DCO® SWITCHING SYSTEMS

ALARMS
OPERATING PROCEDURES

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1. INTRODUCTION

1.01 This section describes the alarm indicators provided in a SYSTEM CENTURY® Digital Central Office equipped with a local line switch (LLS) and a power, ringing, and test access selector (PRT) frame. Also included are an explanation of the probable causes of each alarm and general procedures to follow to locate the cause and correct the fault.

2. RELATED INFORMATION

2.01 General.

A Sales and Instructional Literature Index of latest available publications can be obtained from your Stromberg-Carlson sales representative or from Publications Services, Stromberg-Carlson Corporation, 400 Rinehart Road, Lake Mary, Florida 32746.

2.02 Related Section.

The following section is recommended for use with this document:

23-200-31	Basic Maintenance Panel, Operating Instructions

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3. GENERAL

3.01 In this publication, alarms are defined as visual [lamps and light-emitting diodes (LEDs)] and audible indications of system faults. Maintenance personnel must be completely familiar with the operation of the basic maintenance panel as described in the section titled *Basic Maintenance Panel, Operating Instructions*, referenced in paragraph 2.02.

3.02 Each frame, cell, or circuit alarm is accompanied by an audible alarm and one or more visual alarms on the basic maintenance panel. Four priorities of alarms are normally provided. If Rural Electrification Administration (REA) alarm classification is required, three priorities are used.

3.03 The Stromberg-Carlson alarm priorities are:

a. Office Emergency.
Indicates loss of service to 240 or more ports, or loss of service to police, fire department, etc.

b. Group Emergency.
Indicates loss of service to 30 or more ports.

c. Alert.
Indicates a condition that requires attention, but does not immediately affect service; for example, loss of redundancy, environmental sensors, etc.

d. Nonemergency.
Indicates degradation in service such as reduced traffic, inadequate equipment performance, etc.

3.04 The REA alarm priorities are:

a. Catastrophic.
Indicates system faults requiring immediate action such as: system inoperative, administration and diagnostics inoperative, calls blocked system wide, loss of service at one or more remote satellites, etc.

b. Major.
Indicates degraded service or loss of redundancy in addition to carrier failure, charger failure, ac failure, etc.

c. Minor.
Indicates individual port faults, cumulative line or trunk permanent faults, and optionally, sensor reported faults such as cable pressure, environmental controls, etc.

4. MAIN DISCHARGE CONTROL FRAME

4.01 One main discharge control panel is required for each group of 1920 ports. Two panels can be mounted on each main discharge control frame (MDCF). The alarm indicators on the MDCF are shown in figure 1 and described in table 1.

5. POWER, RINGING, AND TEST ACCESS SELECTOR FRAME

5.01 The PRT frame typically contains two power distribution panels, programable ringing generators, a ringing multiplexer and maintenance cell, a supervisory panel, the test access selector circuitry, and optional paystation power supplies, volunteer fire alarm system, and drum announcer. The alarm indicators are shown in figure 2 and described in table 2.

6. MAINTENANCE AND ADMINISTRATION FRAME

6.01 The maintenance and administration frame (MAF) contains the maintenance and administration (M&A) cell, basic maintenance panel, and two CPU tone and pulse cells. The alarm indicators on the basic maintenance panel are not described in this section since they are described in the section titled *Basic Maintenance Panel, Operating Instructions*, referenced in paragraph 2.02. Other alarm indicators in the M&A frame are shown in figure 3 and described in table 3.

7. LOCAL LINE SWITCH FRAMES

7.01 Each local line switch frame contains up to 12 line group cells and 2 redundant line switch controller cells. Each line group cell contains up to 90 line circuits and associated equipment. The alarm indicators for the frame are shown in figure 4 and described in table 4.

8. LINE/TRUNK FRAMES

8.01 Each line/trunk frame contains up to eight cells that house trunk circuits and associated equipment. The alarm indicators for the various types of circuits in the frame are shown in figure 5 and described in table 5.

