820A (J87822) RINGING, TONE, AND INTERRUPTER PLANT DESCRIPTION

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1. GENERAL

INTRODUCTION

1.01 This section describes the 820A power plant. Included in this section are the following:

- Physical description of 820A power plant
- Functional description of 820A power plant
- Description of operating requirements
- Description of maintenance requirements.

1.02 Whenever this section is reissued, the reason(s) for reissue will be listed in this paragraph. The Equipment Test List is not affected.

1.03 Table A provides a list of abbreviations and acronyms with applicable terms used in this section.

TABLE A

ABBREVIATIONS AND ACRONYMS

ABBREVIATION	TERM
BT	Busy Tone
HT	High Tone
IPM	Interruptions Per Minute
LED	Light Emitting Diode
TPT	Test Progress Tone

PURPOSE OF 820A POWER PLANT

1.04 The 820A power plant provides 0.25 ampere of continuous 20-Hz ringing current, continuous and interrupted call-progress tones, and signaling interruption loops as required by No. 4 ESS toll offices.

EQUIPMENT CHARACTERISTICS

1.05 A fully equipped power plant is comprised of a "0" side and a "1" side. For the tones and interrupted loops, the central processor can actuate a transfer of the load. In case of a failure, the 820A power plant will automatically transfer the load.

2. PHYSICAL DESCRIPTION

A. General

2.01 A fully equipped 820A power plant (see Fig. 1) consists of one bay of equipment. The framework is 2 feet 2 inches wide, 1 foot deep, and 7 feet high and accommodates 25-inch mounting plates. The equipment mounted on the framework extends 8.5 inches from the mounting surface to the front and 12 inches from front to rear. The equipment mounted in the bay listed from the base to the top is as follows:

- DC input filters—Accessible from the front and rear through removable covers
- Input fuse panel—Consisting of 5 fuse blocks

