ES2 AND ES3 DIRECT INTERFACE CHANNEL UNITS AND TEST EXTENDERS CHANNEL UNIT DESCRIPTION D4 CHANNEL BANK DIGITAL TRANSMISSION SYSTEMS

CONTENTS PAGE

1. GENERAL

1.01 This section describes the D4 direct interface channel units which are used with No. 2 and No. 3 ESS switches to allow direct control of the channel unit by the switching equipment, thereby eliminating the trunk circuit. There are separate originating end (ES2O) and terminating end (ES2T) units for No. 2 ESS, but there is only one unit (ES3) for No. 3 ESS. Table A lists the equipment codes and schematic drawings for ⧫ES2 and ES3 units and for the D4/ES2 and D4/ES3 test extenders.⧫

1.02 This section is reissued to include descriptive information on the D4/ES2 and D4/ES3 test extenders. Revision arrows are used to indicate changes. Equipment test list(s) are not affected.

1.03 The direct interface units have many of the same design features (card jack, attenuators, etc.,) (Fig. 1) found on other units and are used in the D4 bank channel positions. The channel banks are mounted in a complex with the switching equipment, and with a direct interface frame for No. 2 ESS. Often all the channels are equipped with direct interface units, but other channel units can be used in the complex. When others are used for No. 2 ESS, peripheral decoder bypass units may be needed in the ESS interface frame depending on the type of channel unit.

1.04 This section presents a functional description of the channel unit(s) based on associated block diagrams. Circuit elements that are common to all units (transformer, active gates and filters, and channel unit logic) are mentioned in the section, but are described in the general channel unit description, Section 365-170-101. Additional circuits in the transmission paths and signaling circuits that characterize the unit(s) are described herein. Instructions on how to set the options and attenuators to the values specified on the circuit layout record card (CLRC) are given in Section 365-800-001 (TOP).

1.05 ⧫The D4/ES2 and D4/ES3 test extenders are provided as support equipment for the direct interface channel units used with No. 2 ESS and No. 3 ESS switching machines. These extenders provide a means for checking both the control leads between the switching machine and the channel unit position in the D4 bank and the various operating functions of the channel units. Instructions on the application of the test extenders are given in Section 365-170-000 (TOP) and the D4 Maintenance Bank test and calibration cards.⧫

2. CHANNEL UNIT DESCRIPTION

A. Applications

ES2O and ES2T Units

2.01 These units form a direct interface between the ESS switching equipment and the channel bank common equipment. Not only do the units perform the signal conversions between the voice signal and dc signaling conditions on the drop side and the digital signals on the line side, but additional logic circuitry in the units allows direct control by the ESS equipment. The ES2O unit combines the functions of a No. 2 ESS outgoing trunk and a D4 dial pulse originating (DPO) unit. The ES2T unit combines the functions of a No. 2 ESS incoming trunk and of the D4 dial pulse terminating (DPT) unit. Since these units provide trunk circuit functions, the number of trunk circuits and trunk frames is reduced in the office. In addition, the direct interface units can be used instead of many conventional trunk circuits using loop and E&M signaling. Replacement lists are given in Section 232-190-027 (Feature Document).

2.02 ▶The D4/ES2 Test Extender, shown in Fig. 2 should be applied as needed before installing the ES2O and ES2T channel units. This unit can be used to check the signaling leads to the switching machine for voltages, grounds, or open circuits. It can also monitor the on-hook off-hook functions and simulate the on-off-hook conditions for both the far and near ends of a facility. Through switches, it can simulate circuit commands from the local peripheral decoder to a channel unit plugged into the extender. Through jacks it can measure the percent distortion of the dial pulse from the far end using a 4A signaling test set or equivalent. A telephone jack provides access to the voice path so that cut-apart is possible of the tip-ring circuit looking either towards the line or drop. Pin jacks are connected to the sensor leads to provide a bridging test point for direct voltage measurements. This unit also provides switchable test pads to adjust the VF levels of the channel unit. It provides a switchable 1500-ohm termination for the tip-ring circuit and a switch that disconnects the tip-ring circuit from the cut apart line access jack and will connect the jack to the T1 and R1 leads of the channel unit. Refer to Section 365-170-000 (TOP) for application details.◀

2.03 Equipment arrangements with the No. 2 ESS direct interface are defined in Section 232-190-027, but some of the differences from the conventional arrangements are given here. Peripheral decoders (PD) are required with the direct interface, and these PDs are mounted in interface frames. Each PD can serve four channels, which are handled as a group. No mixing of direct and conventional interface equipment is allowed in the peripheral decoder group of four since there would be different SD number trunks in the group. Direct interface units are treated like miscellaneous trunk circuits by the ESS program.