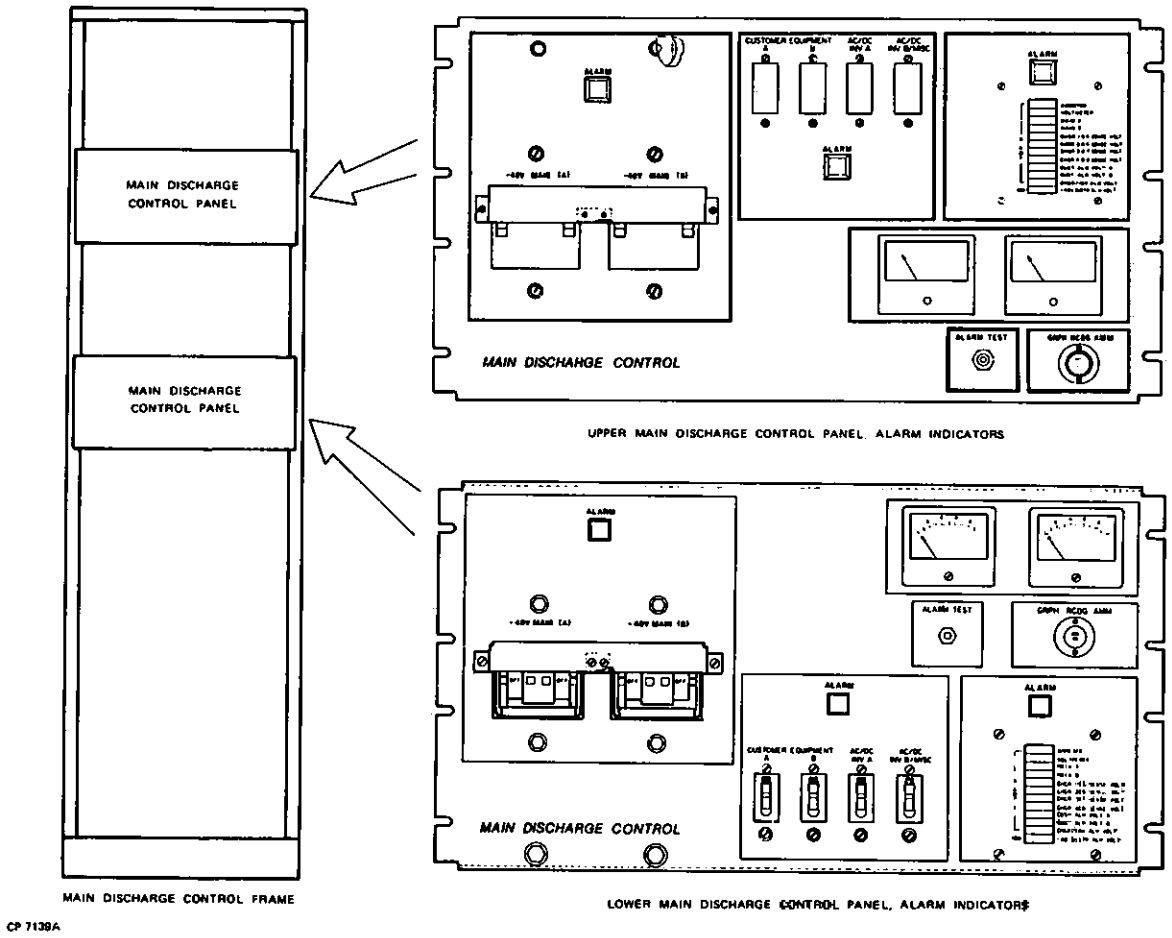
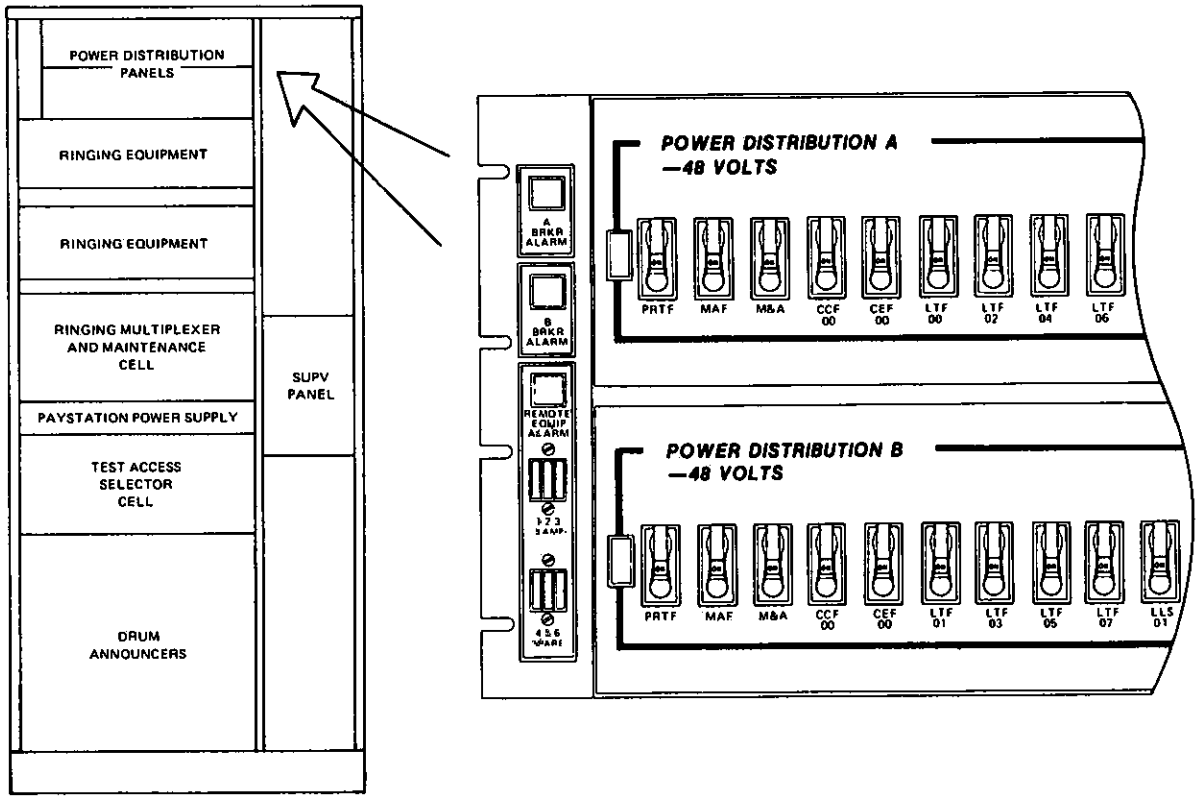