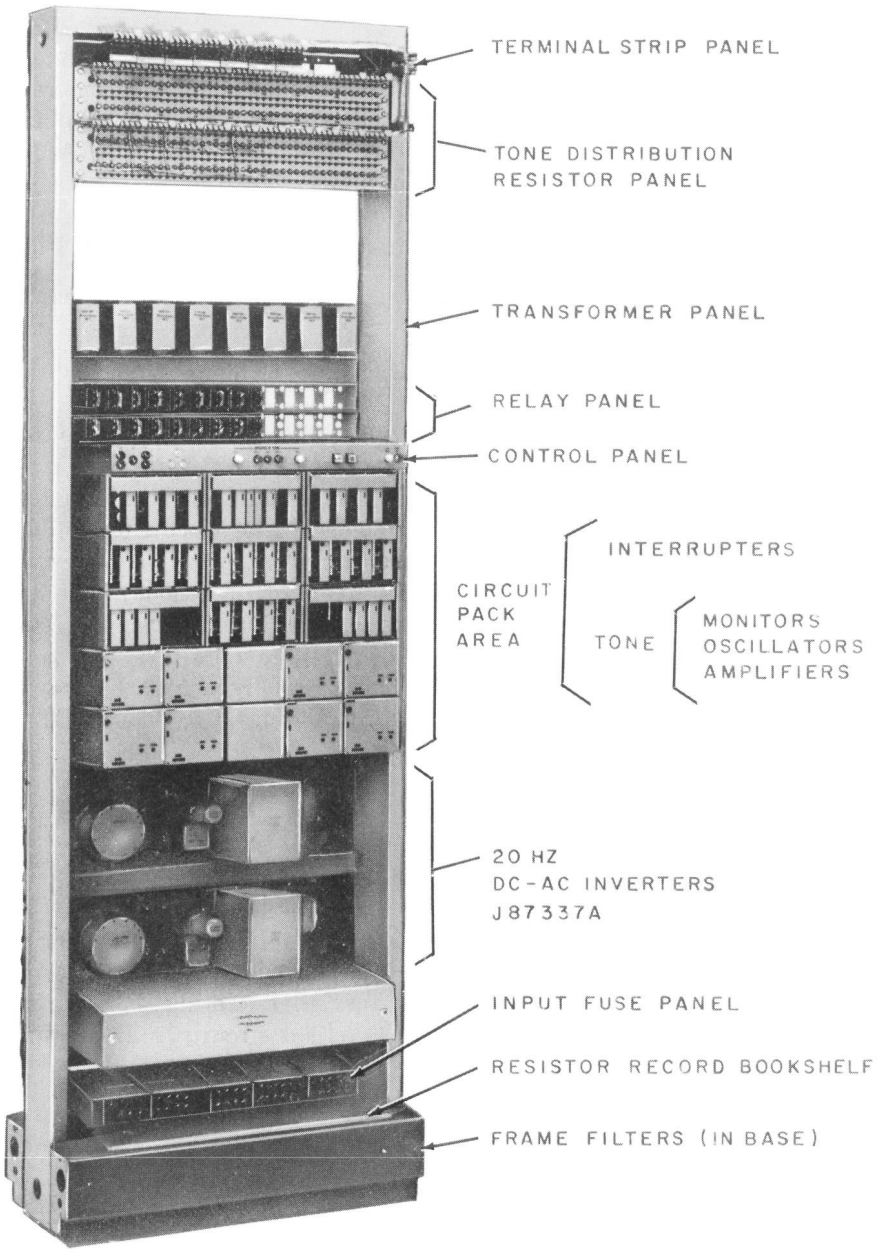

Fig. 1—820A Ringing, Tone, and Interrupter Plant—Front View

- Power relays
- 20 Hz dc-to-ac inverters—Two J87337A dc-to-ac inverters mounted one above the other
- Tone circuit pack area—Consisting of plug-in amplifiers, oscillators, monitors, and solid-state interrupters which are mounted in slide housings for ease in maintenance
- Control panel—A rectangular box type enclosure with removable front cover which mounts the transfer key, switches, lamps, and telephone jacks
- Interrupter and transfer relays
- Output tone transformers—Provided for connection to associated equipment in the office

- Tone distribution resistor panel
- Terminal strip panel—Located at the extreme top of the bay framework.

The external surfaces of the plug-in units, housing, and mounting plates have a 525A gray enamel finish. The approximate weight of the plant is 250 pounds. The plant is designed to operate in an ambient temperature range of 0° to 50°C and under humidity conditions normally encountered within the continental U.S.A. when installed indoors.

B. 20 Hz DC-to-AC Inverters (J87337A)

2.02 The inverter mounting plate (see Fig. 2) is a standard 25-inch by 6-inch plate with transformers, inductors, and filter capacitors mounted in front. All the other components are mounted on the rear of the mounting plate, or wiring side. One terminal block is provided for both input and output connections. Hinged plastic guards are provided over the wiring side to provide personnel protection at high voltage points. All exposed surfaces are finished in gray enamel, and overall inverter unit weight is approximately 28 pounds.

C. Tone Amplifiers

2.03 There are four 264B type tone amplifiers for each side of the 820A power plant. The audible ring (AR) busy tone (BT), high tone (HT), and test progress tone (TPT) amplifiers are located in the circuit pack area. (See Fig. 3.)

D. Tone Oscillators

2.04 In the 820A power plant, four crystal-controlled tone oscillators are required. The 440-Hz oscillator CP-A1152, the 480-Hz oscillator CP-A1153, the 620-Hz oscillator CP-A1154, and the 2225-Hz oscillator CP-A1155. The oscillators are located in the circuit pack area of the plant directly above the tone amplifiers. (See Fig. 3.)

E. Tone Monitors

2.05 The low-voltage monitors are contained in CP-A1027 type circuit packs and are located in the circuit pack area between and above the tone oscillator circuit packs. (See Fig. 4.) Mounted on the front panel of each circuit pack is a LED (light emitting diode) which lights when a low voltage condition exists. There are four "forward-path" low voltage monitors for each side of the plant. There are "return-path" low voltage monitors for all the tones except the BT and HT. (See Fig. 3.)

F. Interrupters

2.06 Duplicate interrupter timing circuits are provided in the 820A power plant. The interrupter timing is located in CP-A1005 and CP-A1006 circuitry. (See Fig. 3.)