ES3 Unit

2.04 The direct interface arrangement for the ▶No. 3 ESS uses different T, R, E, and M lead wiring from that in a conventional interface with E&M signaling. The ES3 unit is used for outgoing or incoming trunks◀ and eliminates the need for the No. 3 universal trunk circuit. No interface frame is needed with the No. 3 ESS direct interface; thus, the D4 channels need not be reserved to match the capacity of peripheral decoders. However, when the direct interface is used, all 24 circuits on the No. 3 ESS network frame should be used with direct interface units and should be identified as E&M circuits.

2.05 ▶The D4/ES3 test extender (faceplate shown in Fig. 3) should be applied and removed before installing the ES3 channel units. This extender can be used for checking both the control leads between the No. 3 ESS switching machine and the channel unit position in the D4 bank and several operating functions of the channel units. By use of the POS TST switch, it can check the signaling leads to the switching machine for voltages, grounds, or open circuits. The unit, through the SC1 LED can monitor the far-end on-hook off-hook functions and with the SC1 switch simulate the on- and off-hook conditions from the far end of the circuit to the local switch. It can also be used with the local and T/R switch to check Tip/Ring trunks. Jack access at SC1 REL is for measuring the percent distortion of the dial pulse from the far end using a 4A signaling test set or its equivalent. Switchable test pads of 1 and 2 dB can be used to adjust the VF levels of the channel unit. Also located in the voice path are line and drop telephone jacks that can provide cut-apart access to the tip-ring circuit. Pin jacks SC1− and SC2+ are connected to the sensor leads to provide bridging test points at the channel unit.◀

2.06 Logic circuitry in the ES2 and ES3 units is where the interaction between the channel

unit and the ESS control equipment takes place. Channel status information from the signaling circuits in the channel unit and inputs from the ESS equipment all appear in the logic circuitry. Since these signals are already in digital form, channel status outputs are available to the ESS, and the ESS inputs can directly control the channel. Indications toward the line or drop of the channel result from the interaction of the ESS inputs and the outputs of the signaling detector and receiver in the channel unit.

B. Transmission

ES2O and ES2T Units

2.07 Figures 4 and 5 are block diagrams for the ES2O and ES2T units, respectively. The hybrid separates the transmit and receive paths on the 4-wire side. A compromise network (2.15 μF+900 ohms) and build-out capacitors are associated with the hybrid to form a terminating set. On the 2-wire side are a set of TST jack contacts, CT relay contacts, and connections to an opto-isolator. In the transmit path on the 4-wire side are a fixed pad, adustable attenuator, TST jack contacts, and the active gates and filters. In the receive path are an adjustable attenuator, TST jack contacts, and the active gates and filters. The attenuators in the transmit path reduce the vf signal levels to the -8.5 TLP at the TST jack contacts, and the attenuators in the receive paths reduce the +4 TLP at the TST jack contacts to the level required on the drop. TST jack contacts allow testing toward the line or drop; the contacts on the 2-wire side allow checking signaling conditions as well as transmission levels.

2.08 The opto-isolator and a 900-ohm resistor form a shunt path across the T&R leads and allow a continuity check of the drop circuit. Part of the opto-isolator, which is a photo-resistive device, is light sensitive and conducts when the other part receives a control signal from the peripheral decoder. Thus, the ESS closes the shunt path and monitors the current on the office drop circuit.

ES3 Unit

2.09 Figure 6 is the block diagram for the unit. On the 2-wire side of the hybrid is the connection to the opto-isolator which is described above. There is a compromise network (2.15 μF+900 ohms) associated with the hybrid, but no capacitance balance options. In the transmit and receive paths, on the 4-wire side are an adjustable attenuator, TST jack contacts, and the gates and filters.

C. Signaling

ES2O and ES2T Units

2.10 These units have most of the signaling circuitry found in the respective dial pulse originating or terminating unit plus additional logic circuitry to accomplish what is normally done in ESS trunk circuits. Both the originating and terminating units supply 48-volt talk battery to the drop, and the terminating unit connects an audible ring toward the line side while the called station is being rung. Logic circuitry executes call processing instructions from the PD and reports calling supervision back via the office ferrod scanners. Inputs on the three PD leads can produce eight circuit states by controlling the relays and logic circuits in the channel unit.

2.11 In the transmit direction, the signaling logic states on both the channel bank TA and TB leads, one (on-hook) or zero (off-hook), are determined by the channel unit logic circuitry which has inputs from the signaling detector and the PD leads. The loop closure detector in the logic circuitry represents the open/closed loop conditions occurring on the loop by a zero/one logic level signal. Two output pairs from the channel unit provide current drive to ESS ferrod sensors to report supervisory conditions. The FO lead drives the ferrod for supervision of the switching network side of trunk, and the F1 lead drives the ferrod for the line side. FOR and FIR leads (not shown in figures) are return paths for the current drive signals.