Figure 1. Main Discharge Control Frame, Alarm Indicators

Table 1. Main Discharge Control Frame, Alarm Indications (Fig. 1)

ALARM DESIGNATION	*ALARM INDICATOR*	*DESCRIPTION*	*CORRECTIVE ACTION*
–48 MAIN ALARM	Red lamp, incandescent	Lights when excessive current causes –48V MAIN (A) or –48V MAIN (B) circuit breaker to open.	Trace cause of excessive current. At least one circuit breaker on power distribution panel will also be open, indicating frame where excessive current was drawn. Check alarms on that frame to locate faulty circuit.
CUSTOMER EQUIPMENT, AC/DC INVA, or AC/DC INVB/MISC ALARM	Red lamp, incandescent	Lights when excessive current causes CUSTOMER EQUIPMENT, AC/DC INVA, or AC/DC INVB/MISC circuit breaker to open.	Check alarm indications on customer-supplied equipment, ac/dc inverters, or miscellaneous equipment to locate fault.
ALARM	Red lamp, incandescent	Lights when GMT fuse below ALARM lamp blows.	Trace cause of fuse blowing according to fuse designation.



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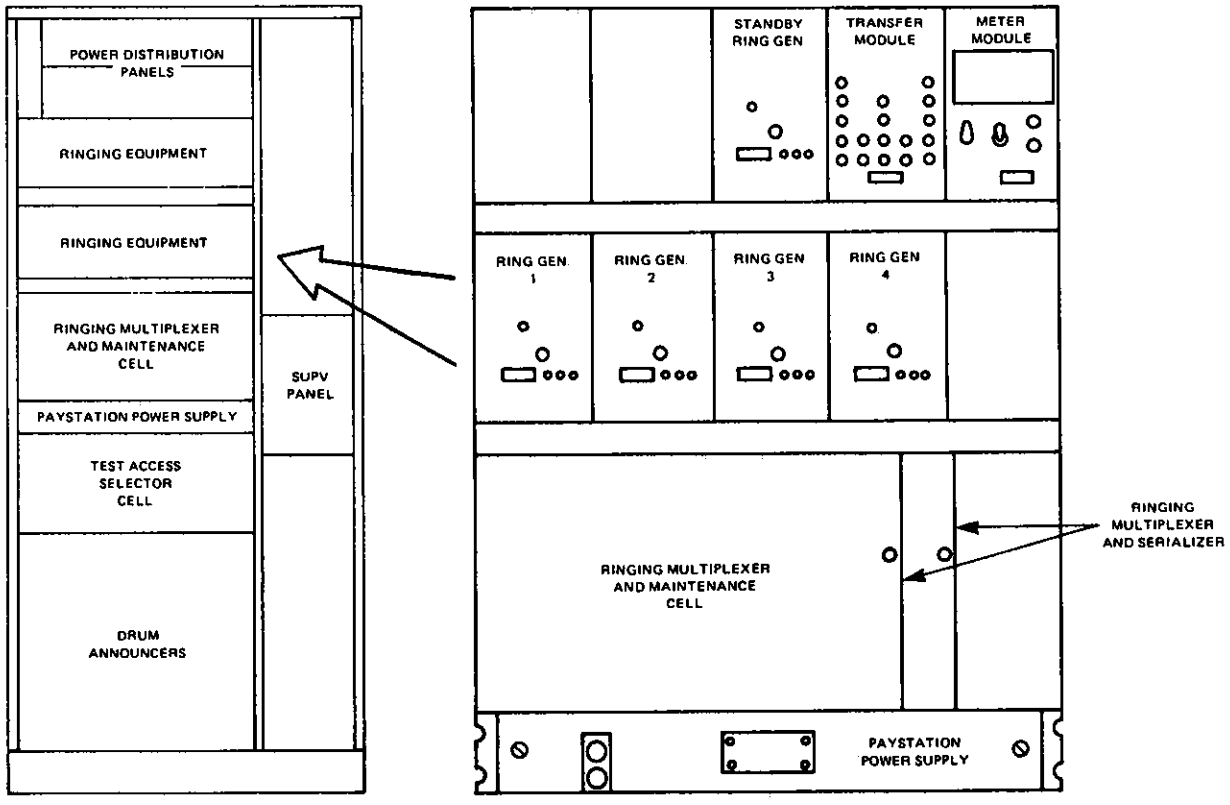

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Figure 2. Power, Ringing, and Test Access Selector Frame, Alarm Indicators

Table 2. Power, Ringing, and Test Access Selector Frame Alarm Indications (Fig. 2)