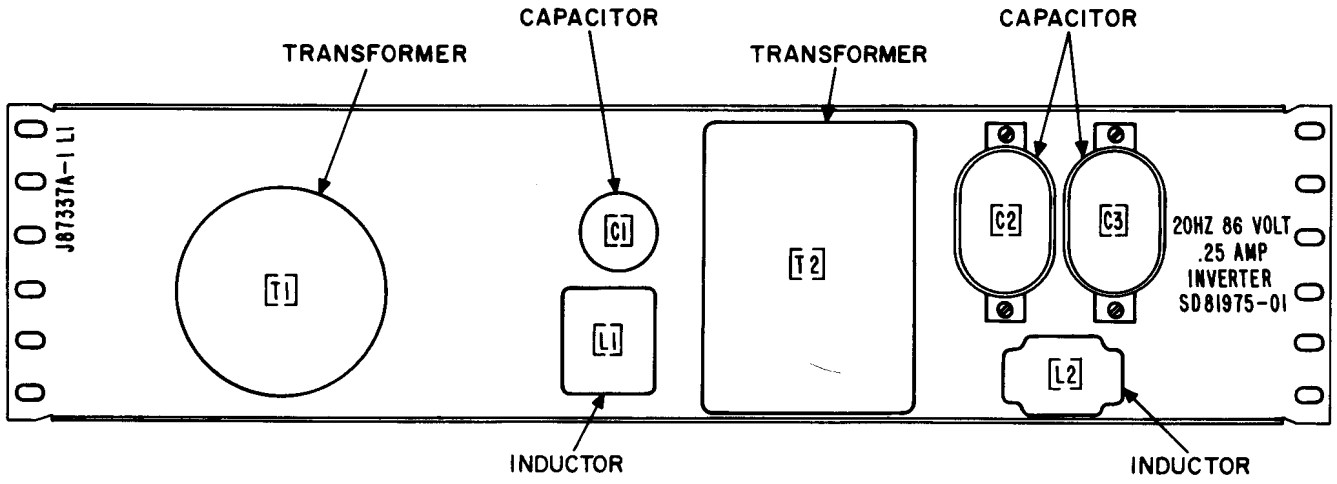

Fig. 2—20 Hz DC-to-AC Inverter (J87337A)

