891A (J85528A)
RINGING POWER PLANT
AUXILIARY RINGING, TONE, AND CADENCE SYSTEM
OPERATING METHODS

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1. GENERAL

1.01 The 891A (J85528A) Auxiliary Ringing, Tone, and Cadence System is arranged in modular form and consists of a maximum of six modules. The ringing generator module is the basic module and is always provided. The remaining modules interface with the ringing generator module and are provided on an optional basis. The optional modules provide audible ring tone (which through connection to the ringing generator module is superimposed on the ringing voltage), cadences, busy tone, receiver-off-hook (ROH), and +AC/DC for superimposed ringing. The 891A System provides ringing, tone, and cadence to nonswitched loads in No. 5 Electronic Switching System (ESS) and No. 10A Remote Switching System (RSS), and other central offices. The circuits in each of the modules, with the exception of the ROH tone module, are duplicated for reliability. One of the duplicate circuits is called the main circuit, and the other is called the reserve circuit. Normally, the outputs are provided from the main circuit and when a fault occurs in the main circuit, all output connections are transferred to the reserve circuits. Power off keys are provided to turn power off to the main and reserve circuits, and transfer and restore switches are provided to manually transfer output connections to the reserve circuits or manually restore output connections to the main circuits. The ringing, tone, and cadence functions are monitored, and alarm outputs are provided for minor and major circuit failures, blown fuses, and output connections to reserve circuits. Inputs to both the office alarm and alarm sending circuits are provided. Ringing outputs are provided through fuses; tone outputs are provided through splitting resistors; cadence loop and alarm outputs are provided through terminal strips.

1.02 The Equipment Test List (ETL) is affected.

1.03 The following items are furnished by a fully equipped J85528A, Auxiliary Ringing, Tone, and Cadence System. (See Fig. 1.)

(1) ***Ringing Capacity***—20 Hz, 43 VA, 84 to 88V, 96 to 101V and 104 to 109 Vac, rms. See Notes 1, 2, 3, 4, 5, 6, 7, and 9.

(2) ***Audible Ringing Tone***—Combined 440 and 480 Hz, 1 VA, 3.80 ±0.45 Vac, rms only pro-

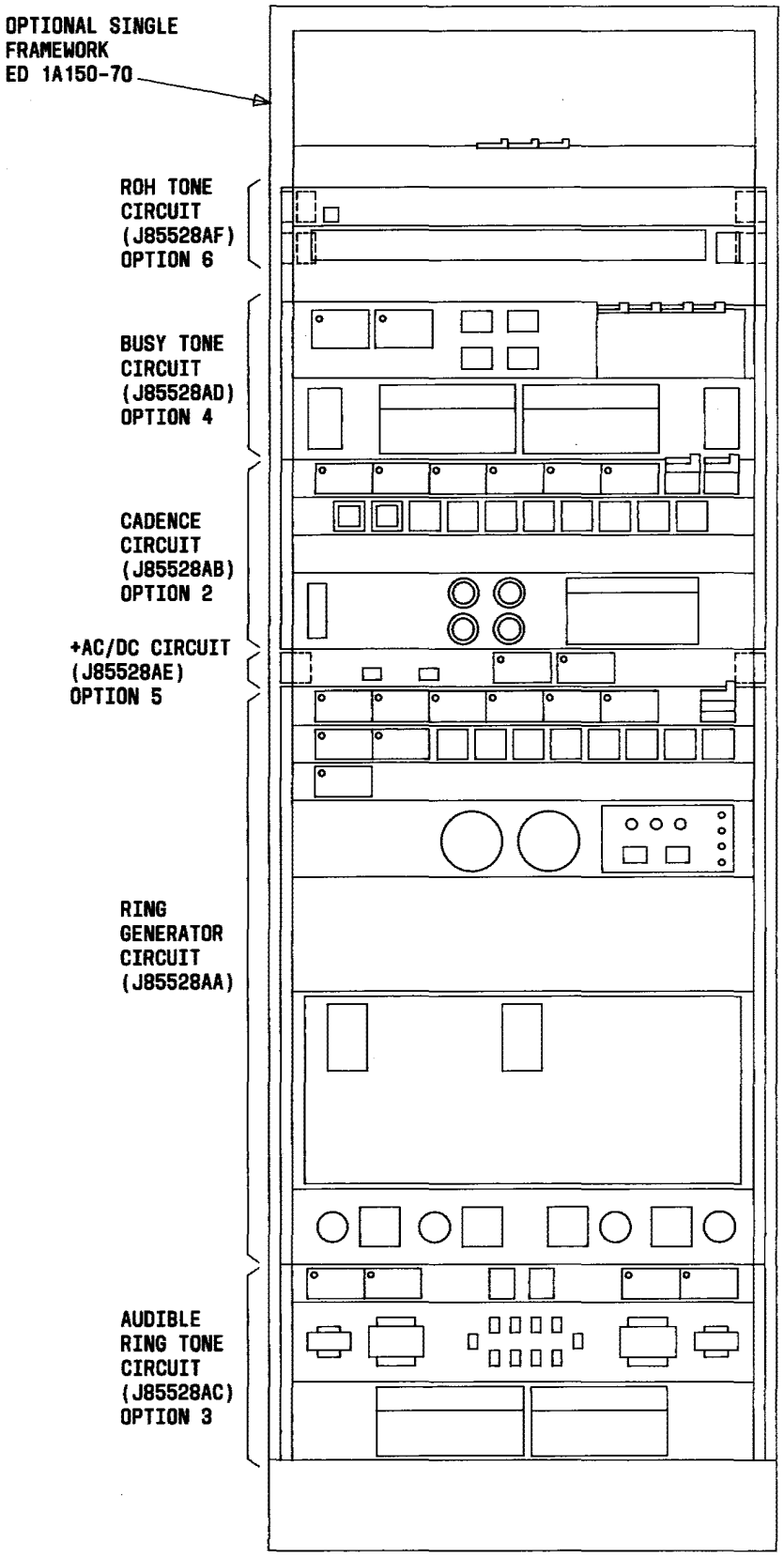

Fig. 1—891A (J85528A) Auxiliary Ringing, Tone, and Cadence System

vided superimposed on ringing voltages. See Notes 4 and 5.

(3) ***Busy Tone***—Combined 480 and 620 Hz, 1 VA, 0.20 ±0.02 Vac, rms. See Note 8.

(4) ***Receiver-Off-Hook (ROH) Tone***—Combined frequencies of 1400, 2060, 2450, and 2600 Hz. The output at leads T and R shall be 11 volume unit (vu) as read on a volume indicating meter. See Note 10.

Note 1: The plant can provide 86V rms at 20 Hz superimposed on -48 Vdc. The voltage is continuous (not cadenced) and contains no audible ring tone component [−AC/DC (86V)].

Note 2: The plant can provide 97V rms at 20 Hz superimposed on -48 Vdc. The voltage is continuous (not cadenced) and contains no audible ring tone component [−AC/DC (97V)].

Note 3: The plant can provide 105V rms, 20 Hz referenced to ground return. The voltage is continuous (not cadenced) and contains no audible ring tone component (105±).

Note 4: The plant can provide 86V rms at 20 Hz plus audible ring tone superimposed on -48 Vdc. The voltage is continuous, not cadenced [−AC/DC AUD (86V)].

Note 5: The plant can provide 86V rms at 20 Hz plus audible ring tone superimposed on -48 Vdc for 2 seconds and -48 Vdc for 4 seconds periodically cadenced at 10 interruptions per minute (ipm) (MR R1 BR1 or CODE 1 GEN BR1).

Note 6: The plant can provide 86V rms at 20 Hz superimposed on -48 Vdc for 2 seconds and -48 Vdc for 4 seconds periodically cadenced at 10 ipm (-AC/DC, 86V, BR1).

