or frame

(b) Light an aisle pilot

(c) Activate a sense point

9.2 System response to the sense point indication may include a number of further actions, such as the following:

(a) Output a message on a local or remote terminal

(b) Activate a central alarm lamp display at the Administrative Control Panel (ACP), and an audible alarm signal of the following types:

(1) Two-level: major and minor

(2) Three-level: critical, major, and minor

(c) Alert an operator via an alarm sender

(d) Reconfigure hardware copies

9.3 The aisle pilot and local lamps assist maintenance personnel **in locating the frame** in which the fault exists. The aisle pilot lamps are red units. When an aisle pilot display is generated, a red visual indicator within the faulty frame is also activated to assist in fault location.

9.4 The high-and low-voltage alarm sensor on the PDU is preset at the factory at 48 Vdc (low voltage) and 54.1 Vdc (high voltage). The customer may request other high- and low-voltage settings as desired.

9.5 System alarms and status indicators on the ACP alert the user to problems that could degrade system performance.

9.6 **Remote Sense Points and Control Points.** Remote sense and control points are used to inform the system of internal and external alarm conditions.

9.7 Sense leads derive the ground required to activate the sense point from the GTD-5 EAX equipment positive return where the sense card is located and powered. The remote sense point and its ground are cabled as paired conductors to the location where dry contacts terminate the pair.

9.8 Remote control leads are paired with the necessary return conductor from the equipment bay where located. These control and return paired conductors must terminate on the remote device being controlled.

9.9 **Trunk Circuits. E&M** trunk circuits should use type II E&M signaling to prevent connection to foreign potentials or grounds. Preventive measures for type II E&M signaling trunks are similar to those used for remote sense and control points (refer to paragraphs 9.7 and 9.8).

9.10 When type I E&M signaling trunk circuits are connected to the GTD-5 EAX, adapters that are powered and located external to the GTD-5 EAX should be used to convert from type I to type II E&M signaling. These adapters should be tested to ensure that foreign potentials and grounds are prevented from entering the GTD-5 EAX on the E&M leads.

10. MISCELLANEOUS HARDWARE

Recorder-Announcer

10.1 The system is arranged to work with all commercially available recorder-announcer machines. This includes the following:

(a) Continuously running multichannel drum-type machines

(b) Cassette or tape loop-type machines with start functions

(c) Single-channel digital machines with start function

(d) Multichannel digital machines, such as the Multichannel Intelligent Announcement System (McIAS™)

10.2 The announcement machines may be ac- or dc-operated and mounted in a miscellaneous-type frame. The audio and control leads are cabled to the distribution frame to be accessed by the serving line or trunk, via the Simplex Adapter/Announcement Interface (SXTK) card, if required.

McIAS is a trademark of the Cognitronics Corporation.

NOTES:

1. Avoid using recorder-announcer units located external to the GTD.5 EAX's power system, except for centralized announcement systems accessed via interswitch trunks.
2. Do not use ac-powered recorder-announcer units with the positive dc conductor also connected to the chassis.

10.3 For precautions and test verification methods concerning dc-powered recorder-announcer units also requiring ac power, refer to Practice 237-224-214.

Outboard Tones

10.4 All tones required by the system are digital tones, internally generated and applied within the network. Therefore, an outboard tone plant is provided only to generate tones used externally to the switch and to miscellaneous equipment as required.

10.5 The outboard tone plant consists of two Outboard Tone (OBDT) cards (F&15449), one Outboard Interrupter (OBDI) card (FB-15450), and one Permanent High Tone (PMHT) card (FB-15190). These cards are located in dedicated card slots in the Facility Test Unit Frame (FTUF).

10.6 The two OBDT cards are programmed (via backplane wiring) to output the following four frequencies:

(a) Dial tone (350 + 440 Hz)

(b) High tone (480 Hz)

(c) Continuous ringback tone (440 + 480 Hz)

(d) Low tone (busy) (480 + 620 Hz)

10.7 The first OBDT card generates dial tone and high tone, and the second OBDT card generates continuous ringback tone and low tone (busy). The continuous ringback tone and low tone are also fed into the OBDI card via backplane wiring to generate the following tones:

(a) Interrupted ringback tone (two seconds on, four seconds off).

(b) Line busy tone (60 interruptions per minute [ipm]).

(c) Reorder tone (120 ipm). The OBDI card also provides 60-ipm and 120-ipm ground pulses.

10.8 The PMHT card generates a permanent high tone that is a combined tone containing 1,400, 2,060, 2,450, and 2,600 Hz, interrupted at the rate of 100 milliseconds (ms) on and 100 ms off. All of these outboard tones are available on the FTUF from where they can be distributed to the user circuits within and outside of the FTUF.

10.9 The outboard tone plant is provided as an option on a simplex basis only. However, provisions are made to have the APC monitor the tone plant in the event of failure viadedicated sense points.

Alarm Sending

10.10 When a site is unattended, it is necessary to provide a means of alerting an attended location of equipment malfunctions. The preferred means for implementing this capability is the provision of a remote terminal so that alarm indications can be transmitted to the attended location.

10.11 An alternate means for communicating the existence of malfunctions at an unattended location is the operator alerting technique.

10.12 When an alarm condition occurs, a hardware device called an alarm sender initiates a call to an operator using a trunk in the same group that serves customer dial 0 traffic Combined Line and Recording (CLR). The operator is advised by a distinctive tone or by a recorded announcement that this is an alarm rather than a CLR call. The severity of the alarm is determined by noting the response to a special directory number dialed into the system.

11. REFERENCES

11.1 The following documents supplement or complement the information in this practice:

DOCUMENT	NUMBER	DESCRIPTION
AGCS Practices	237-224-214	Engineering and Installation of Ground Isolation
	224-017-020	Product Line Reference Guide
	256-224-216	Cabling Methods
GTE Practices	256-050-206	Cabling Methods Power Cable – Running and Securing
	795-000-070	Power Equipment MAX – Ampere Drain Computation – Engineering Applications
	795-001-070	Switching Systems Power Cabling and Fusing – Engineering Applications
	795-100-075	Battery Cells for 50 V-DC Powerboards – Engineering Applications
	795-805-071	Central Office Grounding Systems – Engineering Applications
	795-805-072	AC Service Grounding Engineering Applications
	795-805-073	Transmission Equipment – Central Office Grounding
Handbooks	CH 224-001	GTD-5 EAX Installation Handbook
	CH 224-002	GTD-5 EAX Installation Test Handbook
	CH 224-012	GTD-5 EAX Technical Specification, Section 13, Power
Drawings	H-440000-K	Equipment Isolation Details for Electronic Switching Systems
	ECD-17005	Equipment Power Distribution & Grounding
	ECD-17006-008	Ringing and Coin Battery Equipment Cabling

End of Document