COMMON CHANNEL INTEROFFICE SIGNALING
CONTINUITY CHECK TRANSCEIVER UNIT
J4A010AC-1
DESCRIPTION AND THEORY
NO. 4 ELECTRONIC SWITCHING SYSTEM

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1. GENERAL

INTRODUCTION

1.01 This section provides information for telephone company personnel to attain a better understanding of how the common channel interoffice signaling (CCIS) continuity check transceiver (CCT) unit operates. The following information is included in this section:

- Purpose of the CCIS CCT
- Physical description of the CCIS CCT unit
- Description of the CCIS CCT unit functional interface with the No. 4 Electronic Switching System (ESS)
- A functional description and theory of operation
- Power and alarm circuit operation
- Maintenance philosophy of the CCIS CCT unit.

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

1.02 ▶This section is reissued for the following reasons

- Update text and illustrations to reflect interfaces with the D4 channel bank in addition to the voiceband interface frame
- Incorporate miscellaneous frame C interfaces
- Clarify use of certain acronyms
- Generally update section◀

1.03 ▶This issue of the section is based on the following schematic drawings:

SD-4A025-01, Issue 4A, LDI 4B

SD-4A064-01, Issue 6B, LDI 6A.

If this section is to be used with equipment or apparatus reflecting later issue of the schematic drawings, reference should be made to the schematic drawings and circuit descriptions to determine the extent of the changes and the manner in which the section may be affected.◀

PURPOSE OF CCIS CONTINUITY CHECK TRANSCEIVER

1.04 Signaling is transmitted over the talking path of non-CCIS trunks to provide address and supervisory signals as well as a per call trunk test prior to completing the connection for each call. Since signaling is not transmitted over the talking path of CCIS trunks, a separate voice path assurance test is required before each 2- or 4-wire CCIS trunk is used to insure defective trunks are not utilized. The CCIS CCT described in this section is utilized in each No. 4 ESS office to perform this function. The check consists of transmitting a tone on a trunk from the originating office and detecting that tone on the return path in the case of a 4-wire looped trunk, or detecting a translated response tone in the case of a 2-wire trunk. When the received tone is detected and found to exceed a previously established level and the tone subsequently is detected as having been removed, the continuity check is considered successful. A voice path assurance test is performed on each trunk during call processing routines for each CCIS call. The No. 4 ESS CCIS CCT is also utilized as a transponder to enable a connecting office to perform voice path assurance tests on 2-wire CCIS trunks incoming to the No. 4 ESS office.

1.05 The CCIS CCT unit provides the following.

- Means for housing up to 12 CCT circuit packs (Fig. 1).
- Connectors necessary to wire the circuit packs into the offices. These connectors provide access to signal processor scan and signal distributor (SD) points, and to voiceband interface or ▶D4 channel bank◀ transmission points.
- A power converter and associated power switch to power the circuit packs and provide power control and alarm circuitry.

EQUIPMENT CHARACTERISTICS

1.06 The CCT unit is designed to operate on a supply voltage between 20.75 and 26.25 volts dc at an ambient temperature range of 0 to 50°C. A single 4-wire balanced 600-ohm appearance on the No. 4 switching network is provided for each of the CCT circuits. The CCT is designed to generate a signal level of -15 ±0.5 dBm when measured at the -3 dB transmission level point. The output frequency of each CCT is selectable under program control, as described later in this section.

1.07 The design of the CCIS CCT unit is based upon 1A technology which is described in Section 254-200-001. This technology makes extensive use of integrated circuits, modular construction, and machine-aided wiring.

2. PHYSICAL DESCRIPTION

CCIS CONTINUITY CHECK TRANSCEIVER UNIT J4A010AC-1

2.01 The CCIS CCT unit (Fig. 1) is a 4-inch high assembly designed to be mounted in the 2-foot 2-inch wide miscellaneous frame A or miscellaneous frame C. The miscellaneous frame A may be equipped with a maximum of two CCIS CCT units between equipment locations 54 to 62. ⧫The miscellaneous frame C may be equipped with from a minimum of two to a maximum of 16 CCIS CCT units between equipment locations 10 to 48 and 50 to 82.⧫ Each unit consists of a +5V dc-dc converter, a power switch, three relays, and may be equipped with up to 12 CCT plug-in circuit packs in increments of six. The power switch and three relays provide manual and automatic shutoff of the +24V power to the CCTs and +5V dc-dc converter. It also provides manual power alarm test features and an office alarm signal. Refer to Section 254-200-001 for identification and function of the KS-20738, L4 power switch controls and indicators. The J-87389S +5V dc-dc converter is equipped with a red alarm indicator which, when lighted, indicates a converter power alarm.

