J60110AA NO. 5 SIGNALING TRANSCEIVER, ECHO CANCELER, AND COMPANDOR (INTERNATIONAL INTERFACE UNIT) DESCRIPTION, INSTALLATION, AND MAINTENANCE ANALOG MULTIPLEX EQUIPMENT

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1. INTRODUCTION

1.01 This section provides description, installation, and maintenance information for the J60110AA No. 5 Signaling Transceiver, Echo Canceler, and Compandor for international analog trunks. This new transceiver is also known as an International Interface Unit. It is a direct replacement for the No. 5 line signaling transceiver or No. 6 FMG unit presently used in J68957A and B UTE (unitized terminal equipment) frames.

1.02 This practice is reissued to add information pertaining to switch settings and installation and testing. Tables B and D also are updated. Since this is a major revision, arrows are not used to indicate changes.

1.03 The equipment in J68957A and B UTE frames is used to terminate international analog transmission facilities that use CCITT (International Telephone and Telegraph Consultative Committee) No. 5 or No. 6 Signaling. The J60110AA transceiver provides all the features and capabilities of the original J68957AA transceiver, but has additional circuits

for echo control and compandoring. One application of compandors is to significantly reduce noise on compandored FM satellite trunks. Features and specifications for the J60110AA transceiver are summarized in Table A.

2. DESCRIPTION

A. Physical Description

2.01 The J60110AA transceiver (Fig. 1) is assembled on an epoxy glass printed wiring board which is mounted on a die-cast aluminum frame to form a plug-in unit. The unit is approximately 1-3/4 inches wide, 8 inches high, and 10-1/2 inches deep. The printed wiring board has switches to tailor the unit for a variety of trunk applications. The faceplate has variable pads to adjust transmit and receive levels and a recessed switch and indicator which provides a comprehensive test of the transceiver.

B. Functional Description

General

2.02 A block diagram of the J60110AA transceiver is shown in Fig. 2. The unit is a 2-way device that connects to A6 or D4 channel banks on the line side and to a 4 ESS™ switch VIU (voice interface unit) on the drop side. The transceiver contains components that perform six significant functions:

- Analog Interface
- Compression/Expansion (Compandor)
- Signaling
- Echo Canceling
- Tone Detection
- Control.

Analog Interface

2.03 The transceiver is a digital device; thus, VF (voice frequency) signals applied to the unit must be converted to a digital format. Signals from the A6 or D4 equipment pass through a transformer to convert the balanced signal to an unbalanced signal. The signal is then amplified to provide the correct input level to the codec. The codec converts the analog signal to a digital bit stream required by the circuits in the transceiver.

2.04 Signals applied to the VIU are converted from digital to analog in a codec, amplified, and passed through a 600-ohm balancing transformer. A pad in this circuit adjusts for office loss.

2.05 Signals applied from the VIU to the A6 or D4 equipment pass through identical analog interface components, and functional operation is the same.

Compression/Expansion (Compandor)

2.06 The J60110AA transceiver contains a compandor consisting of a compressor and an expandor circuit. The compandor is for use on trunks with high facility noise; for example, edge of band channels on submarine cable systems and FM compandored transmission over satellite facilities. A compandored circuit provides an end-to-end noise advantage. Low-level signals applied to the A6 or D4 equipment, via the compressor circuit, are amplified, while high-level signals are attenuated. Low-level signals received from the A6 or D4 equipment are attenuated in the expandor circuit, while high-level signals are amplified. The effect is to reduce the dynamic range of the signal for transmission and then restore it when received. This provides the noise advantage. Option switches on the transceiver enable the compandor circuit to be disabled permanently or to be disabled only upon receipt of a 2100-Hz tone.

Signaling

2.07 The transceiver provides the two in-band line signaling frequencies, in a link-by-link continuous-compelled mode, required by the CCITT No. 5 Signaling System. The transmitting section of the signaling circuit sends 2400- and/or 2600-Hz signaling tones to the distant end under control of the signal processor in the 4 ESS switch. The receiving section sends indications to the signal processor in response to 2400- and/or 2600-Hz tone received from the distant end. The signaling circuit can be disabled via an option switch should the trunk require the CCITT No. 6 Signaling System.

Echo Canceling

2.08 The transceiver provides echo control by a technique called echo canceling. A VF signal

originating at the far-end of the trunk (the A6 or D4 channel bank side) can be reflected back to the VIU side of the transceiver because of an impedance mismatch at the near-end of the trunk. The mismatch occurs in the 2- to 4-wire hybrid point in the local network. On circuits without echo control, these reflections result in echo.