2.12 Signaling and supervision in the receive path are accomplished by outputs to F1 ferrod sensors and by the signaling receiver action. Both the output to the sensor and the signaling receiver output are developed in the logic circuitry by the interaction of control signals on the PD leads and received signaling pulses from the carrier. In the ES2O unit, the PD inputs control whether the signaling output will be on the F1 lead or the RB relay is operated. This relay reverses the battery applied to the loop in response to the reversal at the other end. In the ES2T unit, the receive signaling output is always on the F1 lead. Contacts of the cut-through (CT) relay are wired in the T&R leads to close the transmission path under the control of the PD (O) lead. In the ES2T unit, CT relay contacts connect also an audible ring-

ing signal from the office (T1&R1 leads) to the carrier to indicate when the ES2T end is being rung. The audible ringing path is opened when the CT relay operates and the loop is closed.

ES3 Unit

2.13 Transmit signaling states on the channel bank TA andTB leads, one (on-hook) or zero (off-hook), are determined by the signaling detector which monitors conditions at peripheral decoder point B. On an outgoing call, peripheral decoder point B operates and places ground on TB lead causing the ES3 unit to send a seizure toward the far end. The wink back from the far end produces a signal to the F1 ferrod sensor over the E lead. In response, the A PD point places a ground on the TA lead which removes the termination across the T&R produced by the opto-isolator. Outpulsing takes place, and when the called party answers, off-hook is signaled back producing -48 volts on the E lead which saturates the F1 ferrod.

2.14 On an incoming call, the received seizure saturates the F1 ferrod over the E lead. If needed, a wink is applied on M lead to signal far end to start outpulsing. The termination across T&R is removed by opto-isolator. Pulsing is received, and when called party answers, off-hook is sent on the M lead.

Trunk Processing

2.15 During a carrier failure, the D4 channel bank TPU sends a control signal to all channel units which overrides the regular signaling. When a failure occurs, the TPU removes battery from one control lead which removes the current drive on scanner lead F1, giving an on-hook indication. The ES3 unit has an option for connecting another TPU lead which, after a 2.5-second delay, reapplies -48 volts and forces an off-hook indicaton. This sequence releases established connections and makes the trunk appear busy to new calls.

3. CIRCUIT OPTIONS

3.01 On the ES2 units, an attenuator with transmit (T) and receive (R) sections controls the loss inserted in the path. The T section has values of 0.1, 0.2, and 0.4 allowing a total of 0.7 dB, and R section has values of 0.1, 0.2, 0.4, 1, and 2 allowing a total of 3.7 dB. This attenuator may be either a socket-plug or rocker-switch type. On the ES3 unit, there is a rocker-switch attenuator with transmit (T) and receive (R) sections. The T section allows inserting 0.7 dB loss, and the R section allows inserting 3.7 dB. Instructions on how to make attenuator settings are given in Section 365-800-001 (TOP).

3.02 Table B lists the insertion loss, the attenuation range, and the drop-side input and output for the ES2 and ES3 units. The insertion losses and levels include the circuitry between the drop-side leads and the channel TST jack contacts with attenuators set at zero.

3.03 The make busy option is found on the ES3 unit and is designated SD. It is a socket-plug type which is either in the circuit (white showing) or out of the circuit (black showing). This option connects a signal from the TPU which first removes current drive on the F1, F1R pair for an on-hook indication; then, after a 2.5-second delay, supplies current drive for an off-hook indication for the duration of the failure. If the option is not selected, there will be an on-hook indication for the duration of the failure.

3.04 The network build-out capitance (NBOC) options on the ES2 units are associated with the compromise network on the hybrid and allow setting capacitance to the value prescribed to meet office balance requirements. The options are on a socket plug selector, and the capacitors are in the large CAP-PAK in the unit. The NBOC values on the ES2 units are 2, 4, 8, 16, and 64 μF.

4. REFERENCES

4.01 The following is a list of sections associated with the direct interface channel units.

SECTION	TITLE
232-190-027	Direct Interface With T Carrier, No. 2 and 2B Electronic Switching Systems—Feature Document
233-190-027	Direct Interface With T Carrier, No. 3 Electronic Switching System—Feature Document
365-170-000	D4 Channel Bank—TOP
365-170-100	D4 Channel Bank Description
365-170-101	D4 Channel Units—General Description
365-800-001	D1, D2, and D3 Channel Banks (TOP)

◆ TABLE A ◆

DIRECT INTERFACE UNITS
AND TEST EXTENDERS

UNIT	SD/CD
J98726BR 2-Wire No. 2 ESS Terminating Direct Interface (ES2T)	3C335-01, 02
J98726BS 2-Wire No. 2 ESS Originating Direct Interface (ES20)	3C334-01, 02
J98726BU 2-Wire No. 3 ESS T Carrier Direct Interface (ES3)	3C328-01
J98726MM D4/ES2 Channel Unit Test Extender	3C405-01
J98726MN D4/ES3 Channel Unit Test Extender	3C406-01