2.02 The number of CCIS CCTs required in an office to adequately service the maximum expected CCIS call attempts is traffic engineered. Miscellaneous frame A equipage options provide for a maximum of two J4A010AC-1 CCIS CCT units in addition to the two J4A010AE-1 CCIS CCT and loop-around test units which are supplied per basic frame equipage requirements. Each J4A010AE-1 CCIS CCT and loop-around test unit is equipped with eight CCIS CCT plug-in circuit packs and two loop-around test plug-in circuit packs. The J4A010AE-1 unit is described in Section 234-110-105. The J4A010AC-1 CCIS CCT unit may be optionally equipped with either six or twelve CCT plug-in circuit packs. Therefore, miscellaneous frame A may be equipped to provide a maximum of 40 CCTs and four loop-around test circuits. ⧫Miscellaneous frame C may be equipped to provide a maximum of 192 CCT circuits.⧫

3. CCIS CONTINUITY CHECK TRANSCEIVER UNIT FUNCTIONAL INTERFACE

3.01 Figure 2 illustrates the CCIS CCT unit functional interface with the No. 4 ESS. The test signal transmit and receive paths for each CCT are connected via a terminal strip in the multifrequency (MF) signaling frame to the voiceband interface frame or ⧫D4 channel bank. From the voiceband interface frame or D4 channel bank the test signal transmit and receive paths are gated to the trunk under test via the No. 4 ESS switching network.⧫ These paths, designated T, R, T1, R1, 4-wire voice frequency lines, are connected as shown in Figure 3. Four SD points and one scan point (Fig. 2) connect each CCT to the signal processor to initiate, control, and monitor each CCIS trunk test.

3.02 Two scan points and two SD points connect the CCIS CCT unit power and alarm circuit to the signal processor. The two scan points indicate request out-of-service (ROS) and power status and alarms to the signal processor. The two SD points directly control the out-of-service (OS) and acknowledge (ACK) lamps located on the power switch. The power switch is also connected to the office alarm system to signal a major office alarm.

4. FUNCTIONAL DESCRIPTION AND THEORY

FUNCTIONAL OPERATION

4.01 Each CCIS voice path trunk link between two switching offices is tested for continuity and acceptability prior to its use as a talking path. In general, the continuity check is made on a trunk between two switching offices, one link at a time, as the call processing progresses. The typical test

consists of the originating office sending a tone out on the trunk, which in the 4-wire case is then looped back at the receiving office. Successful reception of the tone back at the sending office and subsequent detection of the tone having been removed then constitutes the completion of the test. In the case of 2-wire trunks, two tones are used. One tone is sent at the transmitting end and a transponder at the receiving office sends the other tone back upon receipt of the first tone. Therefore, there are four basic functional modes of CCIS continuity checking:

- 2-wire—originating test
- 2-wire—looping (transponding)
- 4-wire—originating test
- 4-wire—looping (idle mode).

Two-wire trunks always require two test frequencies. The No. 4 ESS is equipped to perform these four functions. The 4-wire looping is performed directly in the No. 4 ESS switching network while the CCIS CCT is utilized to perform the other three functions.

THEORY—SIGNAL AND CONTROL CIRCUITS

4.02 The CCIS CCT (Fig. 4) consists of a single FB-type circuit pack. The transmitter section consists of a 2-frequency oscillator, digital gating, and an active filter output circuit. Tones are generated as square waves for stability and ease of gating, and are then passed through the active filter which selects the sine wave fundamental. The T and R output leads form a balanced 600 ohm output for the switched -15 dBm 1780 Hz or 2010 Hz sine wave signal used to test the continuity and signal loss of a No. 4 ESS trunk.