Note 7: The plant can provide 86V rms, 20 Hz superimposed on +48 Vdc. The voltage is continuous (not cadenced) and contains no audible ring tone component [+AC/DC (86V)].

Note 8: The plant can provide balanced distribution of busy tone (BT60) periodically cadenced at 0.5 second on and 0.5 second off. The output is balanced to ground through splitting resistors.

Note 9: The plant can provide 60 and 120 ipm cadenced loops.

Note 10: The plant can provide a balanced tone output consisting of voltage components at 1400, 2060, 2450, and 2600 Hz periodically cadenced at 0.1 second on and 0.1 second off.

1.04 During ***normal*** operation, power is on both sides "0" (main) and "1" (reserve) of the ring generator circuit, audible ring tone circuit, busy tone circuit, cadence circuit and +AC/DC circuit. The ROH tone circuit is not duplicated, and the same circuit will provide the ROH tone voltage regardless of which side the 891A System is operating on. The main side and reserve side circuits are connected to load circuits through contacts on a transfer relay. When a failure occurs, the transfer relay operates and automatic transfer occurs.

1.05 Each side of the 891A System has its own battery and ground feeders from the office Power Distribution Frame (PDF) for −48 volts. Separate +48 volts and ground feeders are furnished from a power supply to the 891A System when List 5 is provided. The A bus supplies the "0" (main) side of the plant, while the B bus supplies the "1" (reserve) side. All generators are powered by −48 volts dc.

1.06 The ROH tone circuit generates a distinctive tone signal which is applied to a customer line on which the receiver has been left off hook. The acoustic output of the ROH is intended to alert the customer to place the receiver on hook.

1.07 The instructions given in this section are based on the following circuit schematic drawings. For a detailed description of the operation of individual circuits, refer to the corresponding circuit description.

- SD-81885-01, Issue 23B, Signaling Circuit, Circuit Pack Schematic
- SD-82156-01, Issue 9B, Signaling Circuit, Circuit Pack Schematic
- SD-82258-01, Issue 2AR, Inverter Circuit, 20 Hz DC-to-AC Inverter, 86V 0.5 Ampere (J87415)
- SD-82574-01, Issue 1, Ringing and Signaling Circuit, 891A Auxiliary Ringing, Tone, and Cadence System (J85528A)
- SD-99303-01, Issue 19D, Common Systems, 400A Tone Generator Circuit (J99327).

2. APPARATUS

2.01 ***List of Tools and Test Equipment:*** The following tools and test equipment are used in this section:

TOOLS	DESCRIPTION
411C	Test Pick
723B	Tool (Required for removal of circuit packs)
KS-6278	Connecting Clip
WIAF	Cord (8-½ feet long equipped with one 360A tool at each end)
TEST EQUIPMENT	
—	Digital True RMS Multimeter Data Precision Model 248B (ITE 5632) or equivalent (battery powered)
—	Hewlett-Packard 3400A True RMS Voltmeter or Hewlett-Packard 3403A AC Operated True RMS Voltmeter or equivalent
KS-20538	Volt-Ohm-Milliammeter
KS-16653, L1	Volume Indicating Meter
—	Frequency Counter, General Radio Model 1159 or Hewlett-Packard Model 5325B, or equivalent
158A	Board Adapter
—	Isolation Plug, Hubbell No. BL-12-767, or equivalent
—	Hubbell No. GFP115 Ground Fault Circuit Interrupter, or equivalent.

3. OPERATION

Automatic Operation of Plant

3.01 The 891A Auxiliary Ringing, Tone, and Cadence System operates automatically to supply ringing current, tones, and cadence functions at the voltage and power level required by nonswitched loads in No. 5 ESS, No. 10A RSS, and other central offices. Operate the NOR key on the plant control panel.

Requirement: All lamps are off.

Note 1: Manual control (paragraphs 3.03 and 3.04) is provided.

Note 2: The OFF-0-NOR-OFF-1 keys are each provided with mechanical interlocks so that only one position can be operated at a time.

Manual Operation of Plant

3.02 ***Warning: The plant includes automatically controlled equipment. Care must be exercised to prevent transfer to those parts of the plant on which work is to be performed. Before starting work on a ringing generator, tone generator, cadence circuit, or +AC/DC circuit, follow instructions outlined in paragraph 3.03 or 3.04, as required, to prevent automatic transfer.***

3.03 If work is to be performed on the "0" side of the plant, the load must be transferred to the "1" side of the plant as follows:

(1) Depress transfer switch and hold until TRANSFER Light Emitting Diode (LED) lights.

(2) Depress OFF-0 key.

Requirement: The GEN-0 and CAD-0 FAIL LEDs light.

3.04 If work is to be performed on the "1" side of the plant, proceed as follows:

(1) If plant is transferred to "1" side, depress RESTORE switch and hold until TRANSFER LED is off.

(2) Depress OFF-1 switch.

Requirement: The GEN-1 and CAD-1 FAIL LEDs light.

4. ROUTINE CHECKS AND ADJUSTMENTS

4.01 ***DANGER: Isolation of the test meter from ground creates a potential hazard.***

Avoid bodily contact between test meter and other components, conductors, or ground.

4.02 ***Warning: The test meter must be isolated from ground to prevent erroneous reading and equipment damage during testing.*** If test meter is battery powered and not connected to ac power, the meter is isolated, and no additional isolation is required. If the meter is ac powered, the following procedure must be performed:

(1) Connect the ground fault circuit interrupter, Hubbell No. GFP115 or equivalent, to a 115-volt source.

(2) Insert the isolation plug, Hubbell No. BL-12-767 or equivalent, into the ground fault circuit interrupter.

(3) Connect the ac operated instrument to the isolation plug.

4.03 The tone oscillators, tone amplifiers, and tone monitors are the only circuit packs that can be adjusted. For all of these circuit packs, the adjustments are internal; therefore, it is necessary to make use of the 158A board adapter. A 723B tool is required for removal of plug-in circuit packs. A true rms voltmeter must be used for routine checks and adjustments.

Tone Generator Checks

4.04 To test and adjust oscillators in audible ring tone module ("0" side of plant), proceed as follows:

(1) Transfer the load to the "1" side of the plant as outlined in paragraph 3.03.

(2) Using 723B tool, remove 440-Hz, OSC-0 circuit pack.

Note: The 158A circuit pack board adapter is required to access test points and voltage adjust potentiometers.

(3) Extend 440-Hz, OSC-0 circuit pack using the 158A adapter.

(4) Set voltmeter function to TRUE RMS VOLTAGE, and range to 10 VOLTS.

(5) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Connect voltmeter across test points TP4 (ground) and TP5 (output) of the 440-Hz, OSC-0 circuit pack.

(6) Depress NOR key.

Requirement: The voltmeter indicates between 2.54 and 2.66V rms.

Note: If the requirement is not met, adjust potentiometer R3 on 440-Hz, OSC-0 circuit pack until voltmeter indicates between 2.54 and 2.66V rms.

(7) Disconnect voltmeter.

(8) Connect frequency counter across test points TP4 (ground) and TP5 (output).

Requirement: The frequency counter indicates between 437.8 to 442.2 Hz.

Note: There is no provision for field adjustment of the frequency on any of the oscillator circuit packs. If the frequency reading is not within range, the circuit pack must be replaced.

(9) Disconnect the frequency counter.

(10) Depress OFF-0 key.

(11) Pull 440-Hz, OSC-0 circuit pack and remove the 158A circuit pack board adapter.

(12) Reinsert 440-Hz, OSC-0 circuit pack in its original position.

(13) Using 723B tool, remove 480-Hz, OSC-0 circuit pack.

Note: The 158A circuit pack board adapter is required to access test points and voltage adjust potentiometers.