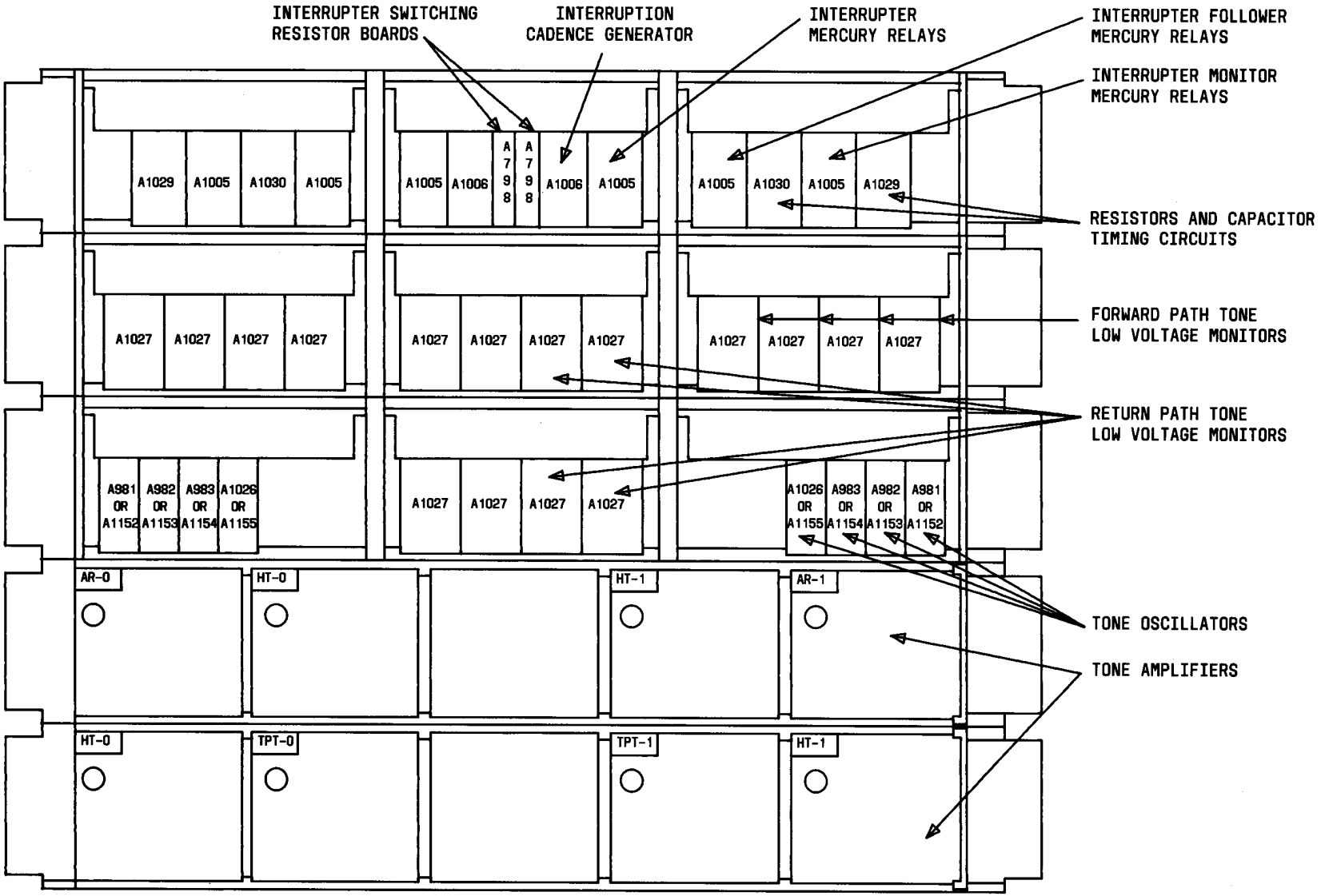

Fig. 3—820A Ringing, Tone, and Interrupter Plant—Circuit Pack Area

G. Plant Control Panel

2.07 The 820A power plant control panel is a standard 25-inch wide rack. The control panel by use of lamps and switches indicates the status of the plant. Refer to Fig. 4 for the location of the lamps and switches. The PWR OFF and OFF NOR lamps are mounted on the extreme right of the control panel. Mounted on the right side of the control panel are the INV RESET and INV TRFR lamps. Mounted in the center of the control panel are OFF-0, NOR, and OFF-1 interlocking switches and the OS-0 and OS-1 lamps. Refer to table of controls and indicators (Table B) for the function of the controls and indicators shown in Fig. 4. Mounted on the left side of the control panel are the -48V, GRD, and HRG connector jacks. Two TEL, one SP, and two TTY connector jacks are mounted on the extreme left side of the control panel.

H. Relay Panel

2.08 There are 18 relays mounted on the relay panel above the control panel. The relays are mounted in two rows as shown in Fig. 5.

I. Transformer Panel

2.09 There are eight transformers mounted in a single row on the transformer panel. (See Fig. 6.)

J. Tone Distribution Resistor Panel

2.10 The tone distribution resistor panel is comprised of two panels. The panels are located at the top of the bay to permit wiring to the user circuits from the front of the bay.

K. Terminal Strip Panel

2.11 The terminal strip panel is located at the very top of the equipment bay and is accessible from the front of the bay. All connections to associated equipment in the office (except for tone outputs) are made from these terminal strips.

L. Input Fuse Panel

2.12 The input fuse panel is located at the bottom of the equipment bay. The fuse consists of five 70-type fuse blocks with each block having eight fuse positions (See Fig. 7.)

M. Frame Filters

2.13 The dc input filter panel contains the capacitors, inductors, and diodes required to provide proper filtering of the -48V dc input. All the components of the filter panel are enclosed with a cover.

N. Growth

2.14 Since the maximum frame equipage per switching system is one each for the 820A frame, no frame growth is required.

3. FUNCTIONAL DESCRIPTION

A. General

3.01 The signal interconnection of the 820A power plant is shown in Fig. 8. The power interconnection of the 820A power plant is shown in Fig. 9. The functional units are as follows:

- J87337A inverters
- Tone distribution circuits
- 60, 120 IPM interrupted loop circuits
- Tone oscillators
- Tone amplifiers
- Tone monitors
- Control and automatic transfer circuits.

B. J87337A Inverters

3.02 The J87337A inverter has a 20-Hz 86-volt, 1/4 ampere output derived from a -48 volt dc input which is used by the ringing and alarm circuits. The functional units of the inverter are as follows:

- A low pass dc input line filter
- A 20-Hz oscillator inverter
- A center tapped ferroresonant regulator
- An output filter.

TABLE B

CONTROLS AND INDICATORS

ASSEMBLY NAME	ASSEMBLY EQUIP. LOCATION	CONTROL/INDICATOR NAME	CONTROL/INDICATOR TYPE	CONTROL/INDICATOR FUNCTION
J87822A Plant Control Panel	Plant Equipment Bay	OS-0	Lamp (White)	Lights only when power is removed from the "0" side of the plant.
		OS-1	Lamp (White)	Lights only when power is removed from "1" side of the plant.
		OFF NOR	Lamp (White)	Lights only when plant is not operating under normal conditions (NOR key not depressed)
		PWR OFF	Lamp (Red)	Lights when power is removed from either side of the plant, either completely or through fuse alarm condition.
		NOR*	Push-button Switch	Normally depressed and power is provided to both sides of the plant.
		OFF-0*	Push-button Switch	When depressed, this switch removes power from the "0" side of the plant. This switch is normally in the released position.
		Off-1*	Push-button Switch	When depressed, this switch removes power from the "1" side of the plant. This switch is normally in the released position.
		INV RESET	Lamp/ Switch	Under transferred conditions with the "1" side of the plant carrying the load, depressing this switch transfers the load to the "0" side of the plant, if the "0" side is able to receive the load and lights the associated switch lamp.
		INV TRFR	Lamp/ Switch	Under normal operating conditions, when the switch is depressed, the inverter load is transferred from the "0" side of the plant to the "1" side of the plant and the associated switch lamp becomes lighted.
Plant Tone Low Voltage Monitors	On Each Monitor Circuit Pack In Circuit Pack Area of Plant	Lamp Indicator	Lamp (Red)	Lights when voltage levels are out of specified limits.