2.09 In the transceiver, both the VF signal (in digital form) from the far-end and the subsequent reflections from the near-end are applied to the echo canceler circuit. The echo canceler circuit samples both digital signals, estimates the degree of cancellation required, and cancels the echo.

2.10 Echo cancelers are sensitive to propagation delay in the "tail circuit," the portion between the canceler and the 2-wire hybrid circuit. The echo canceler chip used in this transceiver provides for delay of up to 48 ms.

2.11 Switchable options are available on the transceiver to automatically disable the echo canceler during data calls and CCITT No. 6 VPA (voice path assurance) tests. Optional switches are also available to set the echo canceler convergence rate and the near-end speech threshold. Convergence rate is the speed of the adoption process that constructs a model of the echo-path impulse response. The model is used to compute an estimate of the echo signal which is then subtracted from the transmit path to cancel the echo. The higher the rate, the faster the convergence; however, too high a rate will result in instability.

Tone Detection

2.12 To disable network echo control devices, data sets generate a 2100-Hz tone. The same tone is also generated by ATME (automatic transmission measuring equipment). The tone detector circuit detects either the presence of 2100-Hz tone, or 2100-Hz tone with phase reversal, in either the transmitting or receiving path. Depending upon the options selected, detection of 2100 Hz can disable the echo canceler and/or the compandor portion of the transceiver. The disabling will occur only when the level of incoming tone is above −31 dBm0 (nominal). Circuits in the transceiver will be enabled if the level drops below that level for more than 100 ms.

Control

2.13 A microprocessor is used for all control functions in the transceiver. For signaling, it interacts with the signal processor in the 4 ESS switch and the signaling circuit in the transceiver. It also processes signals from the tone detector to control the operation of the compandor and echo canceler circuits.

3. PREINSTALLATION PROCEDURES

A. General

3.01 Preinstallation procedures cover the care that should be taken when handling the transceiver, inspecting for damage, and setting switches on the transceiver to conform to circuit requirements.

B. Cautions

Caution 1: Wear a wrist-type ground strap when handling the transceiver. This prevents static charges which can damage a unit. The strap can be attached to framework or any grounded metal object.

Caution 2: Open shipping cartons carefully to avoid damage to the plug-in units. Handle each unit by the edges or the faceplate to prevent scratching contacts or damaging components.

Caution 3: Do not insert the transceiver into the shelf until switches on the unit have been set for circuit requirements.

C. Inspection

3.02 Inspect each transceiver for damage. If damage is noted, contact your AT&T representative.

D. Switch Settings

3.03 Two DIP (dual in-line package) switch assemblies control the various options available and must be set to conform to circuit requirements. The location of the switches is illustrated in Fig. 3. The options available, and the effect of the settings on the circuit, are listed in Tables B, C, and D. Table D, provided by the International Engineering and Operation Organization, lists the switch settings associated

with each one of the six international trunk applications. The settings in Table D are trunk-dependent. The recommended switch settings are entered in the OPTION field of the WORD (Work Order Record and Details) document. In case of conflict, use the settings recommended in the WORD document.

E. Attenuation Pads

3.04 Two attenuation pads are located on the front of the transceiver (Fig. 3) to build out the channel bank-to-VIU trunk loss to −3 dB TLP (transmission level point). Each pad should be set for −3.2 dB upon installation. The 5B insertion loss is 6.8 dB in the receiving direction and 9.8 dB in the transmitting direction. Later, cross-office tests may require the settings be modified. Pad settings are illustrated in Fig. 3.

4. INSTALLATION AND TESTING

Caution: Review preinstallation procedures in Part 3 before attempting installation and testing.

4.01 The installation procedure for the J60110AA transceiver is as follows:

(a) Ensure circuit is out of service.

(b) Remove the old line signaling transceiver or FMG unit still in place.

(c) Insert the new J60110AA transceiver into the shelf.

(d) The FAIL PASS indicator (Fig. 1) on the faceplate will light and extinguish.

(e) Operate the recessed LED CKT/EC (S1) test switch (shown in Fig. 1) until it clicks.

(f) The FAIL PASS indicator should light and then extinguish within 10 seconds. If the indicator does not extinguish, replace the transceiver and repeat procedure from (e).

(g) If the FAIL PASS indicator is flashing, the No. 5 Signaling Enable/Disable option (S2.6) or the VPA option (S3.1) is set incorrectly. Correct per Table D or the WORD document and retest.