(14) Extend 480-Hz, OSC-0 circuit pack using the 158A adapter.

(15) Set voltmeter function to TRUE RMS VOLTAGE and range to 10 VOLTS.

(16) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Connect voltmeter across test points TP4 (ground) and TP5 (output) of the 480-Hz, OSC-0 circuit pack.

(17) Depress NOR key.

Requirement: The voltmeter indicates between 2.54 and 2.66V rms.

Note: If the requirement is not met, adjust potentiometer R3 on 480-Hz, OSC-0 circuit pack until voltmeter indicates between 2.54 and 2.66V rms.

(18) Disconnect voltmeter.

(19) Connect the frequency counter across test points TP4 (ground) and TP5 (output).

Requirement: The frequency counter indicates between 477.6 to 482.4 Hz.

Note: There is no provision for field adjustment of the frequency on any of the oscillator circuit packs. If the frequency is not within range, the circuit pack must be replaced.

(20) Disconnect the frequency counter.

(21) Depress OFF-0 key.

(22) Pull 480-Hz, OSC-0 circuit pack and remove the 158A circuit pack board adapter.

(23) Reinsert 480-Hz, OSC-0 circuit pack in its original position.

(24) Depress NOR key.

(25) Depress RESTORE switch.

Note: If the TRANSFER LED is lighted, depress and hold the RESTORE switch until the TRANSFER LED is off and remains off. With the TRANSFER LED off, the "0" (main) side will be providing the load.

4.05 To test and adjust oscillators in audible ring tone module ("1" side of plant), proceed as follows:

(1) Perform the procedures outlined in paragraph 3.04.

(2) Using 723B tool, remove 440-Hz, OSC-1 circuit pack.

Note: The 158A circuit pack board adapter is required to access test points and voltage adjust potentiometers.

(3) Extend 440-Hz, OSC-1 circuit pack using the 158A adapter.

(4) Set voltmeter function to TRUE RMS VOLTAGE, and range to 10 VOLTS.

(5) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Connect voltmeter across test points TP4 (ground) and TP5 (output) of the 440-Hz, OSC-1 circuit pack.

(6) Depress NOR key.

Requirement: The voltmeter indicates between 2.54 and 2.66V rms.

Note: If the requirement is not met, adjust potentiometer R3 on 440-Hz, OSC-1 circuit pack until voltmeter indicates between 2.54 and 2.66V rms.

(7) Disconnect voltmeter.

(8) Connect frequency counter across TP4 (ground) and TP5 (output).

Requirement: The frequency counter indicates between 437.8 to 442.2 Hz.

Note: There is no provision for field adjustment of the frequency on any of the oscillator circuit packs. If the frequency reading is not within range, the circuit pack must be replaced.

(9) Disconnect the frequency counter.

(10) Depress OFF-1 key.

(11) Pull 440-Hz, OSC-1 circuit pack and remove the 158A circuit pack board adapter.

(12) Reinsert 440-Hz, OSC-1 circuit pack in its original position.

(13) Using 723B tool, remove 480-Hz, OSC-1 circuit pack.

Note: The 158A circuit pack board adapter is required to access test points and voltage adjust potentiometer.

(14) Extend 480-Hz, OSC-1 circuit pack using the 158A adapter.

(15) Set voltmeter function to TRUE RMS VOLTAGE and range to 10 VOLTS.

(16) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Connect voltmeter across test points TP4 (ground) and TP5 (output) of the 480-Hz, OSC-1 circuit pack.

(17) Depress NOR key.

Requirement: The voltmeter indicates between 2.54 and 2.66V rms.

Note: If the requirement is not met, adjust potentiometer R3 on 480-Hz, OSC-1 circuit pack until voltmeter indicates between 2.54 and 2.66V rms.

(18) Disconnect voltmeter.

(19) Connect the frequency counter across test points TP4 (ground) and TP5 (output).

Requirement: The frequency counter indicates between 477.6 to 482.4 Hz.

Note: There is no provision for field adjustment of the frequency on any of the oscillator circuit packs. If the frequency is not within range, the circuit pack must be replaced.

(20) Disconnect the frequency counter.

(21) Depress OFF-1 key.

(22) Pull 480-Hz, OSC-1 circuit pack and remove the 158A circuit pack board adapter.

(23) Reinsert 480-Hz, OSC-1 oscillator circuit pack in its original position.

(24) Depress NOR key.

Requirement: All lamps are off.

4.06 To test and adjust oscillators in busy tone module ("0" side of plant), proceed as follows:

(1) Transfer the load to the "1" side of the plant as outlined in paragraph 3.03.

(2) Using 723B tool, remove 480-2 Hz oscillator circuit pack.

Note: The 158A circuit pack board adapter is required to access test points and voltage adjust potentiometers.

(3) Extend 480-Hz, OSC-2 circuit pack using the 158A adapter.

(4) Set voltmeter function to TRUE RMS VOLTAGE, and range to 10 VOLTS.

(5) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Connect voltmeter across test points TP4 (ground) and TP5 (output) of the 480-Hz, OSC-2 circuit pack.

(6) Depress NOR key.

Requirement: The voltmeter indicates between 2.54 and 2.66V rms.

Note: If the requirement is not met, adjust potentiometer R3 on 480-Hz, OSC-2 circuit pack until voltmeter indicates between 2.54 and 2.66V rms.

(7) Disconnect voltmeter.

(8) Connect frequency counter across test points TP4 (ground) and TP5 (output).

Requirement: The frequency counter indicates between 477.6 to 482.4 Hz.

Note: There is no provision for field adjustment of the frequency on any of the oscillator circuit packs. If the frequency reading is not within range, the circuit pack must be replaced.

(9) Disconnect the frequency counter.

(10) Depress OFF-0 key.

(11) Pull 480-Hz, OSC-2 circuit pack and remove the 158A circuit pack board adapter.

(12) Reinsert 480-Hz, OSC-2 circuit pack in its original position.

(13) Using 723B tool, remove 620-Hz, OSC-0 circuit pack.

Note: The 158A circuit pack board adapter is requried to access test points and voltage adjust potentiometers.

(14) Extend 620-Hz, OSC-0 circuit pack using the 158A adapter.

(15) Set voltmeter function to TRUE RMS VOLTAGE and range to 10 VOLTS.

(16) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Connect voltmeter across test points TP4 (ground) and TP5 (output) of the 620-Hz, OSC-0 circuit pack.

(17) Depress NOR key.

Requirement: The voltmeter indicates between 2.54 and 2.66V rms.

Note: If the requirement is not met, adjust potentiometer R3 on 620-Hz, OSC-0 circuit pack until voltmeter indicates between 2.54 and 2.66V rms.

(18) Disconnect voltmeter.

(19) Connect the frequency counter across test points TP4 (ground) and TP5 (output).

Requirement: The frequency counter indicates between 616.9 to 623.1 Hz.

Note: There is no provision for field adjustment of the frequency on any of the oscillator circuit packs. If the frequency is not within range, the circuit pack must be replaced.

(20) Disconnect the frequency counter.

(21) Depress OFF-0 key.

(22) Pull 620-Hz, OSC-0 circuit pack and remove the 158A circuit pack board adapter.

(23) Reinsert 620-Hz, OSC-0 circuit pack in its original position.

(24) Depress NOR key.

(25) Depress RESTORE switch.

Note: If the TRANSFER LED is lighted, depress and hold the RESTORE switch until the TRANSFER LED is off and remains off. With the TRANSFER LED off, the "0" (main) side will be providing the load.

4.07 To test and adjust oscillators in busy tone module ("1" side of plant), proceed as follows:

(1) Perform the procedures outlined in paragraph 3.04.

(2) Using 723B tool, remove 480-Hz, OSC-3 circuit pack.