ALARM DESIGNATION	*ALARM INDICATOR*	*DESCRIPTION*	*CORRECTIVE ACTION*
A BRKR ALARM	Red lamp, incandescent	Lights when any breaker on POWER DISTRIBUTION A panel opens due to excessive current.	Check alarms on frame indicated by open circuit breaker to locate faulty circuit.
B BRKR ALARM	Red lamp, incandescent	Lights when any breaker on POWER DISTRIBUTION B panel opens due to excessive current.	Same as A BRKR ALARM.
REMOTE EQUIP ALARM	Red lamp, incandescent	Lights when one of GMT fuses below lamp blows due to excessive current in remote alarm circuit.	Check remote alarm circuit for short.
NOTE. The following five indicators are on programable transfer module.			
FA	Red LED	Lights when fuse blows in any module of the ringing system.	Replace blown fuse. Momentarily press RESET button; all alarm indicators go dark. If fuse blows again, replace associated module and press RESET button; all alarm indicators go dark.
TRANSFERRED	Yellow LED	Lights when fault in any main ringing generator causes transfer of load to standby generator.	If FA indicator is lighted, do procedure for FA. If FA indicator is not lighted, replace faulty generators and momentarily press RESET button; all alarm indicators go dark.
MJ	Red LED	Lights when any two ringing generators fail.	If FA indicator is lighted, do procedure for FA. If FA indicator is not lighted, replace faulty generators and momentarily press RESET button; all alarm indicators go dark.

Table 2. Power, Ringing, and Test Access Selector Frame Alarm Indications (Fig. 2) (Cont)

ALARM DESIGNATION	*ALARM INDICATOR*	*DESCRIPTION*	*CORRECTIVE ACTION*
MN	Yellow LED	Lights when one ringing generator fails.	If FA indicator is lighted, do procedure for FA. If FA indicator is not lighted, replace faulty generator and momentarily press RESET button; all alarm indicators go dark.
FAIL	Red LEDs	Lights to indicate which ringing generator(s) failed.	Same as MJ.
OUTPUT OVERLOAD (ringing generator)	Red LED	Lights when generator goes into current-limiting mode or turns off due to overload.	Determine cause of overload and correct it. Momentarily press RESET button on programable transfer module; all alarm indicators go dark.
No designation (ringing multiplexer and serializer)	Green LED	Flashes at 1.2 PPS rate to indicate correct operation of clock.	If indicator is steady on or off, replace ringing multiplexer and serializer PWBA.

9. AUTOMATIC MESSAGE ACCOUNTING FRAME

9.01 The automatic message accounting frame contains a tape control cell and two tape drive units. The alarm indicators are contained on the status control panel, as shown in figure 6 and described in table 6.

10. ALARM SENDING AND CHECKING

10.01 General.

Alarm indications are sent to an operators position, a managers alarm box, or a 7- or 10-digit number. On receipt of the alarm indication, an alarm checking number must be dialed to obtain specific information on the alarm.

10.02 Alarm Sending.

The following options are available:

a. Alarm Sending via Operator Trunk.

Fault indications are forwarded via the regular operator trunk group. When a fault occurs, an operator trunk is seized and a request for service generated. On answer, the operator receives a distinctive tone indicating that the alarm checking number should be dialed.

b. Alarm Sending via Dedicated Trunk.

Similar to alarm sending via operator trunk except that a trunk is dedicated to alarm sending. This trunk may be one-way outgoing only or two-way with the incoming route being used for busy verification.

c. Alarm Sending to Managers Alarm Box.

A spare dial leg(s) is used to send battery or ground to a managers alarm box to operate a relay, light a lamp, or do some similar function.

d. Alarm Sending to 7- or 10-Digit Number.