4.03 The receiver section consists of an active filter, a peak detector, a scaling comparator, and a timing circuit. The active filter has a very narrow bandpass centered at 2010 Hz. The 2010 Hz input signal is then peak detected, and fed to the scaling comparator. The settings of the level 1 and level 2 SD points determine at which of four input levels the comparator will switch. Output from the comparator then goes to the timing circuit. In the transceiving mode (2-wire or 4-wire originating test), the timing circuit turns off the transmitter output signal and operates a scan point if the test is successful. In the transponding mode (2-wire looping), the timing circuit is inoperative and serves only to gate out the transmitter signal while the incoming 2010 Hz tone remains above the comparator acceptance level. (Note that either one of two frequencies may be transmitted and only 2010 Hz may be received. Therefore, the transceiver in a 2-wire office must have the capability of receiving 1780 Hz).

4.04 The CCIS CCT is connected via the No. 4 ESS switching network to the trunk to be tested. The four operating modes of this circuit (Table B) are determined by two SD points from the signal processor: start and frequency. The start SD point determines whether the circuit is in the transponding or transceiving mode. The frequency SD point sets the output frequency to 1780 Hz or 2010 Hz. When the frequency 3D point is open, the transmit frequency is 2010 Hz, and when the frequency SD point is closed, it is 1780 Hz. The transponding mode is passive, where the reception of a 2010 Hz signal, which meets the comparator threshold level established by SD points level 1 and level 2, gates out the transmitter 2010 Hz or 1780 Hz signal to the originating office. Since the 2010 Hz transponding function is performed by the No. 4 ESS switching network, this operating mode of the CCT is used as the idle state.

4.05 When the No. 4 ESS is initiating the continuity check (2-wire or 4-wire originating test), the start SD point is closed. A 2010 Hz or 1780 Hz tone (depending on the state of the frequency SD point) appears on the T and R output leads. Returning 2010 Hz tone appears at the input of the receiver some time later, depending on the length of the trunk under test. Thirty milliseconds after the comparator switches, indicating that the received tone is correct, the receiver timer starts a 40 ms timer and also lowers the comparator acceptance level by 6 dB. After the 40 ms, the transmitted tone is turned off. When the returning 2010 Hz tone falls below the comparator threshold level, the receiver timer initiates a 15 ms delay, after which the report scan point is set. This action indicates a successful test to the signal processor and constitutes a trunk test for both continuity and level.

5. POWER AND ALARM CIRCUITS

INTRODUCTION

5.01 This part includes discussion of the following:

- Power input to the CCT unit
- Power distribution within the CCT unit
- Power control
- Alarm circuits.

Figure 5 is a functional block diagram of the CCT unit power and alarm circuits.

CCIS CONTINUITY CHECK TRANSCEIVER UNIT POWER REQUIREMENTS

5.02 ▶The +24 volt power input required by each CCT unit in miscellaneous frame A or C is distributed from the fuse panels in the respective frame. The +24 volt input supplies each CCT unit which power to operate the +5V dc-dc converter, the power switch control circuits and lamps, and to provide switched +24 volts (+24 START) to the +5V dc-dc converter and each CCT circuit pack. Power distribution to individual CCT's (within miscellaneous frame A or C) is configured such that a power failure or blown fuse will not result in a power failure for all CCT's. The use of protection fuses in miscellaneous frames A and C is different. In miscellaneous frame C, power switch lamps are provided with separate fuses. In event of a blown CCT protection fuse, power switch lamps will continue to function. In miscellaneous frame A the power switch lamps are powered from the same fuse which provides power to the CCT. In the event of a blown fuse, no CCT power switch lamps will function. Fuse configuration and power distribution are covered in detail in the miscellaneous frame A, B and C document, Section 234-110-130. In addition to the +5 volts supplied by the +5V dc-dc converter, each CCT circuit pack internally derives +24, +12, and +7 operating and reference voltages from the switched +24V (+24V Start) received from power switch.◀

POWER CONTROL AND ALARM CIRCUITS

5.03 The circuits that control CCT unit power are:

- CCT unit power switch and relay circuits
- Output monitor and reference circuit internal to the +5V dc-to-dc converter
- Miscellaneous frame A and C fuses.

These circuits operate in conjunction with each other to provide manual and automatic control of unit power, power alarm test, power status and alarm signals to the signal processor and a major alarm signal to the office alarm system. Each CCT unit can be powered up only manually by operation of the power switch ON pushbutton, but it can be powered down both manually, by operation of the power switch OFF pushbutton (normal power down), or automatically when an alarmed power condition occurs (alarmed condition power down).