Note: The 158A circuit pack board adapter is required to access test points and voltage adjust potentiometers.

(3) Extend 480-Hz, OSC-3 oscillator circuit pack using the 158A adapter.

(4) Set voltmeter function to TRUE RMS VOLTAGE and range to 10 VOLTS.

(5) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Connect voltmeter across test points TP4 (ground) and TP5 (output) of the 480-Hz, OSC-3 circuit pack.

(6) Depress NOR key.

Requirement: The voltmeter indicates between 2.54 and 2.66V rms.

Note: If the requirement is not met, adjust potentiometer R3 on 480-Hz, OSC-3 circuit pack until voltmeter indicates between 2.54 and 2.66V rms.

(7) Disconnect voltmeter.

(8) Connect frequency counter across test points TP4 (ground) and TP5 (output).

Requirement: The frequency counter indicates between 477.6 to 482.4 Hz.

Note: There is no provision for field adjustment of the frequency on any of the oscillator circuit packs. If the frequency reading is not within range, the circuit pack must be replaced.

(9) Disconnect the frequency counter.

(10) Depress OFF-1 key.

(11) Pull 480-Hz, OSC-3 circuit pack and remove the 158A circuit pack board adapter.

(12) Reinsert 480-Hz, OSC-3 circuit pack in its original position.

(13) Using 723B tool, remove 620-Hz, OSC-1 circuit pack.

Note: The 158A circuit pack board adapter is required to access test points and voltage adjust potentiometers.

(14) Extend 620-Hz, OSC-1 circuit packs using the 158A adapter.

(15) Set voltmeter function to TRUE RMS VOLTAGE and range to 10 VOLTS.

(16) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Connect voltmeter across test points TP4 (ground) and TP5 (output) of the 620-Hz, OSC-1 circuit pack.

(17) Depress NOR key.

Requirement: The voltmeter indicates between 2.54 and 2.66V rms.

Note: If the requirement is not met, adjust potentiometer R3 on 620-Hz, OSC-1 circuit pack until voltmeter indicates between 2.54 and 2.66V rms.

(18) Disconnect voltmeter.

(19) Connect the frequency counter across test points TP4 (ground) and TP5 (output).

Requirement: The frequency counter indicates between 616.9 to 623.1 Hz.

Note: There is no provision for field adjustment of the frequency on any of the oscillator circuit packs. If the frequency is not within range, the circuit pack must be replaced.

(20) Disconnect the frequency counter.

(21) Depress OFF-1 key.

(22) Pull 620-Hz, OSC-1 circuit pack and remove the 158A circuit pack board adapter.

(23) Reinsert 620-Hz, OSC-1 circuit pack in its original position.

(24) Depress NOR key.

Requirement: All lamps are off.

Tone Amplifier and Low-Voltage Monitor Checks

4.08 To test and adjust tone amplifiers and low-voltage monitors in audible ring tone module ("0" side of plant), proceed as follows:

Note: The sequence for adjusting tone monitors and amplifiers requires that the tone monitors be adjusted first. This simplifies the total adjustment procedures for tone outputs.

(1) Transfer the load to the "1" side of the plant as outlined in paragraph 3.03.

(2) Remove TONE AMP-0 circuit pack using the 723B tool.

Note: The 158A circuit pack board adapter is required to access potentiometers for voltage adjustments.

(3) Extend the TONE AMP-0 circuit pack using the 158A adapter.

(4) Set voltmeter function to TRUE RMS VOLTAGE and range to 10 VOLTS.

(5) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. At rear of plant, connect voltmeter across terminals 1 and 3 of T1 transformer.

(6) Remove 440-Hz, OSC-0 circuit pack using the 723B tool.

(7) Depress the NOR key.

(8) Read voltmeter and adjust potentiometer ADJ 2 (R4) on TONE AMP-0 until a reading of 3.25V rms is obtained.

(9) Depress OFF-0 key.

(10) Pull TONE AMP-0 circuit pack and remove the 158A circuit pack board adapter.

(11) Reinsert TONE AMP-0 circuit pack in its original position.

(12) Remove LV-0 circuit pack using the 723B tool.

(13) Extend the LV-0 circuit pack using the 158A adapter.

(14) Depress NOR key.

(15) Rotate the LV ADJ potentiometer on the LV-0 circuit pack completely ccw.

Requirement: The relay on the LV-0 circuit pack releases and the LED on the faceplate lights.

(16) Very slowly rotate the LV ADJ potentiometer cw until the relay operates and the LED goes off.

(17) Very slowly rotate the LV ADJ potentiometer ccw until the relay releases and the LED lights.

(18) Depress OFF-0 key.

(19) Reinsert 440-Hz, OSC-0 circuit pack in its original position.

(20) Depress NOR key.

Requirement: The relay on LV-0 circuit pack operates and the LED goes off.

Note: The LV-0 tone monitor is now fully adjusted.

(21) Depress OFF-0 key.

(22) Pull LV-0 circuit pack and remove the 158A circuit pack board adapter.

(23) Reinsert LV-0 circuit pack in its original position.

(24) Remove 440-Hz, OSC-0 circuit pack using the 723B tool.

(25) Remove TONE AMP-0 circuit pack using the 723B tool.

(26) Extend the TONE AMP-0 circuit pack using the 158A adapter.

(27) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Disconnect voltmeter from across terminals 1 and 3 and reconnect voltmeter across terminals 7 and 8 of T1 transformer.

(28) Depress NOR key.

(29) Read voltmeter and adjust potentiometer ADJ 2 (R4) on TONE AMP-0 circuit pack until a reading of 2.53V rms is obtained.

(30) Depress OFF-0 key.

(31) Reinsert 440-Hz, OSC-0 circuit pack and remove the 480-Hz, OSC-0 circuit pack.

(32) Depress NOR key.

(33) Read voltmeter and adjust potentiometer ADJ 1 (R3) on TONE AMP-0 circuit pack until the voltmeter indicates 2.81V rms.

(34) Depress OFF-0 key.

(35) Reinsert the 480-Hz, OSC-0 circuit pack in its original position.

(36) Depress NOR key.

Requirement: The voltmeter indicates between 3.724 and 3.876V rms.

Note: The TONE AMP-0 is now fully adjusted.

(37) Depress OFF-0 key.

(38) Disconnect voltmeter.

(39) Pull TONE AMP-0 circuit pack and remove the 158A adapter.

(40) Reinsert the TONE AMP-0 in its original position.

(41) Depress NOR key.

(42) Depress RESTORE switch.

Note: If the TRANSFER LED is lighted, depress and hold the RESTORE switch until the TRANSFER LED is off and remains off. With the TRANSFER LED off, the "0" (main) side will be providing the load.

4.09 To test and adjust tone amplifier and low-voltage monitors in audible ring tone module ("1" side of plant), proceed as follows:

Note: The sequence for adjusting tone monitors and amplifiers requires that the tone monitors be adjusted first. This simplifies the total adjustment procedures for tone outputs.

(1) Perform the procedures outlined in paragraph 3.04.

(2) Remove TONE AMP-1 circuit pack using the 723B tool.

Note: The 158A circuit pack board adapter is required to access potentiometers for voltage adjustments.

(3) Extend the TONE AMP-1 circuit pack using the 158A adapter.

(4) Set voltmeter function to TRUE RMS VOLTAGE and range to 10 VOLTS.

(5) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. At rear of plant, connect voltmeter across terminals 1 and 3 of T2 transformer.

(6) Remove 440-Hz, OSC-1 circuit pack using the 723B tool.

(7) Depress the NOR key.

(8) Read voltmeter and adjust potentiometer ADJ 2 (R4) on TONE AMP-1 circuit pack until a reading of 3.25V rms is obtained.

(9) Depress OFF-1 key.