* These Switches are mechanically interlocked such that only one switch may be operated at a time.

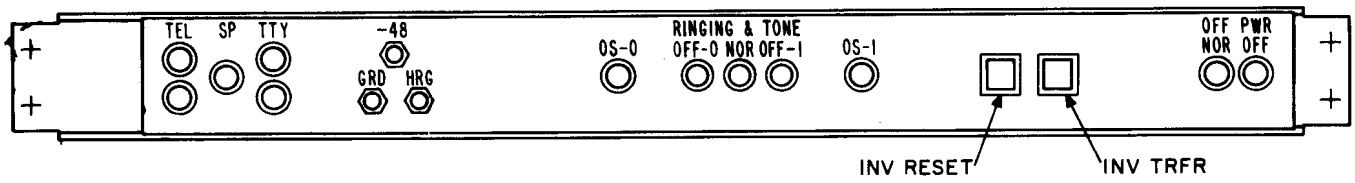

Fig. 4—820A Ringing Tone, and Interrupter Plant—Control Panel

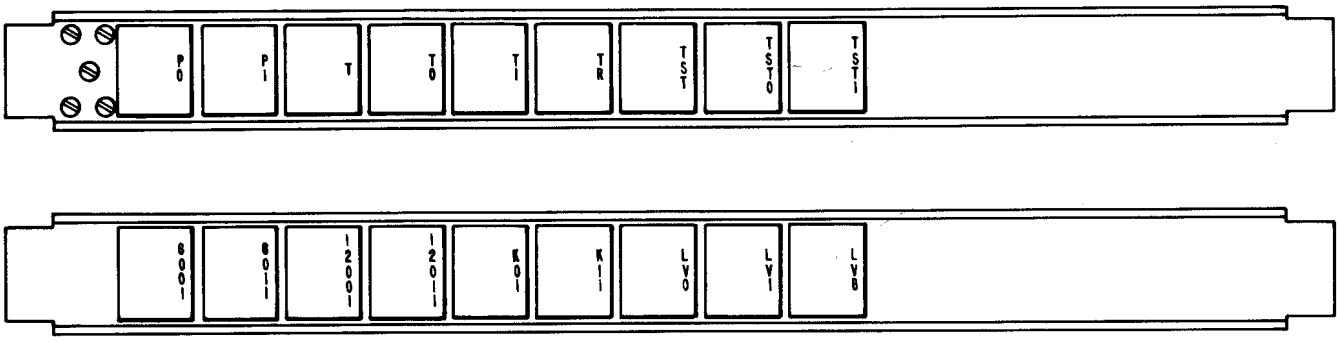

Fig. 5—820A Ringing Tone, and Interrupter Plant—Relay Panel

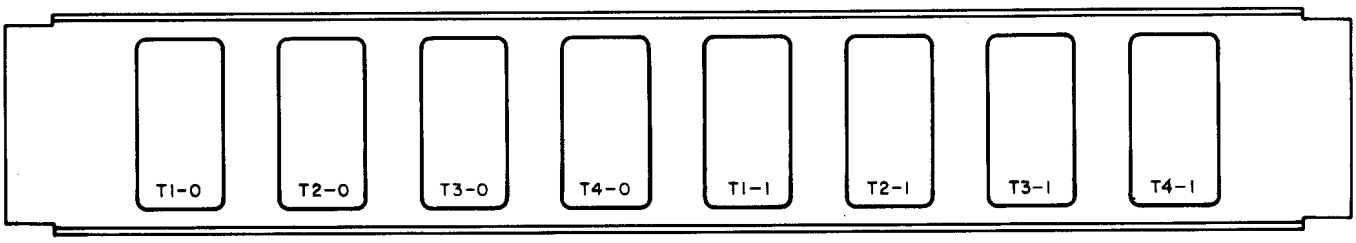

Fig. 6—820A Ringing, Tone, and Interrupter Plant—Transformer Panel