5.04 All fuses in the miscellaneous frame A contain an alarm contact that closes upon fuse failure to operate the frame alarm circuits. The failure or fuse MA or MC will result in a major alarm to the office alarm system and removal of the supply voltage to the associated CCT unit.

5.05 ▶A fuse failure in miscellaneous frame C is reported to the office alarm system via the associated CCIS CCT unit power switch. The loss of the +24 volt input drops the power switch holding coil which provides a major alarm signal to the office alarm system and scan point closures to the signal processor.◀

5.06 The CCT unit +5V dc-dc converter contains circuitry which monitors the +5V output for an out-of-range voltage (OORV), overcurrent (OC), or overvoltage (OV) condition. This circuitry acts as an electronic fuse for the converter during an OC or OV condition. Except during a power alarm test, an OORV, OC, or OV condition of the converter will initiate an automatic power down condition of the CCT unit. In the alarmed condition, power down status is reported to the signal processor via the two power switch scan points (scan point code 1, 1), and a major alarm is signaled to the office alarm system.

5.07 A manual power alarm test may be performed to test the +5V dc-dc converter out-of-range voltage output monitor for correct operation. The power alarm test is started by rotating the power switch OFF pushbutton to the request out-of-service position. This action changes the scan point code to 1, 0 (request out-of-service). After the out-of-service lamp is lighted by the signal processor, the TEST pushbutton is depressed for at least 0.5 seconds to initiate the power alarm test and disable the converter fuse alarm relay. A properly functioning converter senses a power alarm condition and lights its alarm indicator. Test results are verified by observing that the alarm indicator is lighted. Test restoral is accomplished by returning the OFF pushbutton to the normal position and momentarily depressing the ON pushbutton. This action signals a nonpower alarm to the converter to reset the alarm indicator. Test restoral is verified by observing that the converter alarm indicator is extinguished and the power switch lamps are in the normal power on state.

6. MAINTENANCE

INTRODUCTION

6.01 The primary system maintenance objective is to maintain call processing during error and/or fault intervals. To meet this objective, the following is accomplished relative to the CCT voice path assurance test on CCIS trunks:

- Program controlled switching to an alternate trunk when the selected trunk voice path assurance test fails
- Detection of faults
- Isolation of faulted equipment and removal of equipment from service via program control
- Repair of equipment by craft personnel
- Verification of repair by equipment test and fault detection circuits
- Return of repaired equipment to service.

6.02 Craft personnel are notified of CCIS trunk voice path assurance test failures and CCT unit faults by teletypewriter (TTY) output message, office alarm equipment, and/or equipment indicating devices.

6.03 Further maintenance philosophy is described in Section 234-100-000.

6.04 Trunk maintenance is the responsibility of the trunk operations center (TOC). The maintenance operations center (MOC) and the terminal equipment center (TEC) are responsible for maintenance and repair of the CCT unit.

MAINTENANCE SOFTWARE

6.05 Scan and signal distributor points are used for equipment monitoring and control. Each CCT may be tested periodically, utilizing the CCIS loop-around and test circuit, to determine if its operation meets established limits.

MAINTENANCE AIDS

6.06 The following units or panels are used to perform maintenance on the CCT unit.

- Power switch KS-20738, L3, on the miscellaneous frame A control panel J4A010AB, provides fuse alarm status and alarm signals to the signal processor and office alarm system.
- ▶Power switch KS-20738, L3 on the miscellaneous frame C control panel J4A010BA, provides fuse alarm status and alarm signals to the signal processor and office alarm system.◀
- Power switch KS-20738, L4, on the CCT unit, provides manual control of unit power, manual power alarm test, power status and alarm signals to the signal processor, a power alarm signal to the office alarm system, and lamp indicators which light to indicate power and operational status of the CCT unit.
- The +5V dc-dc converter contains an alarm indicator which lights to indicate a converter power alarm condition.
- The telephone and TTY jack unit assembly on the miscellaneous frame A ▶or C◀ control panel provides for telephone communication between frames and the use of the beltline channel (TTY and data set) at the frame.

- Fuse panel, J4A012AD, on the miscellaneous frame A, provides blown fuse indicators.

