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COMMON SYSTEMS
SIGNALING
TONE SUPPLY AND TRANSFER - FUSE AND ALARM -
POWER CONVERTER - CARRIER GROUP ALARM CIRCUIT
FOR USE WITH FU( ) & AUXILIARY
SIGNALING UNITS

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SECTION I - GENERAL DESCRIPTION

1. PURPOSE OF CIRCUIT

1.01 This circuit provides fusing, talk battery, ringing voltages, 2600-Hz tone, major and minor alarms, alarm cutoff, visual indicators of trouble, -48 volt to -24 volt power converter, carrier group alarm, and 500 ohm resistors in the SB lead.

2. GENERAL DESCRIPTION OF OPERATION

FULL BAY CIRCUIT

2.01 This circuit provides means for distributing and fusing -48 volt unfiltered battery power for the J87304A-type power converters and SD-1C284-01 FYH carrier group alarm control units. Distribution and fusing is also provided for filtered -48 volt talking battery for the 72 Type F auxiliary signaling units.

2.02 Distribution and fusing for the -24 volt output from the power converters is provided for the 72 FU( )/auxiliary signaling unit combinations and two SD-1C224-02 FYA, 2600-Hz tone supplies.

2.03 Distribution and fusing for 20-Hz ringing voltage is provided for the auxiliary signaling units.

2.04 Associated alarm circuits will detect a blown fuse or tone supply failure and will initiate either a major or minor office alarm indication, depending on the fuse that blows and/or the type of tone supply failure. A voltage detector circuit monitors the -24 volt output of each associated power converter and will initiate a major office alarm in the event that a power converter fails.

TONE SUPPLY AND TRANSFER CIRCUIT

2.05 The tone supply and transfer circuit, FYA, provides the 2600-Hz oscillator for use by the signaling circuits. The transfer portion of the circuit will switch the full load to either of two oscillators, normally provided, and actuate the office alarm if preset limits are exceeded or if one unit fails.

BAY CONTENTS

2.06 For detailed components and designations specified for each bay height (11, 10 1/2, 9, 7), see Table A on SD-7C011-01.

SECTION II - DETAILED DESCRIPTION

1. FS1 DUAL TONE SUPPLY AND TRANSFER CIRCUIT

1.01 FS1 shows the interconnection of two 2600-Hz tone supplies (odd and even) and their associated transfer circuits. Each oscillator has two outputs (odd and even circuits) and can provide sufficient 2600-Hz power for a full bay but normally supplies tone to only half a bay or less. If either supply should fail to meet its preset limits, the transfer circuit will function, releasing either the TRA or TRB relay (explained in 1.03) which switches all signaling units to the good oscillator and causes the office alarm to be actuated.

1.02 In the event of a tone supply failure, an alarm lamp will light on the failed oscillator. If the failure was caused by a momentary change of the preset limits, it may possibly restore itself to normal or it may be restored by pressing the RST button associated with the lamp. If the lamp remains on, the failed supply may be removed without interruption of service since it is a plug-in device. When the new supply is inserted, its lamp will light, and should extinguish automatically in a short interval or can be restored to normal by pressing the RST button.

1.03 In addition to the lighting of the alarm lamp on the failed oscillator, all signaling units are switched to the good supply and a minor alarm is activated. These latter functions occur when either of the normally operated TRA and TRB relays (FS1) release. The TRA or TRB relay will release if battery is removed from either the odd or even supply, respectively, or if the TR( ) relay in either supply operates removing battery. Release of either TRA or TRB will transfer the tone source and will connect battery to the MN relay in the fuse and alarm circuit (FS2), thus operating it. Operation of the MN relay closes contacts to the minor alarm. If, for any reason, both tone supplies fail, or if battery is lost to both supplies, the TRA and TRB relays will release, operating the MJ relay in the fuse and alarm circuit (FS2) which activates the major alarm. The MN relay would not be operated under this condition.

1.04 Contact protection networks TRA and TRB have been added to the windings of the transfer relays to reduce high voltage transients which occur if TRA or TRB relays release, even though these relays do not normally change state. If protection is not provided, the transients can falsely operate the high voltage sensor in the fuse and alarm circuit causing a major alarm, or can effect signaling circuits.