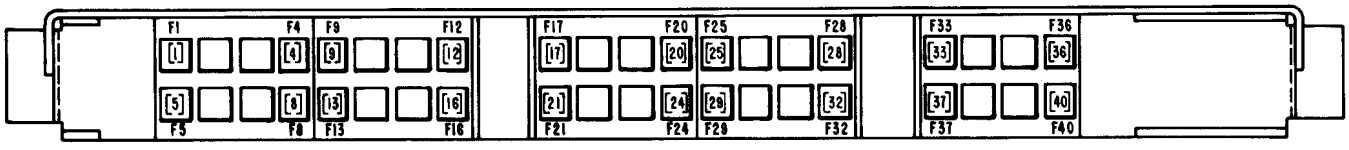

Fig. 7—820A Ringing, Tone, and Interrupter Plant—Fuse Panel

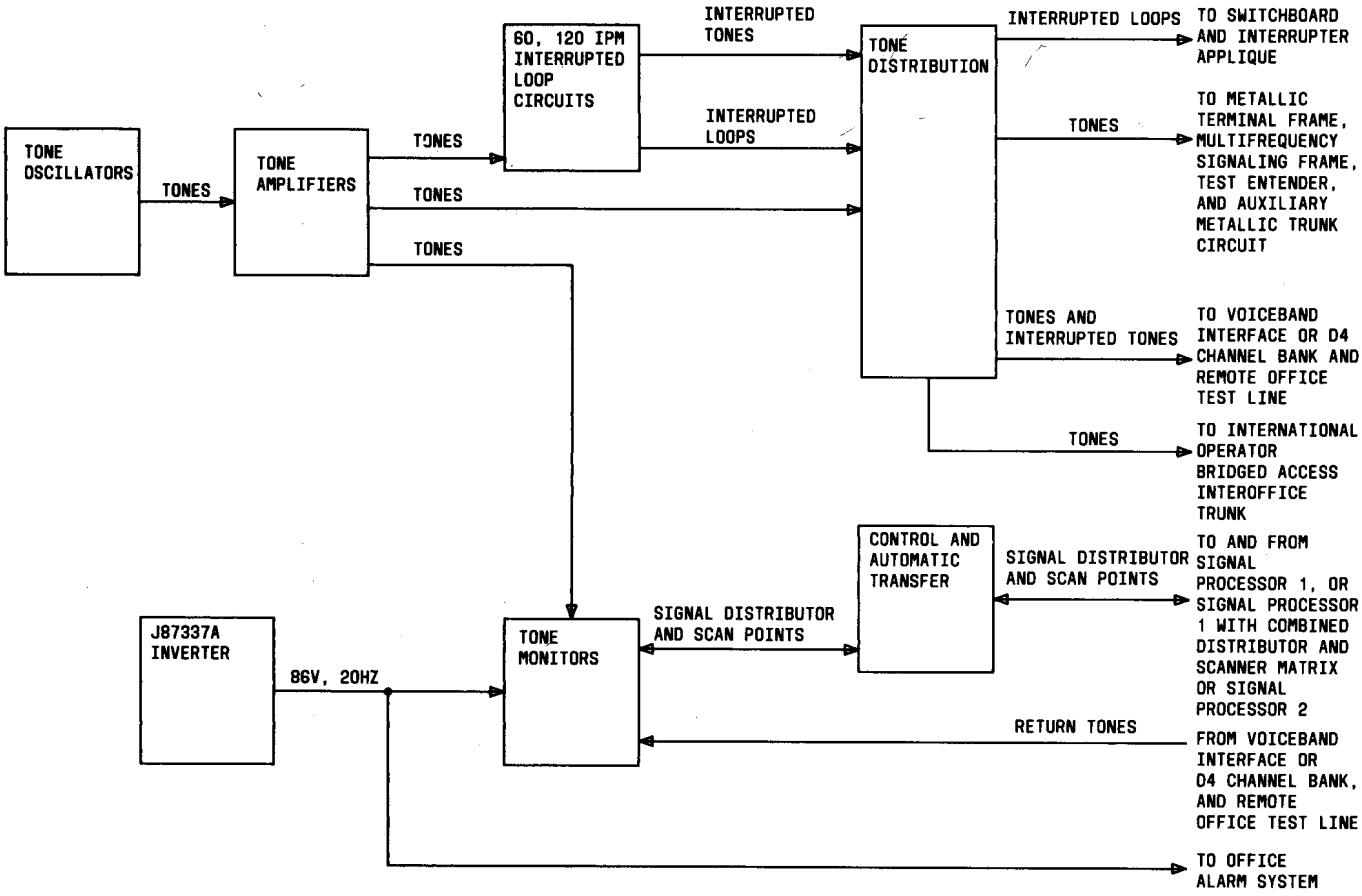

Fig. 8—820A Ringing, Tone, and Interrupter Plant—Functional Block Diagram

3.03 The ***low pass*** dc input line filter reduces both the noise level fed back to the battery from the inverter and the source impedance presented to the inverter by the battery.