1. The DCO switching system is programed to send a recorded announcement to a 7- or 10-digit number when an alarm

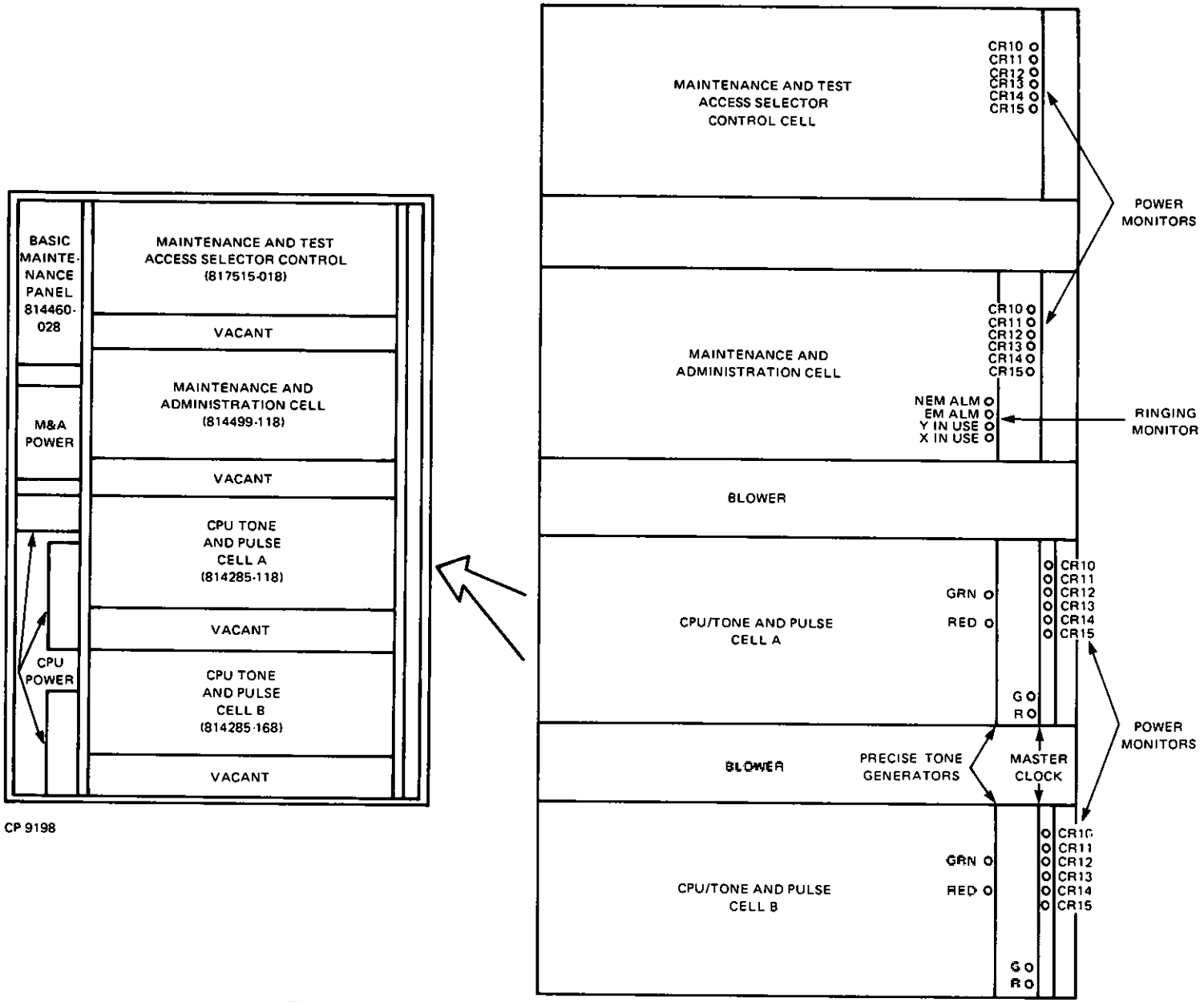

Figure 3. Maintenance and Administration Frame, Alarm Indicators

Table 3. Maintenance and Administration Frame, Alarm Indications (Fig. 3)

ALARM DESIGNATION	*ALARM INDICATOR*	*DESCRIPTION*	*CORRECTIVE ACTION*
CR10, CR11, CR12, CR13, CR14, CR15 (814202-026 PWBAs)	Red LEDs	Each power monitor (one in each cell) contains six LEDs, which monitor six separate voltages in cell. Lighted LED indicates voltage is within tolerance. Voltages monitored (from top to bottom of PWBA) are: +15V −15V −12V − 5V +12V + 5V	If indicator goes dark, check power supply serving cell to determine cause of out-of-tolerance voltage level.
CR1, CR2 (814033-526)	CR1: red LED CR2: green LED	Each master clock PWBA (X and Y) contains one red and one green LED. Lighted green LED indicates on-line circuit; lighted red LED indicates faulty circuit.	Replace PWBA containing lighted red indicator.
NOTE. The following four LEDs are on 814057-086 PWBA.			
CR5	Red LED	Lights when ringing interrupter X is on-line.	
CR6	Red LED	Lights when ringing interrupter Y is on-line.	
CR7	Red LED	Lights when on-line ringing interrupter or ringing generator fails and transfer to faulty redundant equipment occurs.	Replace interrupter PWBAs. If alarm continues, check ringing generator according to manufacturer's instructions.
CR8	Red LED	Lights when on-line ringing interrupter or ringing generator fails and transfer to good redundant equipment occurs.	Replace faulty interrupter PWBA. If alarm continues, check ringing generator according to manufacturer's instructions.

Table 3. Maintenance and Administration Frame, Alarm Indications (Fig. 3) (Cont)

ALARM DESIGNATION	*ALARM INDICATOR*	*DESCRIPTION*	*CORRECTIVE ACTION*
CR1, CR2 (814009-026 PWBA)	CR1: red LED CR2: green LED	Each precise tone generator PWBA (X and Y) contains one red and one green LED. Lighted green LED indicates on-line circuit; lighted red LED indicates faulty circuit.	Replace PWBA containing lighted red indicator.