1.05 An alarm cutoff key (ACO) is provided on the front panel. When operated, it will silence the minor alarm and light the ACO lamp indicating a defective supply or that a supply is removed. A major alarm can be released only by replacing one of the defective supplies or by restoring battery to either or both supplies. A major alarm will be activated if only one supply is in place and it fails. When the defective supply is replaced with a good one and restored to normal (or the second defective supply is replaced as in the case of a major alarm), a minor alarm will sound once again if the ACO key is still operated. The alarm will be silenced and the ACO lamp extinguished when the key is returned to normal (see paragraph 7 ALARM ROUTINES).

2. FS2 BATTERY FUSE AND ALARM CIRCUIT

2.01 Indicator-type fuses P( ) are provided for the supply leads PC( ) to the -48 volt power converters.

2.02 An indicator-type fuse, CGA, is provided for the supply lead to the carrier group alarm control units (FS5).

2.03 An indicator-type fuse, ALM, is provided for the supply lead to the tone supply alarm circuit, the regulated converter alarm circuits (part of FS6), and the ringing supply alarm circuit (part of FS4).

2.04 The PC ALM lamp and the MJ relay provide an indication of operation of the tone supply alarm circuit in the event of a failure of both tone supply oscillators.

2.05 The combination of the L1 inductor and C1 capacitor will furnish sufficient attenuation to battery and induced lead noise to permit the use of signal battery supplies for talking battery.

2.06 Indicator-type fuses TB( ) are provided in the talking battery supply leads TB( ) to the associated type F auxiliary signaling units. Each talking battery supply lead may be loaded by up to six auxiliary signaling units.

2.07 The SB( ) lead provides battery through a 500 ohm resistor for the SB( ) lead when working with trunk circuits requiring Type II or Type III signaling leads.

2.08 The SIG ALM lamp and the MN relay provide an indication of operation of the tone supply alarm circuit in the event of a failure of one tone supply oscillator.

2.09 The PC ALM lamp and the MJ relay also provide an indication of operation of any of the P( ) fuses or release of any of the PF relays (FS3) when the associated PF

key is operated. Operation of the MJ relay provides two loop closures to the major office alarm system, and one loop closure to the MTCE System circuit.

2.10 The SIG ALM lamp and the MN relay provide an indication of operation of any of the CGA, ALM, TB( ), S( ), RS( ), TS( ), or PF3 fuses. Operation of the MN relay provides two loop closures to the minor office alarm system, and one loop closure to the MTCE System circuit.

2.11 A diode, CR4, blocks the CO -48V battery from the converter fuse and alarm circuit (FS3) when either a P( ) fuse blows or both tone supplies are bad.

3. FS3 CONVERTER FUSE AND ALARM CIRCUIT

3.01 Indicator-type fuses, S( ), are provided in the -24 volt supply leads to the associated type F signaling units. Each supply lead, S( ), may be loaded by up to six FU( ) and auxiliary signaling unit combinations.

3.02 Indicator-type fuses, TS-O and TS-E, are provided in the -24 volt supply leads to the FYA 2600-Hz tone supply and transfer circuits.

3.03 Indicator-type fuses TS-O, TS-E and PF3 are provided in the -24 volt supply lead to the converter high or low voltage detection circuit. Only TS-O and TS-E are used in the 7 ft. bays.

3.04 Potentiometer RB( ), resistors RC( ), RE( ) and RF( ), lamp PF( ), relay PF( ), key PF( ), capacitor CA( ), transistor Q( ), and diode CRA( ), and their associated circuitry, provide a voltage monitoring and alarm circuit for the -24 volt converter output. Alarm restoral control functions are provided by key PF( ).

3.05 Resistor RC( ) and potentiometer RB( ) series-limit the supply current to operate the PF( ) relay. The supply voltage must be more negative than -17.8 volts for the PF( ) relay to operate.

3.06 Provided the office -48 volt signal supply is present on the ALM fuse lead, the PF( ) lamp will be lit if the PF( ) relay releases or if the PF( ) key is released while the PF( ) relay is operated.