- ◗Fuse panel J4A010CB-1, on the miscellaneous frame C, provides blown fuse indicators.◖

6.07 Further information on the power switch controls and indicators is provided in Section 254-200-001.

ROUTINE TASKS

6.08 The procedures for performing any routine tasks relative to the CCT unit are provided in the appropriate task oriented practices (TOP) document.

REPAIR OR REPLACE TASKS

6.09 Repair or replace tasks relative to the CCT unit are provided in the appropriate TOP document or covered in training.

7. REFERENCES

7.01 The following is a listing for further information relating to the CCIS CCT unit.

NUMBER	TITLE
SD-4A025-01	Miscellaneous Frame A Circuit
SD-4A064-01	CCIS Continuity Check Transceiver Circuit
SD-4A081-01	CCIS Continuity Check Transceiver and Loop-Around Test Circuit

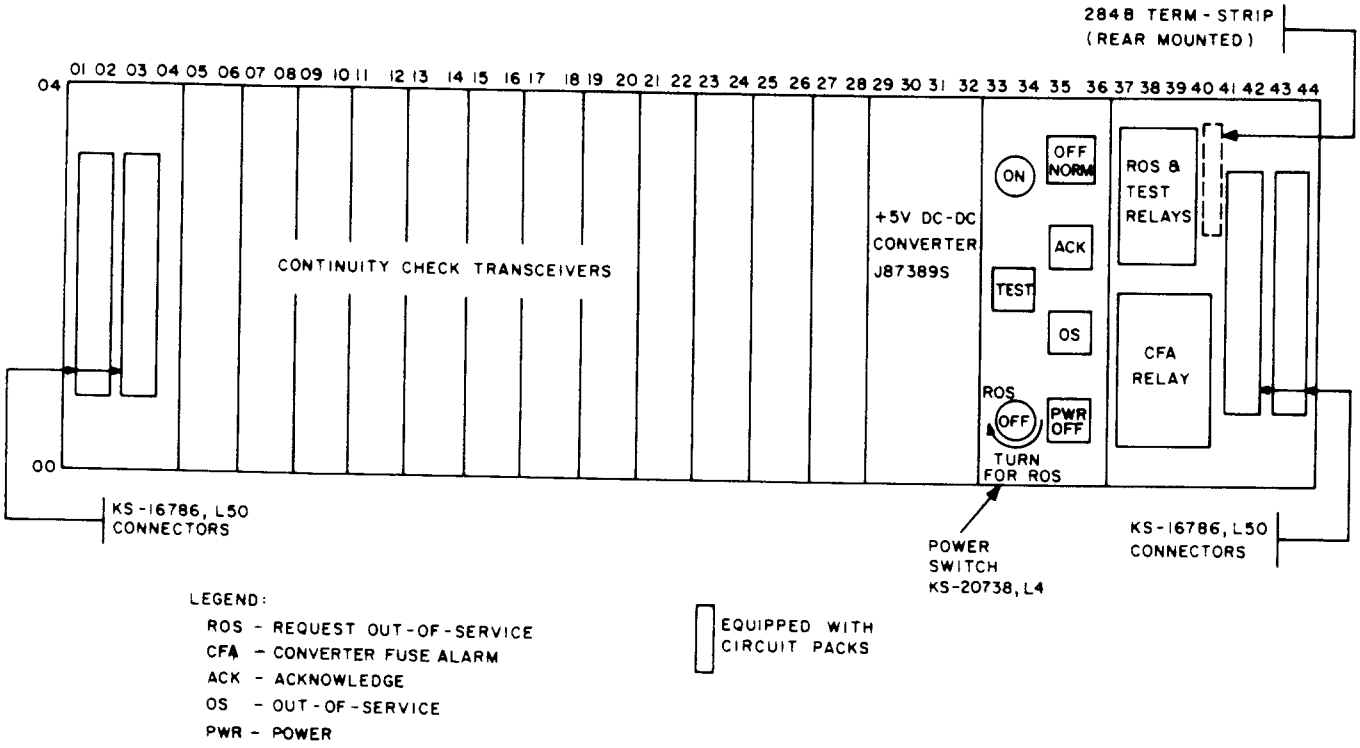

Fig. 1—CCIS Continuity Check Transceiver Unit J4A010AC-1—Equipment Identification