(10) Pull TONE AMP-1 circuit pack and remove the 158A circuit pack board adapter.

(11) Reinsert the TONE AMP-1 circuit pack in its original position.

(12) Remove LV-1 circuit pack using the 723B tool.

(13) Extend the LV-1 circuit pack using the 158A adapter.

(14) Depress NOR key.

(15) Rotate the LV ADJ potentiometer on the LV-1 circuit pack completely ccw.

Requirement: The relay on the LV-1 circuit pack releases and the LED on the faceplate lights.

(16) Very slowly rotate the LV ADJ potentiometer cw until the relay operates and the LED goes off.

(17) Very slowly rotate the LV ADJ potentiometer ccw until the relay releases and the LED lights.

(18) Depress OFF-1 key.

(19) Reinsert 440-Hz, OSC-1 circuit pack in its original position.

(20) Depress NOR key.

Requirement: The relay on LV-1 circuit pack operates and the LED goes off.

Note: The LV-1 tone monitor is now fully adjusted.

(21) Depress OFF-1 key.

(22) Pull LV-1 circuit pack and remove the 158A circuit pack board adapter.

(23) Reinsert LV-1 circuit pack in its original position.

(24) Remove 440-Hz, OSC-1 pack using the 723B tool.

(25) Remove TONE AMP-1 circuit pack using the 723B tool.

(26) Extend the TONE AMP-1 circuit pack using the 158A adapter.

(27) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Disconnect voltmeter from across terminals 1 and 3 and reconnect voltmeter across terminals 7 and 8 of T2 transformer.

(28) Depress NOR key.

(29) Read voltmeter and adjust potentiometer ADJ 2 (R4) on TONE AMP-1 circuit pack until a reading of 2.53V rms is obtained.

(30) Depress OFF-1 key.

(31) Reinsert 440-Hz, OSC-1 circuit pack and remove the 480-Hz, OSC-1 circuit pack.

(32) Depress NOR key.

(33) Read the voltmeter and adjust potentiometer ADJ 1 (R3) on TONE AMP-1 circuit pack until the voltmeter indicates 2.81V rms.

(34) Depress OFF-1 key.

(35) Reinsert the 480-Hz, OSC-1 circuit pack in its original position.

(36) Depress NOR key.

Requirement: The voltmeter indicates between 3.724 and 3.876V rms.

Note: The TONE AMP-1 is now fully adjusted.

(37) Depress OFF-1 key.

(38) Disconnect voltmeter.

(39) Pull TONE AMP-1 circuit pack and remove the 158A adapter.

(40) Reinsert the TONE AMP-1 in its original position.

(41) Depress NOR key.

Requirement: All lamps are off.

4.10 To test and adjust tone amplifier and low-voltage monitors in busy tone module ("0" side of plant), proceed as follows:

Note: The sequence for adjusting tone monitors and amplifiers requires that the tone monitors be adjusted first. This simplifies the total adjustment procedures for tone outputs.

(1) Transfer the load to the "1" side of the plant as outlined in paragraph 3.03.

(2) Remove TONE AMP-2 circuit pack using the 723B tool.

Note: The 158A circuit pack board adapter is required to access potentiometers for voltage adjustments.

(3) Extend the TONE AMP-2 circuit pack using 158A adapter.

(4) Set voltmeter function to TRUE RMS VOLTAGE and range to 10 VOLTS.

(5) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. At rear of plant, connect voltmeter across terminals 1 and 3 of T3 transformer.

(6) Remove 480-Hz, OSC-2 circuit pack using the 723B tool.

(7) Depress the NOR key.

(8) Read voltmeter and adjust potentiometer ADJ 2 (R4) on TONE AMP-2 circuit pack until a reading of 3.75V rms is obtained.

(9) Depress OFF-0 key.

(10) Pull TONE AMP-2 circuit pack and remove the 158A circuit pack board adapter.

(11) Reinsert TONE AMP-2 circuit pack in its original position.

(12) Remove LV-2 circuit pack using the 723B tool.

(13) Extend the LV-2 circuit pack using the 158A adapter.

(14) Depress NOR key.

(15) Rotate the LV ADJ potentiometer on the LV-2 circuit pack completely ccw.

Requirement: The relay on the LV-2 circuit pack releases and the LED on the faceplate lights.

(16) Very slowly rotate the LV ADJ potentiometer cw until the relay operates and the LED goes off.

(17) Very slowly rotate the LV ADJ potentiometer ccw until the relay releases and the LED lights.

(18) Depress OFF-0 key.

(19) Reinsert 480-Hz, OSC-2 circuit pack in its original position.

(20) Depress NOR key.

Requirement: The relay on LV-2 circuit pack operates and the LED goes off.

Note: The LV-2 tone monitor is now fully adjusted.

(21) Depress OFF-0 key.

(22) Pull LV-2 circuit pack and remove the 158A circuit pack board adapter.

(23) Reinsert LV-2 circuit pack in its original position.

(24) Remove 480-Hz, OSC-2 circuit pack using the 723B tool.

(25) Remove TONE AMP-2 amplifier circuit pack using the 723B tool.

(26) Extend the TONE AMP-2 circuit pack using the 158A adapter.

(27) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Disconnect voltmeter from across terminals 1 and 3 and reconnect voltmeter across terminals 5 and 7 of T3 transformer.

(28) Depress NOR key.

(29) Read voltmeter and adjust potentiometer ADJ 2 (R4) on TONE AMP-2 circuit pack until a reading of 0.1414V rms is obtained.

(30) Depress OFF-0 key.

(31) Reinsert 480-Hz, OSC-2 circuit pack and remove the 620-Hz, OSC-0 circuit pack.

(32) Depress NOR key.

(33) Read the voltmeter and adjust potentiometer ADJ 1 (R3) on TONE AMP-2 circuit pack until the voltmeter indicates 0.1414V rms.

(34) Depress OFF-0 key.

(35) Reinsert the 620-Hz, OSC-0 circuit pack in its original position.

(36) Depress NOR key.

Requirement: The voltmeter indicates between 0.196 and 0.204V rms.

Note: The TONE AMP-2 is now fully adjusted.

(37) Depress OFF-0 key.

(38) Disconnect voltmeter.

(39) Pull TONE AMP-2 circuit pack and remove the 158A adapter.

(40) Reinsert the TONE AMP-2 in its original position.

(41) Depress NOR key.

(42) Depress RESTORE switch.

Note: If the TRANSFER LED is lighted, depress and hold the RESTORE switch until the TRANSFER LED is off and remains off. With the TRANSFER LED off, the "0" (main) side will be providing the load.

4.11 To test and adjust tone amplifiers and low-voltage monitors in busy tone module ("1" side of plant), proceed as follows:

Note: The sequence for adjusting tone monitors and amplifiers requires that the tone monitors be adjusted first. This simplifies the total adjustment procedures for tone outputs.

(1) Perform the procedures outlined in paragraph 3.04.

(2) Remove TONE AMP-3 circuit pack using the 723B tool.

Note: The 158A circuit pack board adapter is required to access potentiometers for voltage adjustments.

(3) Extend the TONE AMP-3 circuit pack using 158A adapter.

(4) Set voltmeter function to TRUE RMS VOLTAGE and range to 10 VOLTS.

(5) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. At rear of plant, connect voltmeter across terminals 1 and 3 of T4 transformer.

(6) Remove 480-Hz, OSC-3 circuit pack using the 723B tool.

(7) Depress the NOR key.

(8) Read voltmeter and adjust potentiometer ADJ 2 (R4) on TONE AMP-3 circuit pack until a reading of 3.75V rms is obtained.

(9) Depress OFF-1 key.

(10) Pull TONE AMP-3 circuit pack and remove the 158A circuit pack board adapter.

(11) Reinsert TONE AMP-3 circuit pack in its original position.