(h) Attenuation pads may have to be readjusted. Conduct office loss tests and make the adjustments. Instructions are contained in "Connect Channel Group" in AT&T TOP (Task Oriented Practice) 234-150-040 (Maintenance for J68957A and B UTE Frames).

(i) On compandored trunks, a level tracking test is required per Table E. This is required because compandors double any loss variation occurring in the connecting facility. All international compandored circuits will have an ICL (inserted connection loss) of 0 dB and an EML (expected measured loss) of 4 dB.

5. MAINTENANCE

5.01 Routine maintenance for the J60110AA transceiver is covered under AT&T-CP 660-630-350 (Maintenance of Interzone International Message Trunks). In case of trouble, the unit should be replaced and returned to AT&T.

Caution: Operation of the LED CKT/E.C. TEST switch will interrupt service on the circuit under test.

5.02 In case of an echo-related trouble report, the LED CKT/E.C. TEST switch may be operated. If the indicator lights and then extinguishes within 10 seconds, the echo canceler is operating properly.

6. ISSUING ORGANIZATION

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TABLE A

J60110AA TRANSCEIVER SPECIFICATIONS

CHARACTERISTIC	SPECIFICATION
Echo Path Return Loss	0 or 6 dB (Selectable)
ERL Enhancement	>27 dB
Maximum Impulse Response Length	<48 ms
Convergence Rate	25/50 dB/Second (Selectable)
Frequency Response (Relative to 804 Hz)	0 ±0.5 dB (300 to 3000 Hz)
Transmission Level	Rcv: +7 TLP (IN) −3 TLP (OUT) Trmt: −3 TLP (IN) −16 TLP (OUT)
Input/Output Impedance	600 Ohms Balanced
Signaling*	Rcv. Tone 2400 and/or 2600 Hz ±15 Hz at −9 dBm0 ±7 dB Trmt. Tone 2400 and/or 2600 Hz ±6 Hz at −9 dBm0 ±1 dB
VPA (Detection)	2000 ±20 Hz
Tone Disabling	Canceler: 2100 Hz ±21 Hz With or Without Phase Reversal Compandor: 2100 Hz ±21 Hz

* See CCITT Recommendation Q143 and Q144.