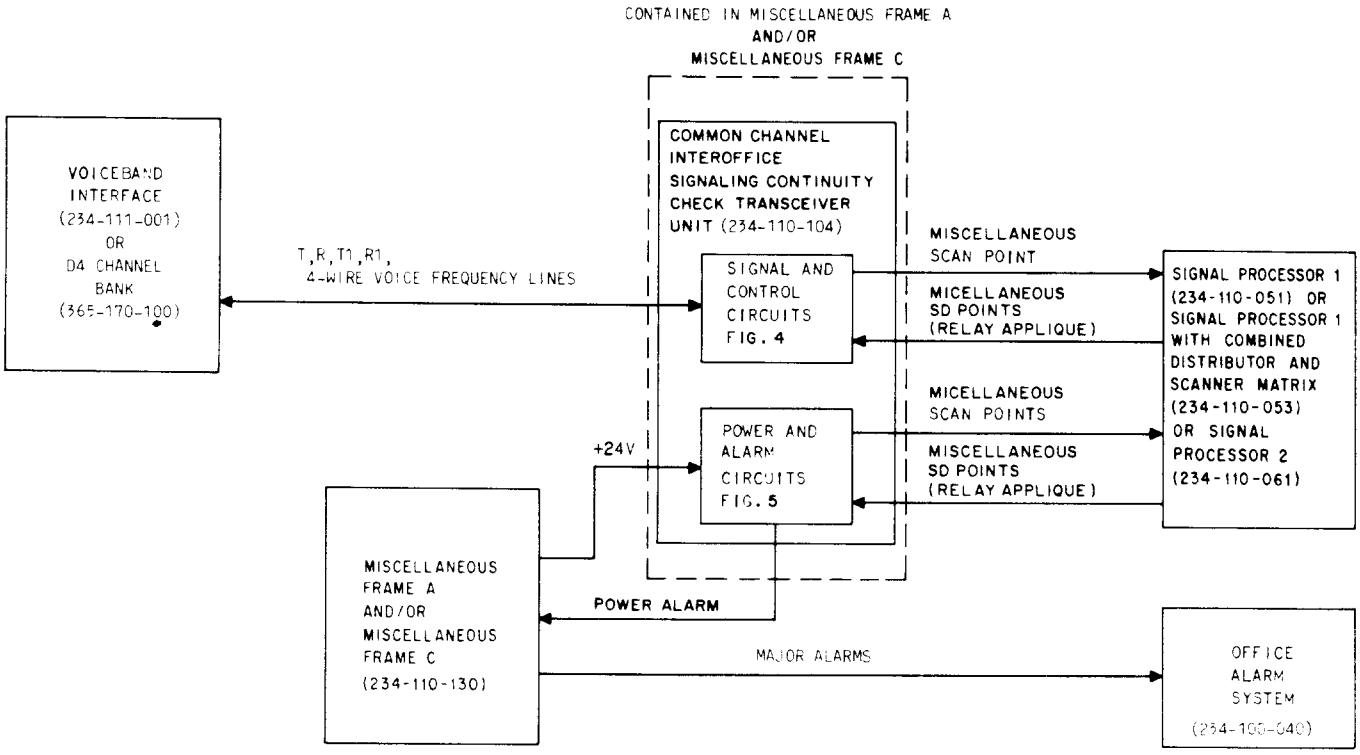

Fig. 2—CCIS Continuity Check Transceiver Unit Functional Interface—Block Diagram

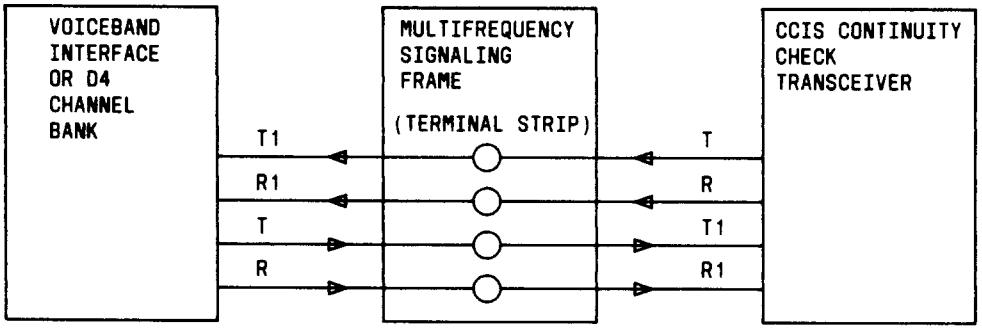

Fig. 3—Interconnections—CCT 4-Wire Voice Frequency Lines

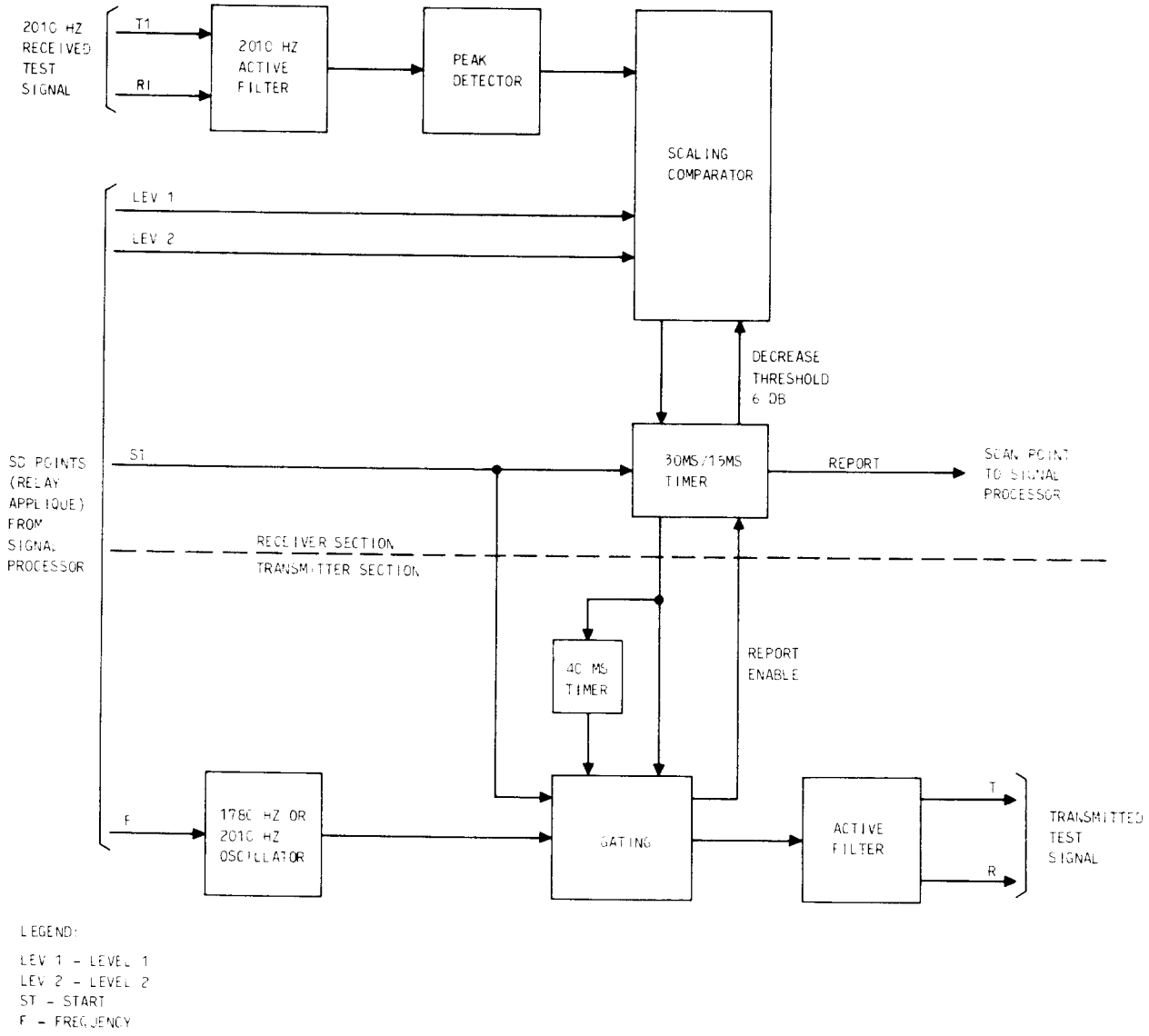

Fig. 4—CCIS Continuity Check Transceiver—Functional Block Diagram

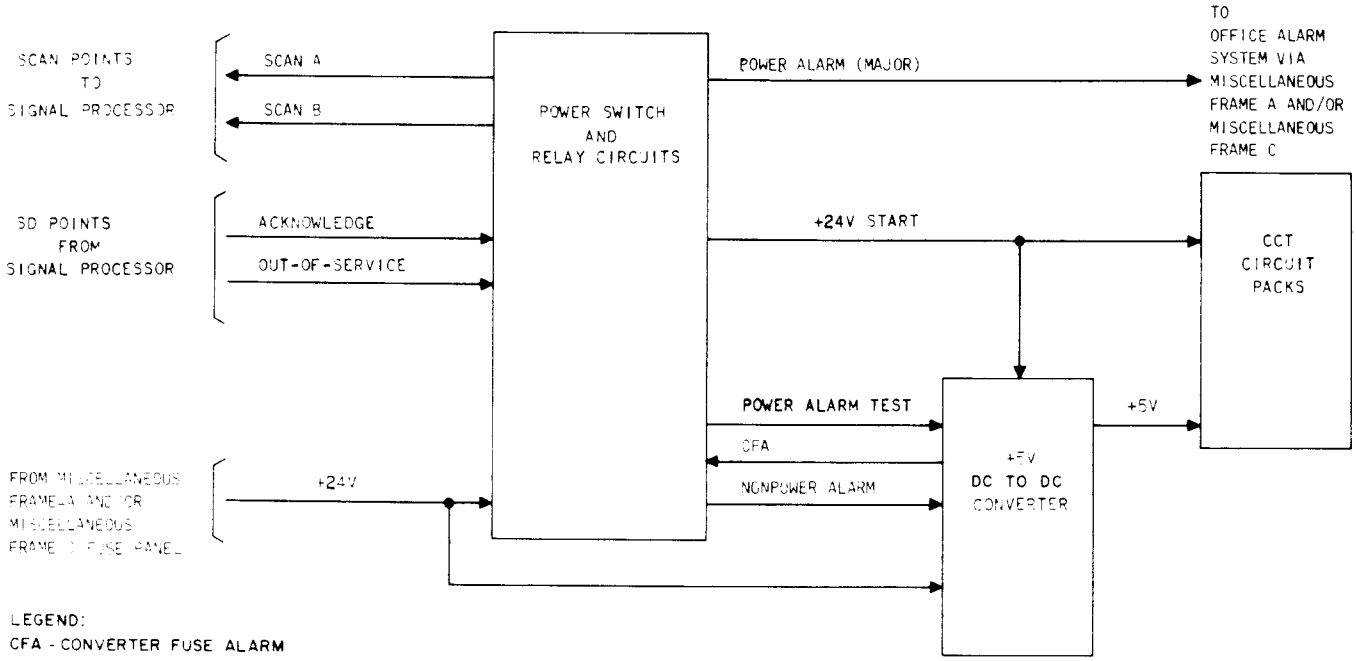

Fig. 5—CCIS Continuity Check Transceiver Unit—Power and Alarm Circuits