3.07 Operation of the PF( ) key with the PF( ) relay operated will extinguish the PF( ) lamp.

3.08 Release of the PF( ) relay when the PF( ) key is in the operated condition will cause the PF( ) lamp, the PC ALM lamp, and the MJ relay to operate.

3.09 A voltage divider across the -24 volt output of the power converter is formed by resistor RC( ), potentiometer RB( ), and the PF( ) relay coil. Transistor Q( ) is connected from the junction of resistor PC( ) and the PF( ) relay coil, terminal C, to ground when the PF( ) key is operated.

3.10 If the -24 volt supply voltage becomes more negative so as to exceed a preselected voltage of -27.5 volts (determined by the zener diode and the setting of potentiometer RB( )), the transistor Q( ) will conduct. This will effect an electrical ground across the PF( ) relay coil, and cause the PF( ) relay to release. Capacitor CA( ) will suppress any line transients that would otherwise inadvertently operate transistor Q( ).

3.11 Release of the PF( ) relay when the PF( ) key is in the operated condition completes two loop closures from the ALM fuse through the "a" break contact of the PF( ) relay to operate the PF( ) lamp; and through the "b" break contact of the PF( ) relay to operate the PC ALM lamp and the MJ relay. This is an office alarm condition.

3.12 Returning the PF( ) key to the non-operated condition will extinguish the PC ALM lamp and release the MJ relay. The PF( ) lamp will remain lit by virtue of a path from the ALM fuse through the "a" break contact of the PF( ) relay. This provides clearing of the office alarm while preserving the local alarm indication by keeping the PF( ) lamp lit.

3.13 The PF( ) key in the nonoperated condition will also open the path from ground to transistor Q( ) and allow the PF( ) relay to operate if the -24 volt supply voltage is more negative than -17.8 volts. The PF( ) lamp will then be operated by a path from the ALM fuse through a contact of the PF( ) key and the "a" make contact of the PF( ) relay.

3.14 Illumination of the PF( ) lamp indicates a trouble condition when the PF( ) key is operated.

3.15 With the PF( ) key operated, a trouble condition will cause the MJ relay to operate. Restoring the PF( ) key to the nonoperated condition will release the MJ relay.

3.16 Operation of any of the S( ), TS( ), or PF3 fuses will operate the SIG ALM lamp and the MN relay.

4. FS4 RINGING SUPPLY FUSE CIRCUIT

4.01 Indicator-type fuses RS( ) are provided in the ac ringing supply leads to the auxiliary signaling units. Each RS( ) fuse may be loaded by up to twelve auxiliary signaling units.

4.02 Resistance lamps RLA( ) and RLB( ) are provided in the ac ringing supply leads. Each RS( ) fuse supplies power to two resistance lamps and two associated ringing supply leads RS( ). Each supply lead may be

loaded by up to six auxiliary signaling units.

4.03 Operation of any RS( ) fuse will operate the RS relay, which will operate the SIG ALM lamp and relay MN. This is a MINOR ALM condition.

5. FS5 CARRIER GROUP ALARM CONTROL CIRCUIT

5.01 The carrier group alarm control unit (FYH) is a plug-in unit which may be provided to permit activation of the trunk (circuit) release and make-busy features of the various auxiliary units. It accepts a dc ground or a loop closure to ground as an indication of carrier terminal status from an associated carrier alarm and restoral circuit on a single lead per group of 12 circuits. It translates this into control information for up to 12 associated auxiliary units located on one dual shelf in the bay. The control unit provides all common functions necessary for proper trunk conditioning. This unit is intended for use initially with type N systems, but may be used with any future carrier system which provides the necessary status information output, i.e. A5/A6.

5.02 Included in the control unit is an alarm override key and lamp circuit which may be selected by auxiliary unit option control, to permit patching of equipment during an alarm condition. The lamp circuit provides an indication of key operation. A similar key providing the same function may be remotely located by connection to appropriate bay terminals.

5.03 The CGA provides a break contact for a carrier failure alarm indication for the ESS remote master scanner applique circuit.