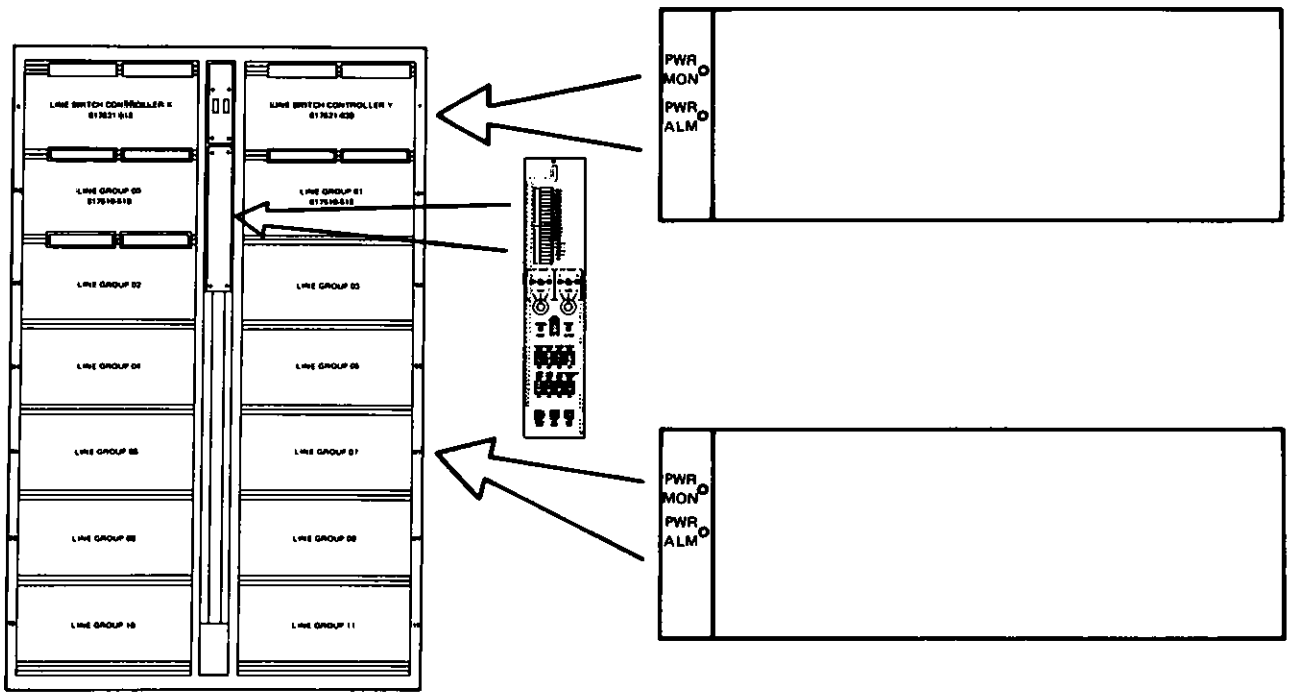

Figure 4. Local Line Switch Frame, Alarm Indicators

Table 4. Local Line Switch, Alarm Indications (Fig. 4)

ALARM DESIGNATION	*ALARM INDICATOR*	*DESCRIPTION*	*CORRECTIVE ACTION*
PWR MON	Green LED	LED monitors cell power supply outputs. Lighted LED indicates voltage is within tolerance.	Check power supply fuses. If none have blown, replace power supply.
PWR ALM	Red LED	Lights when power supply fails.	Check power supply fuses. If none have blown, replace power supply.
FRAME ALARM	Red LED	Lights when supervisory panel fuse blows or any switch on panel is turned off. Also lights if cell power supply fuse blows.	Check fuses and switches. If all OK, replace power supply. Operate FUSE ALM RST switch.