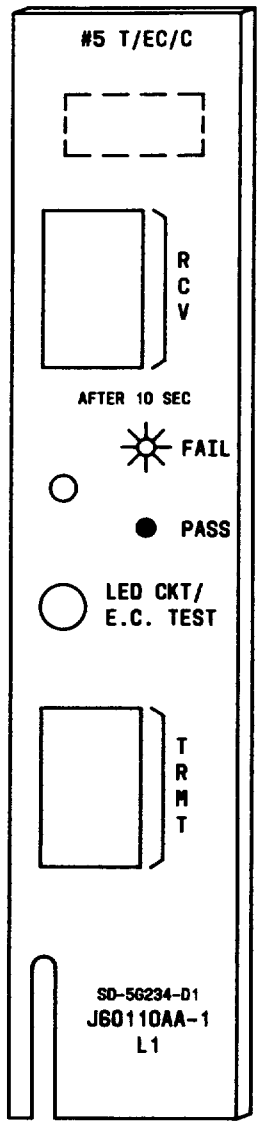

Fig. 1—J60110AA-1 Transceiver

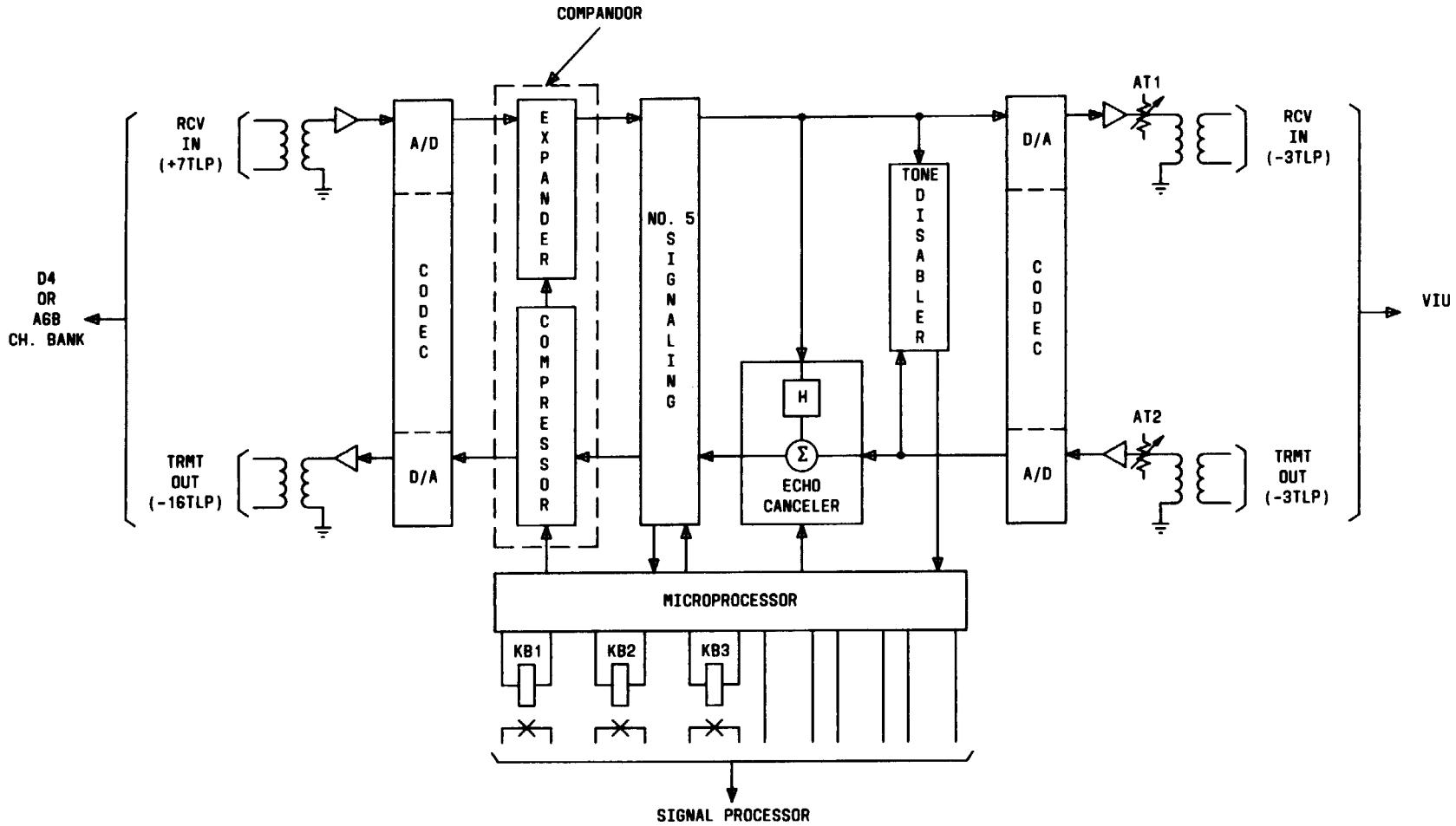

Fig. 2—J60110AA-1 Transceiver Block Diagram

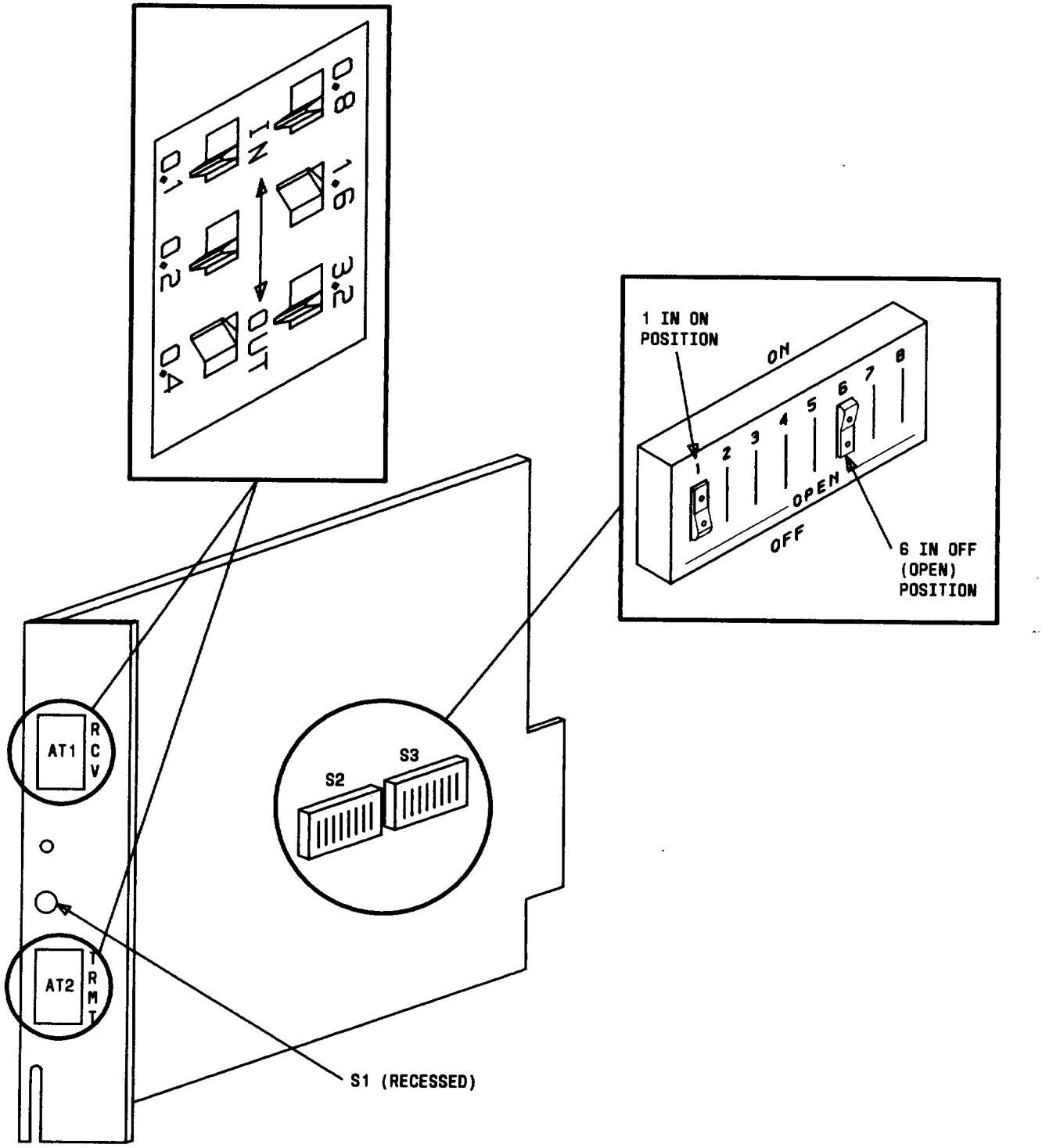

Fig. 3—Switch Locations and Settings

TABLE B

TRANSCEIVER OPTION SWITCHES

SWITCH (SEE FIG. 3)	FUNCTION	EXPLANATION
S2.1	Compandor Control	See Caution. Enables (ON) or disables (OFF) compandor.
S2.2 S2.3	Unaffected Level Point	If compandor is used, setting must match far-end and will be provided to CL by International Engineering & Operations as a permanent note on the Facility Order and entered in the OPTION field of the WORD document.
S2.4 S2.5		Switch combinations set the gain/loss of transmitting compressor to complement loss/gain of receiving expandor. See Table C.
S2.6	No. 5 Signaling Control	Enables (ON) or disables (OFF) No. 5 Signaling.
S2.7	Echo Canceler Disable on Tone	Disables canceler upon receipt of 2100-Hz tone (OFF position). Tone is ignored when switch is set to ON position. (With switch 2.7 in OFF position, switch 2.8 should be in ON position.)
S2.8	Echo Canceler Disable on Tone With Phase Reversal	Disables canceler upon receipt of 2100-Hz tone with phase reversal (OFF position). Tone with phase reversal is ignored when switch is set to ON position). (With switch 2.8 in ON position, switch 2.7 should be in OFF position.)
S3.1	VPA	Setting for CCITT No. 5 Signaling (ON position). Setting for CCITT No. 6 Signaling (OFF position).
S3.2	Echo Canceler Control	Echo canceler enabled when switch is set to ON, disabled when set to OFF.
S3.3	Compandor Disable on Tone	Compandor disabled on receipt of 2100-Hz tone when switch is set to OFF position. Tone is ignored when switch is set to ON position.
S3.4	Echo Canceler	Sets echo canceler convergence rate ON = 25 dB/s OFF = 50 dB/s
S3.5	Near-End Speech Threshold	Sets near-end speech threshold ON = 6 dB OFF = 0 dB
S3.6	Not Used	—
S3.7	Noise Matching	See Caution. OFF position provides noise matching which eliminates noise problems that occur in a relatively quiet trunk with a noisy echo path. ON position disables noise matching.
S3.8	Not Used	—

Caution: To be used only in circuit applications where the average noise level at the equipment side of the echo canceler (Tin Port) is greater than 30 dBrnC0 when calls are established. If in doubt after verification of WORD document OPTION field, consult International Engineering & Operations before enabling this option.