6. FS6 REGULATED CONVERTER CIRCUIT

6.01 The -48 to -24 volt dc regulated converter provides controlled power for operating the signaling units and tone supplies. The converter reduces the effect of -48 volt battery office noise and limits the variations in voltage, thus providing more stable operation of the signal detector and speech amplifier. In addition, the voltage converter helps to isolate the 2600-Hz tone from the -48 volt supply.

6.02 The converter has the plus (+) input tied to the plus (+) output and both input and output tied to frame ground.

6.03 Each converter can provide for a maximum of 24 signaling units and one oscillator. There can be a maximum of three converters for the 11 ft., 10 1/2 ft. and 9 ft. bays. There can be two converters for the 7 ft. bay.

SECTION III - REFERENCE DATA

1. WORKING LIMITS

FULL BAY FUSE AND ALARM CIRCUIT

1.01 This circuit shall be used to feed the J87304A-type power converters and FU( ) and auxiliary signaling units. See Table A, SD-7C011-01 for requirements.

1.02 With the PF( ) key in the nonoperated condition, the PF( ) relay will operate when the -24 volt supply voltage is more negative than -17.8 volts.

1.03 With the PF( ) key in the operated condition, the PF( ) relay will release when the -24 volt supply voltage is more negative than -28.5 volts.

2. FUNCTIONAL DESIGNATIONS

2.01 Fuses

Designation	Meaning	Main Function
ALM	Alarm	Fuse in -48 volt lead to alarm circuit for tone supply, RS( ) fuses, and power failure circuit.
CGA	CGA Control Common	Fuse in -48 volt lead to carrier group alarm control unit, SD-1C284-01.
P	Power Converter	Fuse in -48 volt supply lead to each -48 volt power converter.
RS	Ringing Supply	Fuse in the ac ringing supply lead to 12 or less auxiliary signaling units.
S	Signaling Units	Fuse in -24 volt supply lead to six or less FU( ) plus AUX single frequency signaling circuits.
TB	Talking Battery	Fuse in filtered -48 volt talking battery lead to six or less auxiliary signaling units and to 12 SB lead limiting resistors.

TS-O TS-E	Tone Supply and Power Failure	Fuse in the -24 volt supply lead to the FYA 2600-Hz tone supply and transfer circuits (SD-1C224-02) and to the converter voltage level detection circuit.
PF3	Power Failure	Fuse in the -24 volt supply lead to the converter voltage level detection circuit No. 3 in 11 1/2 ft., 10 1/2 ft. and 9 ft. bays.

2.02 Key

Designation	Meaning	Main Function
PF( )	Power Failure	Provide alarm restoral control functions.
ACO	Alarm Cut Off	Silence the minor alarm indication and light the ACO lamp to indicate a tone supply failure.

2.03 Lamps

Designation	Meaning	Main Function
PF( )	Power Failure	Lamp lit with PF( ) key operated indicates an alarm condition. Lamp lit with PF( ) key not operated indicates presence of -48 volts at power converter and presence of -24 volts at alarm circuit.
PC ALM	Power Converter Alarm	Major alarm indication caused by the operation of any of the P( ) fuses or the power converter alarm circuit.
SIG ALM	Signal Alarm	Minor alarm indication caused by the operation of any of the S( ), TS( ), TB( ), PF3, RS( ), CGA, or ALM fuses.
ACO	Alarm Cutoff	Indication of trouble in one or more of the tone supplies.

2.04 Relays

Designation	Meaning	Main Function
MJ	Major Alarm	Major alarm indication caused by the operation of the regulated converter alarm circuit, the tone oscillator alarm circuit (for a double unit failure condition), or any of the P( ) fuses.
MN	Minor Alarm	Minor alarm indication caused by the operation of the tone oscillator alarm circuit (for a single unit failure condition), or any of or S( ), TS( ), TB( ), PF3, RS( ), CGA, or ALM fuses.
RS( )	Ringing Supply	Alarm condition indication when any of the RS( ) fuses blows.
PF( )	Power Failure	Major alarm indicated when not operated, which occurs when the voltage from a power converter is either off, too low, or too high.
TRA	Tone Supply (ODD)	Minor alarm when odd tone supply is out of limits or Major alarm when odd and even supplies are both out of limits.
TRB	Tone Supply (Even)	Minor alarm when even tone supply is out of limits or Major alarm when even and odd supplies are both out of limits.