(12) Remove LV-3 circuit pack using the 723B tool.

(13) Extend the LV-3 circuit pack using the 158A adapter.

(14) Depress NOR key.

(15) Rotate the LV ADJ potentiometer on the LV-3 circuit pack completely ccw.

Requirement: The relay on the LV-3 circuit pack releases and the LED on the faceplate lights.

(16) Very slowly rotate the LV ADJ potentiometer cw until the relay operates and the LED goes off.

(17) Very slowly rotate the LV ADJ potentiometer ccw until the relay releases and the LED lights.

(18) Depress OFF-1 key.

(19) Reinsert 480-Hz, OSC-3 circuit pack in its original position.

(20) Depress NOR key.

Requirement: The relay on LV-3 circuit pack operates and the LED goes off.

Note: The LV-3 tone monitor is now fully adjusted.

(21) Depress OFF-1 key.

(22) Pull LV-3 circuit pack and remove the 158A circuit pack board adapter.

(23) Reinsert LV-3 circuit pack in its original position.

(24) Remove 480-Hz, OSC-3 oscillator pack using the 723B tool.

(25) Remove TONE AMP-3 circuit pack using the 723B tool.

(26) Extend the TONE AMP-3 circuit pack using the 158A adapter.

(27) See ***DANGER*** and ***Warning*** in paragraphs 4.01 and 4.02. Disconnect voltmeter from across terminals 1 and 3 and reconnect voltmeter across terminals 5 and 7 of T4 transformer.

(28) Depress NOR key.

(29) Monitor voltmeter and adjust potentiometer ADJ 2 (R4) on TONE AMP-3 circuit pack until a reading of 0.1414V rms is obtained.

(30) Depress OFF-1 key.

(31) Reinsert 480-Hz, OSC-3 circuit pack and remove the 620-Hz, OSC-1 circuit pack.

(32) Depress NOR key.

(33) Read the voltmeter and adjust potentiometer ADJ 1 (R3) on TONE AMP-3 circuit pack until the voltmeter indicates 0.1414V rms.

(34) Depress OFF-1 key.

(35) Reinsert the 620-Hz, OSC-1 circuit pack in its original position.

(36) Depress NOR key.

Requirement: The voltmeter indicates between 0.196 and 0.204V rms.

Note: The TONE AMP-3 is now fully adjusted.

(37) Depress OFF-1 key.

(38) Disconnect voltmeter.

(39) Pull TONE AMP-3 circuit pack and remove the 158A adapter.

(40) Reinsert the TONE AMP-3 in its original position.

(41) Depress NOR key.

Requirement: All lamps are off.

Pulsing Signal Output Check (Receiver-Off-Hook Generator)

4.12 To check the pulsing signal output from the receiver-off-hook generators, proceed as follows:

(1) On KS-16653, L1, volume indicating meter, operate the key to HIGH IMP position and rotate RANGE SWITCH to 18.

(2) ***Warning: Extreme care should be taken when making connections of test equipment to terminals on TB1 on the unit. Shorting terminals or wrong connections may cause damage to the receiver-off-hook generator.*** Connect the KS-16653, L1, volume

indicating meter to terminals 17 and 27 on the TB1 terminal strip of the receiver-off-hook generator. The TB1 is located top-front of plant, adjacent to the receiver-off-hook generator.

Requirement: The KS-16653, L1, volume indicating meter indicates +11 vu.

Note: If the requirement is ***not*** met, remove cover and adjust the LEVEL CONTROL potentiometer on printed wiring card P-42E811 for a reading of +11 vu on the volume indicating meter.

(3) Reinstall cover if removed.

(4) Disconnect the KS-16653, L1, volume indicating meter.

Fuse Alarm Checks

4.13 To check the fuse alarms for the ringing generator circuit ("0" side of plant), proceed as follows:

(1) Transfer the load to the "1" side of plant as outlined in paragraph 3.03.

Note: The later designed fuse caps for 70-type fuses contain an aperture or slot adjacent to the hole for the colored bead, providing access to the alarm test point (see Fig. 2).

(2) Depress NOR key.

(3) Prepare the alarm test cord by connecting one end of the WIAY testing cord to the 141 cord and 720A voltage pickup tool. (The KS-6278 connecting clip may be used to replace the 720A voltage pickup tool.) On the opposite end of the WIAY testing cord, connect the 411C test tool (see Fig. 3).

(4) ***Caution: Test only the fuses associated with the same polarity voltage supply.*** Install the 720A voltage pickup tool in a −48 volt spare 70-type fuse position. (If the 720A tool is not available, obtain the same polarity voltage supply by connecting a KS-6278 connecting clip with the WIAY testing cord to the positive or negative bus bar).

Note: Leave 720A voltage pickup tool in spare 70-type fuse position in ringing generator module for all −48 volt fuses.

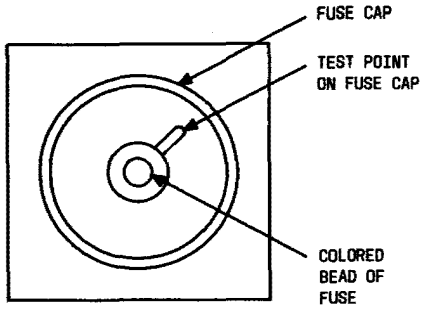

Fig. 2—Typical 70-Type Fuse Cap

(5) With the tip of the 411C tool, touch the exposed alarm test point on the F1 fuse cap.

Requirement: The FA1 relay operates and a visual and audible fuse alarm is generated.

(6) Remove the 411C tool from the fuse cap.

Requirement: Visual and audible fuse alarms are retired.

(7) Repeat Steps (5) and (6) for fuses F2, F3, F4, F17, F18, and F21.

4.14 To check the fuse alarms for the audible ring circuit ("0" side of plant), proceed as follows:

(1) With the tip of the 411C tool, touch the exposed alarm test point on the F41 fuse cap.

Requirement: The FA1 relay operates and a visual and audible fuse alarm is generated.

(2) Remove the 411C tool from the fuse cap.

Requirement: Visual and audible fuse alarms are retired.

(3) Repeat Steps (1) and (2) for fuses F42, F43, F45, and F46.

4.15 To check the fuse alarms for the busy tone circuit ("0" side of plant), proceed as follows:

(1) With the tip of the 411C tool, touch the exposed alarm test point on the F57 fuse cap.

Requirement: The FA1 relay operates and a visual and audible fuse alarm is generated.

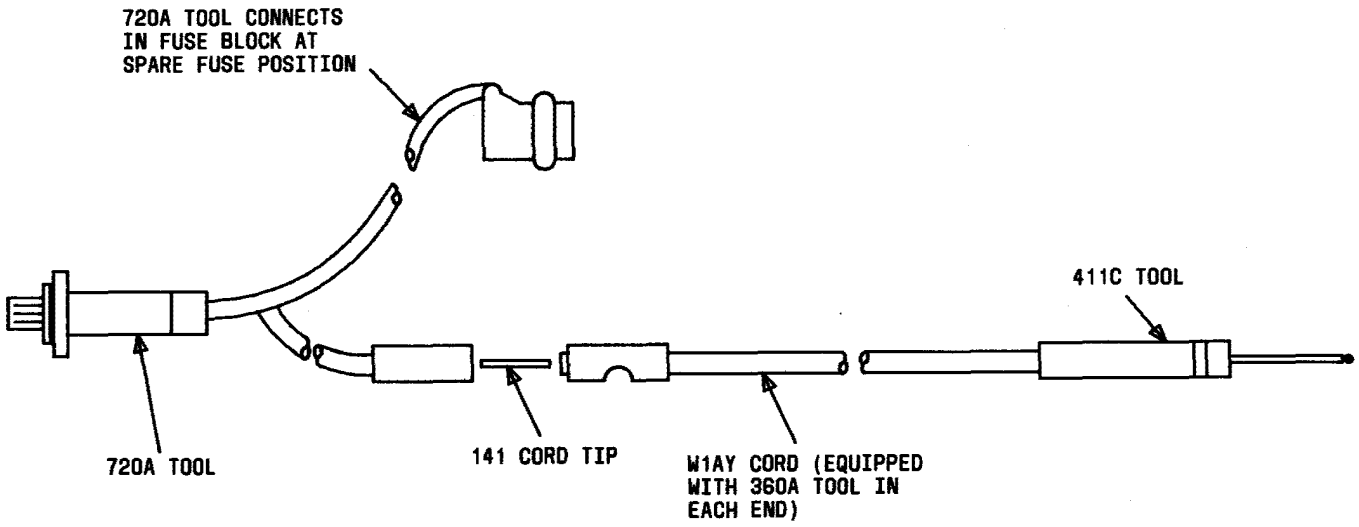

Fig. 3—Fuse Alarm Test Cord Assembly

(2) Remove the 411C tool from the fuse cap.