TABLE A

ABBREVIATIONS AND ACRONYMS

ABBREVIATION	TERM
ACK	Acknowledge
CCIS	Common Channel Interoffice Signaling
CCT	Continuity Check Transceiver
ESS	Electronic Switching System
MF	Multifrequency
MOC	Maintenance Operations Center
OC	Overcurrent
OORV	Out-of-Range Voltage
OS	Out-of-Service
OV	Overvoltage
ROS	Request Out-of-Service
SD	Signal Distributor
TEC	Terminal Equipment Center
TOC	Trunk Operations Center
TOP	Task Oriented Practices
TTY	Teletypewriter

TABLE B

CCIS CONTINUITY CHECK TRANSCEIVER OPERATING MODES

	SD Point START = OPEN (Transponding)	SD Point START = CLOSED (Transceiving)
SD Point FREQUENCY= OPEN (2010 Hz Transmit)	IDLE (2010 Hz Transponding)	4-WIRE ORIGINATING TEST (2010 Hz Transmit) (2010 Hz Receive)
SD Point FREQUENCY= CLOSED (1780 Hz Transmit)	2-WIRE TRANSPONDING (2010 Hz Receive) (1780 Hz Transmit)	2-WIRE ORIGINATING TEST (1780 Hz Transmit) (2010 Hz Receive)