2.05 Circuit Breaker

Designation	Meaning	Main Function
MCB1	Master Circuit Breaker	Main power control.

3. FUNCTIONS

3.01 Provides fuse protection of -48 volt supply leads to -48 volt power converters.

3.02 Provides fuse protection of -48 volt supply leads to SB lead limiting resistors.

3.03 Provides fuse protection of -48 volt supply leads to carrier group alarm common control unit.

3.04 Provides fuse protection of -48 volt supply leads to tone supply alarm circuit, RS( ) fuse alarm circuit, and the power failure circuit.

3.05 Provides fuse protection of filtered -48 volt talking battery supply leads to the auxiliary signaling units.

3.06 Provides fuse protection of -24 volt supply leads to the FU( ) and auxiliary signaling unit combinations.

3.07 Provides fuse protection of -24 volt supply leads to the tone supply and level detection circuits.

3.08 Provides alarm indication for operation of any fuse.

3.09 Provides circuitry to monitor output voltage of each -48 volt power converter.

3.10 Provides visual indication of operation of alarm circuits.

3.11 Provides loop closures to office alarm and MTCE system circuits in the event of an alarm condition.

3.12 Provides -24 volt dc for signaling units.

3.13 Provides limiting resistors for SB leads.

3.14 Provides 2600 Hz tone and transfer circuit.

3.15 Provides for MN alarm for one tone supply failure and MJ alarm for a dual tone supply failure.

4. CONNECTING CIRCUITS

4.01 Connecting information may be found on application schematic SD-7C012-01.

5. MANUFACTURING TESTING REQUIREMENTS

FULL BAY FUSE AND ALARM CIRCUIT

5.01 Set potentiometers RB1, RB2, and RB3 to maximum clockwise position.

5.02 Verify continuity of all circuitry and install all TS-O, TS-E, and PF3 fuses. (Note: PF3 fuse is not used in 7 ft. bays.)

5.03 Connect a dc power supply (0-30 volts) negative terminal to -24 volt supply lead B1. Connect the positive terminal to ground. Operate the PF1 key.

5.04 Set dc power supply output to -20 ± 1 volts. The PF1 relay shall operate.

5.05 Set dc power supply output to -27.5 ± 1 volts. Slowly adjust potentiometer RB1 counterclockwise until relay PF1 releases.

5.06 Set PF1 key to nonoperated condition, PF1 relay shall operate.

5.07 Set dc power supply output to -24 volts. Operate the PF1 key; relay PF1 will remain operated.

5.08 Slowly increase dc power supply output until relay PF1 releases. Supply voltage shall be -27.5 ±0.5 volts. If overvoltage alarm point is not within specified limits, repeat 5.04 through 5.07 until potentiometer RB1 is properly adjusted.

5.09 Repeat 5.02 through 5.08 for each alarm circuit substituting:

Supply Lead	Key	Lamp	Relay	Pot
B1	PF1	PF1	PF1	RB1
B2	PF2	PF2	PF2	RB2
B3	PF3	PF3	PF3	RB3

ALARM CIRCUIT

5.10 Verify that alarm circuit has no unwanted grounds.

TONE SUPPLY ALARM CIRCUIT

5.11 Apply -48 volt to the ALM fuse and remove odd tone supply (TS); relay TRA should release and MN alarm should operate.

5.12 Operate ACO key; MN relay should release.

5.13 Remove even TS and return ACO key to normal.

5.14 The MJ alarm should be operated and the TRA and TRB relays should be released.

5.15 Return odd and even TS; MJ alarm relay should release, TRA and TRB relays should operate.

6. INITIAL CONVERTER INSTALLATION PROCEDURE

FULL BAY FUSE AND ALARM CIRCUIT

6.01 Bay circuit breaker MCB1 should be off.

6.02 Install ALM fuse.

6.03 Set PF( ) keys to nonoperated condition. All PF( ) lamps shall be extinguished.

6.04 Install the regulated converters, FYA 2600-Hz tone oscillators, FYG carrier group alarm common control units, and FU( )

universal converters with associated auxiliary signaling units per Table A of SD-7C011-01, sheet B3.