3.04 The ***20-Hz oscillator inverter*** determines the frequency of the circuit and converts the dc voltage at the filter output to an ac square-wave voltage at the ferroresonant regulator input.

3.05 The ***filtered ferroresonant regulator*** converts the unregulated ac square-wave voltage from the oscillator stage into a sinsoidal voltage, regulated for input voltage and load current variations.

3.06 The ***output filter,*** electrically connected between the ferroresonant regulator and the circuit output terminals, works in conjunction with the ferroresonant regulator to provide a further improvement in the waveshape and therefore reduce the electrical noise level of the inverter output voltage.

C. Tone Distribution Circuits

3.07 The ***tone distribution splitting-resistors*** are used for a balanced distribution of the

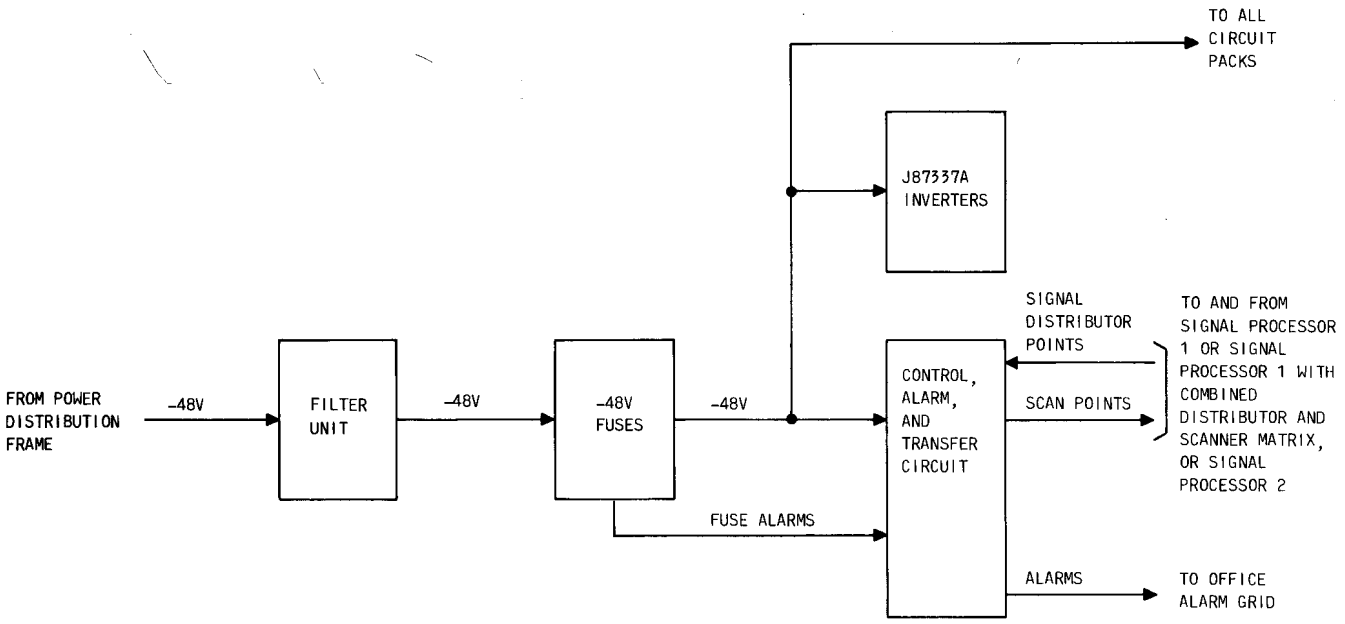

Fig. 9—820A Ringing Tone, and Interrupter Plant—Power And Alarm Circuits

tones and are multiplied at the plant output in accordance with the basic number required by No. 4 ESS.

D. 60, 120 IPM Interrupted Loop Circuits

3.08 The interrupted output signals are derived from the interrupter timing circuitry which drives a duplicate set of mercury relays. The mercury relays in turn drive wire-spring follower relays which provide the interrupted loops each through a 100-ohm resistance to the connecting circuits such as the interrupter applique or switchboard circuits. The interrupted loops are not fused; therefore, caution should be exercised to ensure proper utilization of the interrupted loops.

E. Tone Amplifiers

3.09 The tone amplifiers are the second half of the tone generator and are fed by the tone oscillators in four discrete combinations to produce the four call-progress tones. The 440 Hz and 480 Hz combine to yield the audible ring tone. The 480 Hz and 620 Hz combine to yield the busy tone (BT). The 480 Hz alone is the high tone (HT). The 2225 Hz alone is the test progress tone (TPT).