TABLE C

UNAFFECTED LEVEL-POINT SETTINGS

SWITCH SETTINGS				TOTAL UNAFFECTED LEVEL POINT
2.2	2.3	2.4	2.5	
ON	ON	ON	ON	-10
ON	ON	ON	OFF	-11
ON	ON	OFF	ON	-12
ON	ON	OFF	OFF	-13
ON	OFF	ON	ON	-14
ON	OFF	ON	OFF	-15
ON	OFF	OFF	ON	-16
ON	OFF	OFF	OFF	-17
OFF	ON	ON	ON	-18
OFF	ON	ON	OFF	-19
OFF	ON	OFF	ON	-20
OFF	ON	OFF	OFF	-21
OFF	OFF	ON	ON	-22
ON	ON	OFF	ON	-23
OFF	OFF	OFF	ON	-24
OFF	OFF	OFF	OFF	Not Assigned

TABLE D

OPTION SETTINGS BY TRUNK APPLICATION (NOTE 1)

		TRANSIT TRUNK (NOTE 2)		INTERNATIONAL TRUNK		COMPANDORED TRUNK	
SWITCH	FUNCTION	CCITT #5	CCITT #6	CCITT #5	CCITT #6	CCITT #5	CCITT #6
S2.1	Compandor Control	OFF	OFF	OFF	OFF	ON	ON
S2.2	Unaffected Level Point	ON	ON	ON	ON	Table C	Table C
S2.3	Unaffected Level Point	ON	ON	ON	ON	Table C	Table C
S2.4	Unaffected Level Point	ON	ON	ON	ON	Table C	Table C
S2.5	Unaffected Level Point	ON	ON	ON	ON	Table C	Table C
S2.6	CCITT #5 Transceiver	ON	OFF	ON	OFF	ON	OFF
S2.7	Echo Canceler Disable-Tone	ON	ON	OFF	OFF	OFF	OFF
S2.8	Echo Canceler Disable-Phase	ON	ON	ON	ON	ON	ON
S3.1	VPA Control	ON	ON	ON	OFF	ON	OFF
S3.2	E.C. Control	OFF	OFF	ON	ON	ON	ON
S3.3	Compandor Disable on Tone	ON	ON	ON	ON	ON	ON
S3.4	Echo Canceler Convergence	ON	ON	ON	ON	ON	ON
S3.5	Near-End Speech Threshold	ON	ON	ON	ON	ON	ON
S3.7	Noise Matching	ON	ON	ON	ON	ON	ON

Note 1: Switch settings are also indicated on the OPTION field of the WORD document.

Note 2: The following pertains to transit trunks:

- Transit trunks do not normally require echo control (EAPM 21-84, para. 2.09).
- On CCITT #5 transit trunks, the J68957AA transceiver should be replaced by the 5B
- On CCITT #6 transit trunks, power consumption and economic considerations dictate the use of FMG units, thus the 5B is not recommended.

TABLE E

TEST LEVELS FOR OFFICE-LOSS TESTS

UNAFFECTED LEVEL POINT	TOUT WITH TIN = 1004 Hz @		ROUT WITH RIN = 1004 Hz @ −10 dBm0
	−10 dBm0	−16 dBm0	
−10	−26.0	−29.1	−10.0
−11	−26.5	−29.4	−9.0
−12	−27.0	−30.0	−8.0
−13	−27.5	−30.6	−7.0
−14	−28.0	−31.1	−6.0
−15	−28.5	−31.6	−5.0
−16	−29.0	−32.2	−4.0
−17	−29.5	−32.6	−3.0
−18	−30.0	−33.1	−2.0
−19	−30.5	−33.6	−1.0
−20	−31.0	−34.1	0.0
−21	−31.5	−34.6	+1.0
−22	−32.0	−35.1	+2.0
−23	−32.5	−35.5	+3.0
−24	−33.0	−36.1	Overload
None	−26.0	−32.2	−10.0

Note: Adjust the attenuators until the measured output value agrees with the corresponding −10 dBm0 value for the desired ULP (unaffected level point). Then send 6 down from the 51A test position and read the values under −16 dBm0 for the corresponding ULP. Note that the 51A (List 6) used in the international offices has a −4 dB TLP.