6.05 Install the CGA and associated P( ) fuses.

6.06 Install the TB( ) and S( ) fuses per table A of SD-7C011-01, sheet B3.

6.07 Turn on power by operating bay circuit breaker MCB1; the PF( ) lamp will light.

6.08 Install fuses TS-O, TS-E and PF3. PF( ) relays shall operate. (Note: PF3 fuse is not used in 7 ft. bays.)

6.09 Operate the PF( ) key; the associated PF( ) lamp will go out.

6.10 Install the RS( ) fuses as required.

6.11 Operate (MCB1) and all power should be removed from bay and continuity should be observed between MJMCR AND MJMC leads.

7. ALARM ROUTINES

TONE SUPPLIES

7.01 The following procedures are to be used when an alarm is activated by failure of the tone supply and transfer circuit. Refer to alarm restore procedures as covered in CD-1C224-02.

7.02 Minor Alarm: When a minor alarm sounds and the source of trouble is a defective tone supply as indicated by a lighted ALM lamp on the Tone Supply which cannot be extinguished when the RST button on the supply is depressed:

(a) Operate ACO key. ACO lamp lights and minor alarm is silenced.

(b) Remove defective supply.

(c) Insert good supply. ALM lamp lights and may restore itself. Minor alarm may sound if ALM lamp goes out.

(d) If ALM lamp remains lighted, press RST button. ALM lamp is extinguished and minor alarm sounds.

(e) Release ACO key. ACO lamp is extinguished and minor alarm is silenced.

7.03 Major Alarm: When a major alarm sounds and the source of trouble is a pair of defective tone supplies in one bay:

(a) Remove at least one defective supply.

(b) Insert good supply. ALM lamp lights and may restore itself. Major alarm may be silenced, causing minor alarm to sound.

(c) If ALM lamp remains lighted, press RST button. ALM lamp is extinguished, the major alarm silenced, and the minor alarm sounds.

(d) Operate ACO key. ACO lamp lights and the minor alarm is silenced.

(e) If only one spare supply is available, the second defective supply may be left in place until it can be replaced.

(f) When the second good supply is available, follow the procedures of 7.02, beginning with (b).

8. BAY OFFICE ALARM

MINOR ALARM

8.01 A minor office alarm is caused by operation of any of the CGA, ALM, TB( ), S( ), TS( ), PF3, or RS( ) fuses. The SIG ALM lamp will be lit.

8.02 Removal of the blown fuse will cancel the alarm condition and turn off the SIG ALM lamp. Replacement of the blown fuse should restore normal operation of the system.

MAJOR ALARM

8.03 Set any illuminated PF keys to the nonoperated condition. The office alarm condition will be canceled and PC ALM lamp will go out if no fuses are blown. The local alarm indicator (PF( ) lamp) will remain lighted.

8.04 Check P( ) fuses. If blown, removal will cancel the alarm condition. Replacement of the blown fuse should restore normal operation of the system.

8.05 A major office alarm condition without a blown fuse indicates a failed power converter, i.e., no voltage or a voltage too low or too high as discussed in Section II, or a double unit failure indication from the tone oscillator alarm circuit. Replace the associated power converter or tone oscillators.

8.06 Set the illuminated PF( ) key to the operated condition. The PF( ) lamp will go out.

SECTION IV - REASONS FOR REISSUE

D. Description of Changes

D.1 In FS3 and FS4, changed Table A to detail information for 7 ft., 9 ft. and 12 1/2 ft. bays.

D.2 In App Fig. 1, 2, 4 and 5 added "max" quantity for components and reference to Table A.

D.3 In FS2 and App Fig. 2, changed designation of 500 ohm, 19DY, resistors from "R( )" to "SB( )" and from "R1-72" to "SB1-72", respectively.

D.4 In FS2, deleted sheet notation for Table A and deleted Note 1 and reference to it.

D.5 In Supporting Information Table, added equipment reference.

D.6 In FS2, added reference to Note 1C4 at frame ground symbol.

D.7 In CAD9 and CAD10, resistor designations changed from "R" to "SB".

D.8 In FS3 and FS4, added odd, even tone supply assignments to Table A.

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