Requirement: Visual and audible fuse alarms are retired.

(3) Repeat Steps (1) and (2) for fuses F58, F59, F61, and F62.

4.16 To check the fuse alarms for the cadence circuit ("0" side of plant), proceed as follows:

(1) With the tip of the 411C tool, touch the exposed alarm test point on the F25 fuse cap.

Requirement: The FA1 relay operates and a visual and audible alarm is generated.

(2) Remove the 411C tool from the fuse cap.

Requirement: Visual and audible fuse alarms are retired.

(3) Repeat Steps (1) and (2) for fuses F26, F27, F28, F29, and F30.

(4) Remove the 720A tool from the spare fuse position.

(5) Depress RESTORE switch on plant control panel.

Note: If the TRANSFER LED is lighted, depress and hold the RESTORE switch until the TRANSFER LED is off and remains off. With the TRANSFER LED off, the "0" (main) side will be providing the load.

Fuse Alarm Checks

4.17 To check the fuse alarms for the ringing generator circuit ("1" side of plant), proceed as follows:

(1) Perform the procedures as outlined in paragraph 3.04.

Note: The later designed fuse caps for 70-type fuses contain an aperture or slot adjacent to the hole for the colored bead, providing access to the alarm test point (see Fig. 2).

(2) Depress NOR key.

(3) Prepare the alarm test cord by connecting one end of the WIAY testing cord to the 141 cord and 720A voltage pickup tool (the KS-6278 connecting clip may be used to replace the 720A voltage pickup tool.) On the opposite end of the WIAY testing cord, connect the 411C test tool (see Fig. 3).

(4) ***Caution: Test only the fuses associated with the same polarity voltage supply.*** Install the 720A voltage pickup tool in a −48 volt spare 70-type fuse position. (If the 720A tool is not available, obtain the same polarity voltage supply

by connecting a KS-6278 connecting clip with the WIAY testing cord to the positive or negative bus bar.)

Note: Leave 720A voltage pickup tool in spare 70-type fuse position in ringing generator module for all −48 volt fuses.

(5) With the tip of the 411C tool, touch the exposed alarm test point on the F9 fuse cap.

Requirement: The FA1 relay operates and a visual and audible fuse alarm is generated.

(6) Remove the 411C tool from the fuse cap.

Requirement: Visual and audible fuse alarms are retired.

(7) Repeat Steps (5) and (6) for fuses F10, F11, F12, F13, F15, F16, F19, F20, F23, and F24.

4.18 To check the fuse alarms for the audible ring circuit ("1" side of plant), proceed as follows:

(1) With the tip of the 411C tool, touch the exposed alarm test point on the F43 fuse cap.

Requirement: The FA1 relay operates and a visual and audible fuse alarm is generated.

(2) Remove the 411C tool from the fuse cap.

Requirement: Visual and audible fuse alarms are retired.

(3) Repeat Steps (1) and (2) for fuses F49, F50, F51, F53, and F54.

4.19 To check the fuse alarms for the busy tone circuit ("1" side of plant), proceed as follows:

(1) With the tip of the 411C tool, touch the exposed alarm test point on the F65 fuse cap.

Requirement: The FA1 relay operates and a visual and audible fuse alarm is generated.

(2) Remove the 411C tool from the fuse cap.

Requirement: Visual and audible fuse alarms are retired.

(3) Repeat Steps (1) and (2) for fuses F66, F67, F68, F69, and F70.

4.20 To check the fuse alarms for the cadence circuit ("1" side of plant), proceed as follows:

(1) With the tip of the 411C tool, touch the exposed alarm test point on the F33 fuse cap.

Requirement: The FA1 relay operates and a visual and audible alarm is generated.

(2) Remove the 411C tool from the fuse cap.

Requirement: Visual and audible fuse alarms are retired.

(3) Repeat Steps (1) and (2) for fuses F34, F35, F36, F37, F38, and F39.

(4) Remove the 720A tool from the spare fuse position.

(5) Depress RESTORE switch.

Note: If the TRANSFER LED is lighted, depress and hold the RESTORE switch until the TRANSFER LED is off and remains off. With the TRANSFER LED off, the "0" (main) side will be providing the load.

Requirement: Visual and audible fuse alarms are retired.

Fuse Alarm Relay Checks

4.21 ***Caution: The following checks are made with the equipment service.*** To check the operation of the fuse alarm relays, proceed as follows.

(1) Remove the original fuse from one of the fuse holders in Table A.

(2) Install a blown fuse in the associated fuse holder being checked.

Requirement: The associated relays in Table A operates and the office audible and visual alarms are activated.

(3) Remove the blown fuse from the fuse holder being checked.

Requirement: The associated relays in Table A releases and the office audible and visual alarms are retired.

(4) Install the original fuse that was removed in Step (1).

(5) Repeat Steps (1) through (4) for the remaining fuse holders given in Table A.

TABLE A

FUSE ALARM RELAY CHECKS

FUSE MOUNT	FUSE ALARM RELAY
— AC/DC (86V)	FA-2
— AC/DC (97V)	FA-2
105±	FA-2
MR R1 BR1 OR CODE 1 GEN BR1	FA-2
— AC/DC (86V) BR1	FA-2
— AC/DC AUD (86V)	FA-2
+AC/DC (86V)	FA-2

5. TROUBLES

5.01 Troubles which may occur in the plant will usually be indicated by an alarm. Table B provides the status of failure conditions, other than blown fuses, and indicates which failure conditions result in automatic transfer. A blown input or output fuse by itself or accompanied with any of the failure conditions shown in the table has a major failure status.

5.02 ***List of Controls and Indicators:*** Refer to Table C for a list of controls and indicators.

Trouble Table

5.03 The possible causes of trouble in a unit and the action to be taken are given in Table D. In addition to the actions specified, check for loose or open connections or short circuits due to foreign material lying across associated wiring terminals.