F. Tone Oscillators

3.10 The crystal-controlled tone oscillators are the first half of the tone generators and are used to provide the four frequencies necessary to produce the four call-progress tones required by the plant. The four frequencies generated by the oscillators are 440 Hz, 480 Hz, 620 Hz, and 2225 Hz.

G. Tone Monitors

3.11 The tone monitors are used to monitor the outputs of the tone transformers for low voltage. These monitors are designated "forward-path" monitors and detect the presence or absence of the tones supplied by the plant. There are also "return-path" monitors which are used to test the integrity of the transmission path external to the plant for all the tones except the continuous busy tone (BT) and high tone (HT) for which the return paths are not monitored.

H. Control and Automatic Transfer Circuits

3.12 Control of the plant is from the control panel. The OFF-0, NOR, and OFF-1 keys are mechanically interlocked to prevent power being removed from both sides of the plant at the same time. The normal condition for the plant is for

the NOR key to be depressed with either the "0" side or the "1" side of the plant carrying the load.

3.13 Power is supplied to both sides of the plant with the NOR key depressed. If a failure of any unit, fuse, or loss of power occurs on either side, the system automatically scans each side to determine which should supply the load. If power is off to the "0" side of the plant and the load is to be transferred back to the "0" side of the plant, the power must be ***restored*** to the "0" side of the plant manually or transfer will ***not*** occur.

4. POWER

POWER REQUIREMENTS

4.01 The No. 4 ESS ringing and tone frame power requirement is -48 volts dc from the power distribution system. This -48 volts dc is the only supply input to the ringing and tone frame and is used to power all logic circuitry, indicators, relays, and inverters.

POWER AND ALARM CIRCUITS (FIG. 9)

4.02 The 820A power and alarm circuits consist of a filter unit, fuses, a control circuit, and an alarm and transfer circuit.

4.03 The circuits which control power in the 820A plant are:

- Power switch
- Alarm circuit
- Fuses.

These circuits operate in conjunction with each other to provide manual and automatic control of frame power, frame power status signals to the signal processor, and a major alarm signal to the office alarm system. The frame can be powered down both manually by operation of the power switch (OFF-0 or OFF-1) and automatically when an alarm power condition occurs. Functions of the power switches and lamps are described in Table B.

4.04 All fuses contain an alarm contact that closes upon fuse failure and signals a fuse alarm to the alarm circuit. Receipt of a fuse alarm will result in the alarm circuit initiating an alarm power down condition and a major alarm output to the office alarm grid. By means of scan points, the signal processor is also notified of a fuse alarm condition.

5. MAINTENANCE

INTRODUCTION

5.01 The primary system maintenance objective is to maintain ringing and tone signals during error or fault intervals. This objective is met by:

- Detection of faults and errors
- Continuation of operation during a fault condition by switching to the redundant side of the 820A plant
- Repair of faulty equipment by craft personnel
- Verification of repair by equipment test or fault detection circuits
- Return of repaired equipment to service.

5.02 Craft personnel are notified of faults by scan point reports to system equipment, office alarm equipment, or frame indicating devices.

5.03 The No. 4 ESS maintenance philosophy and maintenance facilities are discussed in Section 234-100-000.

5.04 The Maintenance Operations Center is responsible for control, routine maintenance, and analysis functions. The Terminal Equipment Center is responsible for the repair function.

MAINTENANCE SOFTWARE

5.05 Scan and signal distributor points are used for equipment monitoring and equipment conditioning.

MAINTENANCE AIDS

5.06 The following maintenance aids are used to perform maintenance on the 820A frame.

- Tone monitor circuit packs provide continuous monitoring of all tone generators
- Fuse panel provides blown fuse indications

- Other test points, jacks, or indicators are provided on various circuit packs and the frame for maintenance.

5.07 Table B provides further information on the 820A frame controls and indicators.

ROUTINE TASKS

5.08 The procedures for performing any routine tasks to be performed at the 820A frame are provided in the TOP document.

REPAIR AND REPLACE TASKS

5.09 Repair and replace tasks to be performed at the 820A frame are provided in the TOP document.

6. REFERENCES

6.01 The following listing provides further information concerning the 820A Ringing, Tone, and Interrupter Plant:

NUMBER	TITLE
234-100-000	No. 4 Electronic Switching System, General Description
234-010-002	Abbreviations and Acronyms
167-728-101	820A Ringing, Tone, and Interrupter Plant, Theory
SD-82157-01	820A Ringing, Tone, and Interrupter Plant
SD-81975-01	20 Hz DC-to-AC Inverter
SD-81885-01	Signaling Circuit Pack Schematics
SD-82156-01	Ringing, Tone, and Signaling Circuits, General Use Circuit Packs.