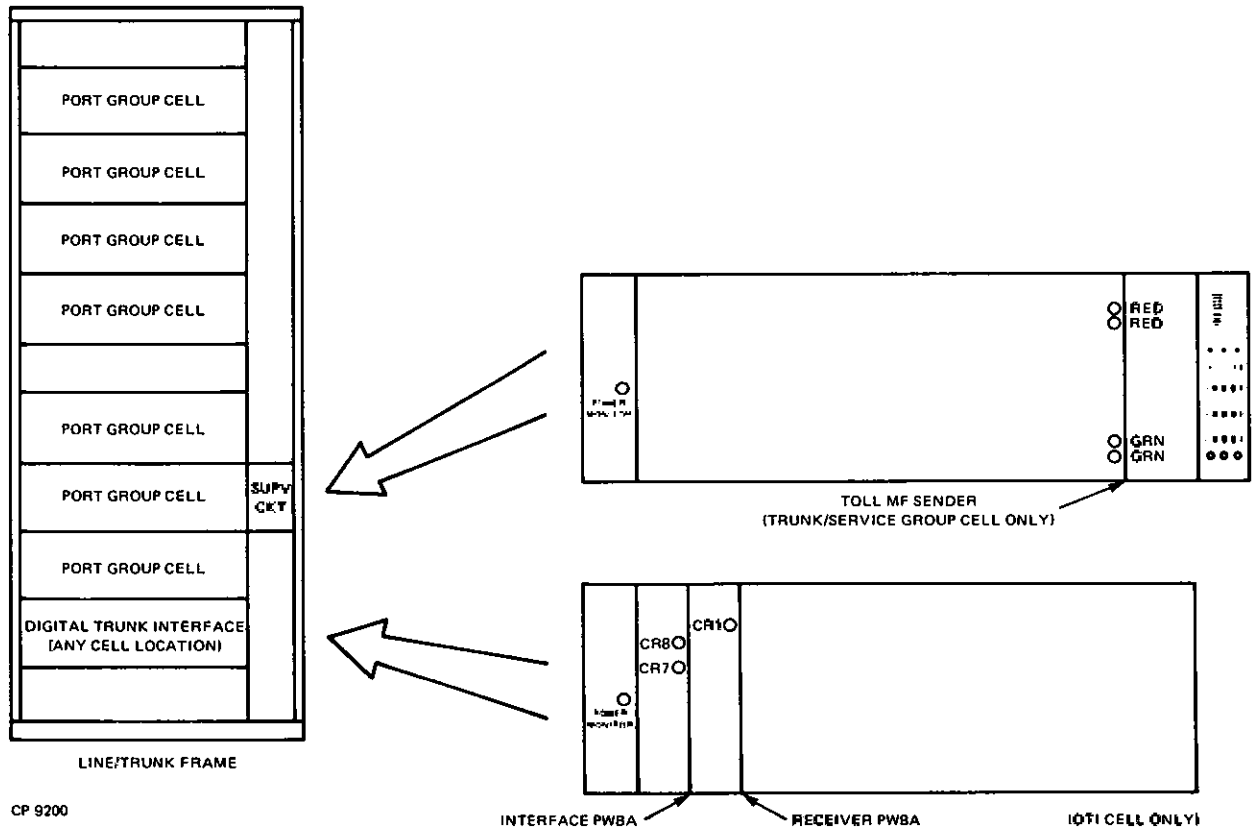

Figure 5. Line/Trunk Frame, Alarm Indicators

Table 5. Line/Trunk Frames, Alarm Indications (Fig. 5)

ALARM DESIGNATION	*ALARM INDICATOR*	*DESCRIPTION*	*CORRECTIVE ACTION*
CR2, CR3, CR102, CR103, (814077-026 or 814555-026 PWBA)	CR2, CR102; red LEDs CR3, CR103; green LEDs	Each toll multifrequency sender PWBA contains two identical circuits. Each circuit has green in-use LED and red fault LED.	Replace PWBA if either red indicator lights.
POWER MONITOR	Green LED	LED monitors cell power supply outputs. Lighted LED indicates voltage is within tolerance.	Check fuses on front of power supply. If none have blown, replace power supply.
NOTE. The following three LEDs are on supervisory panel on right side of frame.			
FUSE ALM	Red LED	Lights when any GMT fuse on front of supervisory circuit blows.	Determine cause of fuse blowing (short-circuit on PWBA in line/trunk frame or on ringing monitor and serializer PWBA in PRT frame). Replace fuse and operate FUSE ALM RESET switch on supervisory circuit.
THERMAL ALM	Red LED	Lights when ambient temperature rises above predetermined limit.	Check air-conditioning equipment.
PWR SUP ALM	Red LED	Lights when power supply fails in line/trunk frame.	Check power supply fuses. If none have blown, replace power supply.
NOTE. The following three LEDs are in DTI cell only.			
CR8 OUT OF SYNC	Red LED	Lights when outgoing clock is not synchronous with DCO clock.	Replace interface PWBA.
CR7 LOOP-BACK	Red LED	Lights when DTI is in loop-back mode.	Replace interface PWBA or diagnostics PWBA.
CR1 SEARCH	Red LED	Lights when frame synchronizer is in search mode.	Run loop-back test to determine if fault is in DTI or span.

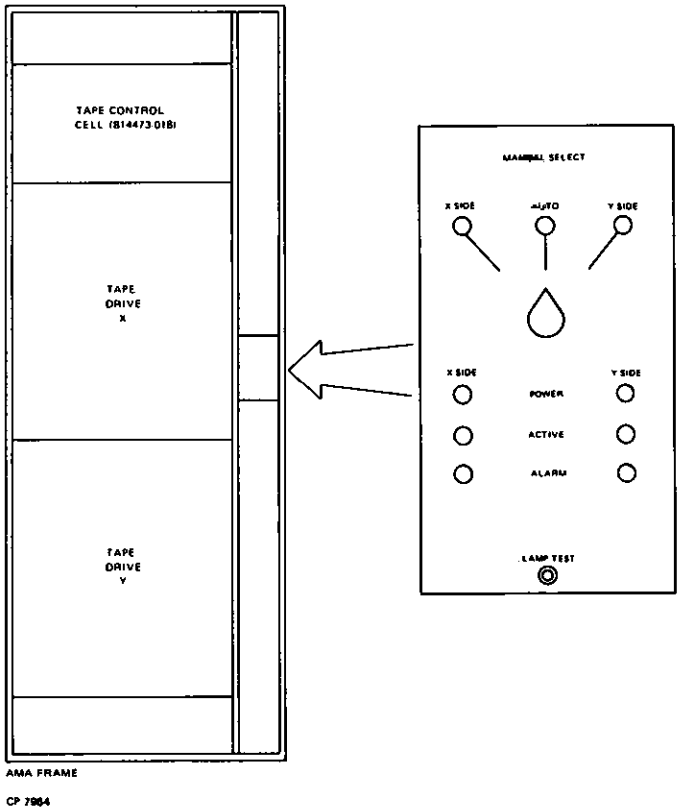

Figure 6. Automatic Message Accounting Frame, Alarm Indicators

Table 6. Automatic Message Accounting Frame, Alarm Indications (Fig. 6)

ALARM DESIGNATION	*ALARM INDICATOR*	*DESCRIPTION*	*CORRECTIVE ACTION*
ALARM, X SIDE or Y SIDE	Red LEDs	Lighted LED indicates faulty record side if any of the following occur:	
		1. Error in one side causes switchover to other side.	Check fault printout to determine cause of error.
		2. Tape interface buffer PWBA is removed.	Insert PWBA.
		3. Tape motion control PWBA is removed.	Insert PWBA.
POWER, X SIDE or Y SIDE	Red LEDs	Lighted LED(s) indicate(s) power is being applied to X and/or Y side.	None required.
ACTIVE, X SIDE or Y SIDE	Red LEDs	Lighted LED indicates on-line side.	None required.

occurs. A list of up to 10 alarm reporting numbers can be programed.