TABLE B

STATUS OF FAILURE CONDITIONS

SIDE OPERATING WHEN FAILURE OCCURRED	RING GENERATOR CIRCUIT, CADENCE CIRCUIT, OR TONE CIRCUITs FAILED ON MAIN SIDE	RING GENERATOR CIRCUIT, CADENCE CIRCUIT, OR TONE CIRCUITs FAILED ON RESERVE SIDE	TRANSFER OCCURS AS RESULT OF FAILURE	FAILURE STATUS	
				MINOR	MAJOR
Main	Yes	No	Yes	X	
Main	No	Yes	No	X	
Main	Yes	Yes	Yes		X
Reserve	Yes	No	No	X	
Reserve	No	Yes	No		X
Reserve	Yes	Yes	No		X

TABLE C

CONTROLS AND INDICATORS

NAME	COMPONENT	DESIGNATION	FUNCTION
J85528AA Ringing Generator Circuit	LED (Red)	TRANSFER	Lights when transferred.
	LED (Red)	GEN-0 FAIL	Lights when ringing generator module fails on "0" side.
	LED (Red)	GEN-1 FAIL	Lights when ringing generator module fails on "1" side.
	LED (Red)	FUSE ALARM	Lights when a —48V battery distribution or ring fuse operates.
	Pushbutton switch	TRANSFER	Transfers operation from "0" (main) side to "1" (reserve) side.
	Pushbutton switch	RESTORE	Restores operation to "0" (main) side from "1" (reserve) side.
	Pushbutton key	OFF-0*	When depressed, power is removed from "0" side of plant and the following LEDs will light: GEN-0 FAIL and CAD-0 FAIL.
	Pushbutton key	OFF-1*	When depressed, power is removed from "1" side of plant and the following LEDs will light: GEN-1 FAIL and CAD-1 FAIL.
	Pushbutton key	NOR*	Normally depressed to supply input power to the "0" (main) side and "1" (reserve) side simultaneously.
J85528AC Audible Ring Tone Circuit	LED (Red)	LV-0	Lights when audible ring tone voltage levels are out of limits or when audible ring tone module fails on "0" side.
	LED (Red)	LV-1	Lights when audible ring tone voltage levels are out of limits or when audible ring module fails on "1" side.
J85528AB Cadence Circuit	LED (Red)	CAD-0	Lights when cadence module fails on "0" side.
	LED (Red)	CAD-1	Lights when cadence module fails on "1" side.

*These keys are mechanically interlocked so that ***only one*** key may be operated at a time.

TABLE C (Contd)

CONTROLS AND INDICATORS

NAME	COMPONENT	DESIGNATION	FUNCTION
J85528AD Busy Tone Circuit	LED (Red)	LV-2	Lights when busy tone voltage levels are out of limits or when busy tone module fails on "0" side.
	LED (Red)	LV-3	Lights when busy tone voltage levels are out of limits or when busy tone module fails on "1" side.
J85528AF ROH Tone Circuit	Lamp (Red)	Has no designation	Lights when ROH tone module fails.

* These keys are mechanically interlocked so that ***only one*** key may be operated at a time.

TABLE D

TROUBLE TABLE

TROUBLE CONDITION	PROBABLE CAUSE	REMEDY (SEE NOTE)
A. GEN-0 FAIL LED and TRANSFER LED lights, minor office alarm is generated, and fuse alarm LED is on or off	Defective GEN-0 inverter (SD-82258-01)	If fuse F1 is not blown or blows when replaced, check GEN-0 inverter in accordance with Section 161-201-301.
B. GEN-1 FAIL LED lights, minor office alarm is generated, and fuse alarm LED is on or off	Defective GEN-1 inverter (SD-82257-01)	If fuse F9 is not blown or blows when replaced, check GEN-1 inverter in accordance with Section 161-201-301.
C. CAD-0 FAIL LED and TRANSFER LED lights, minor office alarm is generated, and fuse alarm LED is on or off	Defective cadence circuit or monitor circuit on "0" (main) side (SD-82574-01)	If fuses F25 or F27 is not blown, replace CAD GEN-0 and CAD-0 circuit packs. If fuse F25 is blown, replace CAD GEN-0 and CAD-0 circuit packs. Then replace F25. If F27 is blown or if circuit pack replacement does not remedy problem, check for fault in cadence monitor circuit.
D. CAD-1 FAIL LED lights, minor office alarm is generated, and fuse alarm LED is on or off	Defective cadence circuit on monitor circuit on "1" (reserve) side (SD-82574-01)	If fuse F33 or F35 is not blown, replace CAD GEN-1 and CAD-0 circuit packs. If fuse F33 is blown, replace CAD GEN-1 and CAD-0 circuit packs, then replace F33. If F35 is blown or if circuit pack does not remedy problem, check for fault in cadence monitor circuits.
E. LV-0 LED and TRANSFER LED lights, minor office alarm is generated, and fuse alarm LED is on or off	Audible ring tone circuit is defective or requires adjustment on "0" (main) side	If a fuse has been replaced and blows, replace circuit pack fed by that fuse, then replace fuse (see FS3 in SD-82574-01). Test oscillator circuits in accordance with paragraph 4.02. Replace 440-Hz OSC-O or 480-Hz OSC-O circuit packs if defective and retest.

Note: Whenever a fuse alarm is provided, the blown fuse must be replaced before other remedies are tried.

TABLE D (Contd)

TROUBLE TABLE

TROUBLE CONDITION	PROBABLE CAUSE	REMEDY (SEE NOTE)
E. LV-0 LED and TRANSFER LED lights, minor office alarm is generated and fuse alarm LED is on or off (Contd)		Test monitor and amplifier circuit in accordance with paragraph 4.06. Replace TONE AMP-0 or LV-0 circuit packs if defective and retest.
F. LV-1 LED lights, minor office alarm is generated, and fuse alarm LED is on or off	Audible ring tone circuit is defective or requires adjustment on "1" (main) side	If a fuse has been replaced and blows, replace circuit pack fed by that fuse, then replace fuse (see FS3 in SD-82574-01). Test oscillator circuit in accordance with paragraph 4.03. Replace 440-Hz OSC-1 or 480-Hz OSC-1 circuit pack if defective and retest. Test monitor and amplifier circuit in accordance with paragraph 4.07. Replace TONE AMP-1 or LV-1 circuit pack if defective and retest.
G. LV-2 LED and TRANSFER LED lights, minor office alarm is generated, and fuse alarm LED is on or off	Busy tone circuit is defective or requires adjustment on "0" (main) side	If a fuse has been replaced and blows, replace circuit pack fed by that fuse, then replace fuse (see FS3 in SD-82574-01). Test oscillator circuit in accordance with paragraph 4.04. Replace 480-Hz OSC-2 or 620-Hz, OSC-0 circuit pack if defective and retest. Test monitor and amplifier circuit in accordance with paragraph 4.08. Replace TONE AMP-2 or LV-2 circuit pack if defective and retest.
H. LV-3 LED lights, minor office alarm is generated, and fuse alarm LED is on or off	Busy tone circuit is defective or requires adjustment on "1" (reserve) side	If a fuse has been replaced and blows, replace circuit pack fed by that fuse, then replace fuse (see FS4 in SD-82574-01).

Note: Whenever a fuse alarm is provided, the blown fuse must be replaced before other remedies are tried.

TABLE D (Contd)

TROUBLE TABLE

TROUBLE CONDITION	PROBABLE CAUSE	REMEDY (SEE NOTE)
H. LV-3 LED lights, minor office alarm is generated, and fuse alarm LED is on or off (Contd)		Test oscillator circuit in accordance with paragraph 4.05. Replace 440-Hz OSC-3 or 620-Hz, OSC-1 circuit pack if defective and retest. Test monitor and amplifier circuit in accordance with paragraph 4.09. Replace TONE AMP-3 or LV-3 circuit pack if defective and retest.
I. Blown fuse F73 in +AC/DC circuit and fuse alarm LED is on.	Defective capacitor C7 (SD-82754-01)	Replace capacitor C7, then replace fuse F73.
J. Blown fuse F74 in +AC/DC circuit and fuse alarm LED is on	Defective capacitor C8 (SD-82754-01)	Replace capacitor C8, then replace fuse F74.
K. Lamp or ROH tone module lights or fuse alarm LED lights and fuse F75 blown	Defective ROH tone module	Checks the pulse generator, oscillator, and amplifier circuits in the generator in accordance with Section 201-576-501 and replace the defective circuit.

Note: Whenever a fuse alarm is provided, the blown fuse must be replaced before other remedies are tried.