2. When an alarm occurs, the first alarm reporting number is automatically dialed and a recorded announcement is sent to the line. A timer is started and, if the alarm checking number is not dialed within a predetermined programable interval, the next number on the list is dialed. The system continues through the list (recycling if necessary) until the alarm checking number is dialed. (If one of the numbers programed is the operator, cycling stops and the operator is called repeatedly until the alarm checking number is dialed.)

3. The recorded announcement is normally made by the telephone company and tells the called party the name of the office, advises that an alarm condition exists, and gives the alarm checking number to be dialed for further information.

10.03 Alarm Checking.

When the alarm checking number is dialed, the caller hears an audible signal indicating the actual alarm classification. Tables 7 and 8 describe the various faults that cause an alarm to be sent for REA and Stromberg-Carlson alarm classifications, respectively.

Table 7. REA Alarm-Checking Fault Classification

ALARM CODE	*POSSIBLE FAULT*	*PRIORITY*
No tone	System inoperative.	Catastrophic
	All calls blocked.	Catastrophic
	Calls blocked in one common control sector.	Catastrophic
	Administrative and diagnostic functions inoperative.	Catastrophic
	DSU: remote unit inoperative, total span outage, or inability to interpret message.	Catastrophic
60-ipm busy tone	Calls blocked in one port group.	Major
	Degraded service throughout system.	Major
	Redundancy lost; degraded service on active side.	Major
	Redundancy lost; active side functioning properly.	Major
	Charger failure.	Major
	DSU: span outage (degraded service), span transfer failure, charger failure, or commercial ac power failure and inoperative standby ac source.	Major
	DTI: thresholds exceeded (frame loss, slips, bipolar violations), DTI cell out of service, or span failure.	Major
1-ring code (ringback tone)	Non service-affecting fault (ringing generator, interrupter, test call generator, etc.).	Minor
	Environment outside normal limits; system operational.	Minor
	DSU: ringing generator failure, loss of frame sync, cumulative permanent alarm, party detect failure, paystation power supply failure, illegal entry of remote facility, environment of remote facility outside normal limits, loss of cable pressure.	Minor
2-ring code (ringback tone)	No faults.	

Table 8. Stromberg-Carlson Alarm-Checking Fault Classification

ALARM CODE	*POSSIBLE FAULT*	*PRIORITY*
No tone	System inoperative.	Emergency
	All calls blocked.	Emergency
	Calls blocked in one common control sector.	Emergency
	DSU: remote unit inoperative, total span outage, or inability to interpret message.	Emergency
Steady high tone	Calls blocked in one port group.	Group emergency
	Degraded service throughout system.	Group emergency
	DSU: span outage (degraded service), span transfer failure, charger failure and inoperative standby ac source.	Group emergency
	DTI: thresholds exceeded (frame loss, slips, bipolar violations), DTI cell out of service, or span failure.	Group emergency
Steady low tone	Administrative and diagnostic functions operative but degraded.	Nonemergency
	Redundancy lost; degraded service on active side.	Nonemergency
	Degraded service in one common control sector.	Nonemergency
	Port fault detected by test call generator.	Nonemergency
	Cumulative line/trunk permanent.	Nonemergency
	High or low battery voltage.	Nonemergency
	DSU: ringing generator failure, loss of frame sync, cumulative permanent alarm, party detect failure, pay-station power supply failure, illegal entry of remote facility, environment of remote facility outside normal limits, loss of cable pressure.	Nonemergency
120-ipm busy tone	Carrier or radio failure.	Nonemergency
Ringback tone	Redundancy lost; on-line side functioning.	Alert
	Environment outside normal limits; system operational.	Alert
	Battery charger failure.	Alert
100-Hz tone	Commercial ac power failure; standby ac generator inoperative.	Alert
Tick tone	Non service-affecting fault (ringing generator, interrupter, test call generator, etc.).	Alert
	Sensor-reported fault (cable pressure, forced entry into building, etc.).	Alert
2-ring code (ringback tone)	No faults.	

11. LAST RESORT ALARM

11.01 A last-resort alarm is indicated by lighting a large lamp external to the system. This alarm is initiated when condition a or b occurs while the panel is in the remote mode:

a. The maintenance processor does not provide a class of alarm within 1 second of the detection of a hardware fault.

b. The maintenance processor times out and one of the following also occurs:

1. Call processor sanity error, parity error, or watchdog timeout.
2. Maintenance processor, sanity error, or parity error.
3. Port control store parity error.
4. Call processor bus mismatch.
5. Nonsynchronous operation.
6. Clock fault.
7. Ringing fault.
8. Combined power fault.
9. Tone fault.

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