TABLE B

INSERTION LOSSES

CHANNEL UNIT	TRANSMIT PATH				RECEIVE PATH			
	MIN INSERTION LOSS (DB)	ATTENUATOR RANGE (DB)	INPUT LEVEL (DB)		MIN INSERTION LOSS (DB)	ATTENUATOR RANGE (DB)	OUTPUT LEVEL (DB)	
			MIN	MAX			MIN	MAX
ES20, ES2T and ES3	7.8	0 – 0.7	-0.7	0	6.3	0 – 3.7	-6.0	-2.3

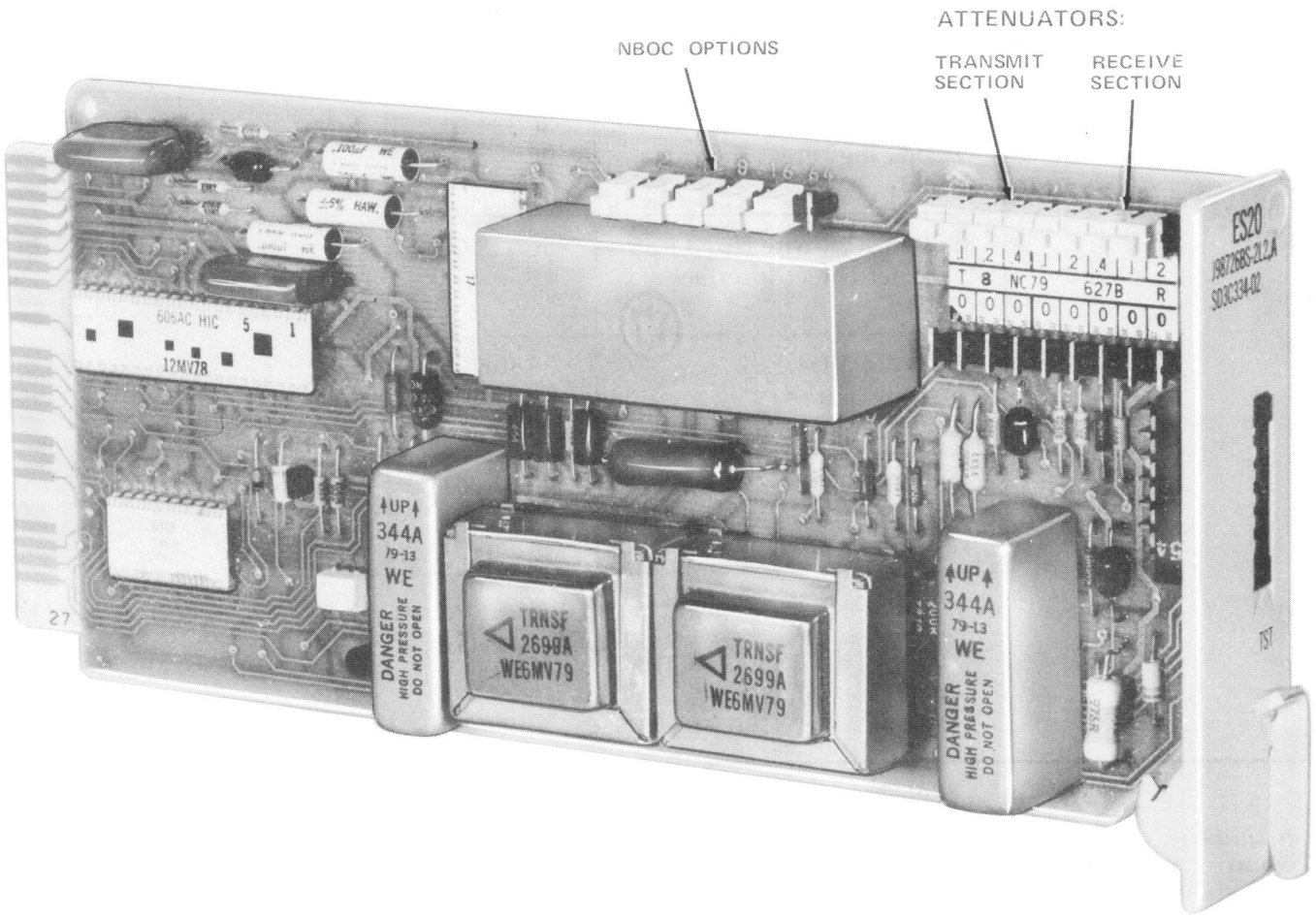

Fig. 1—ES20 Direct Interface Channel Unit

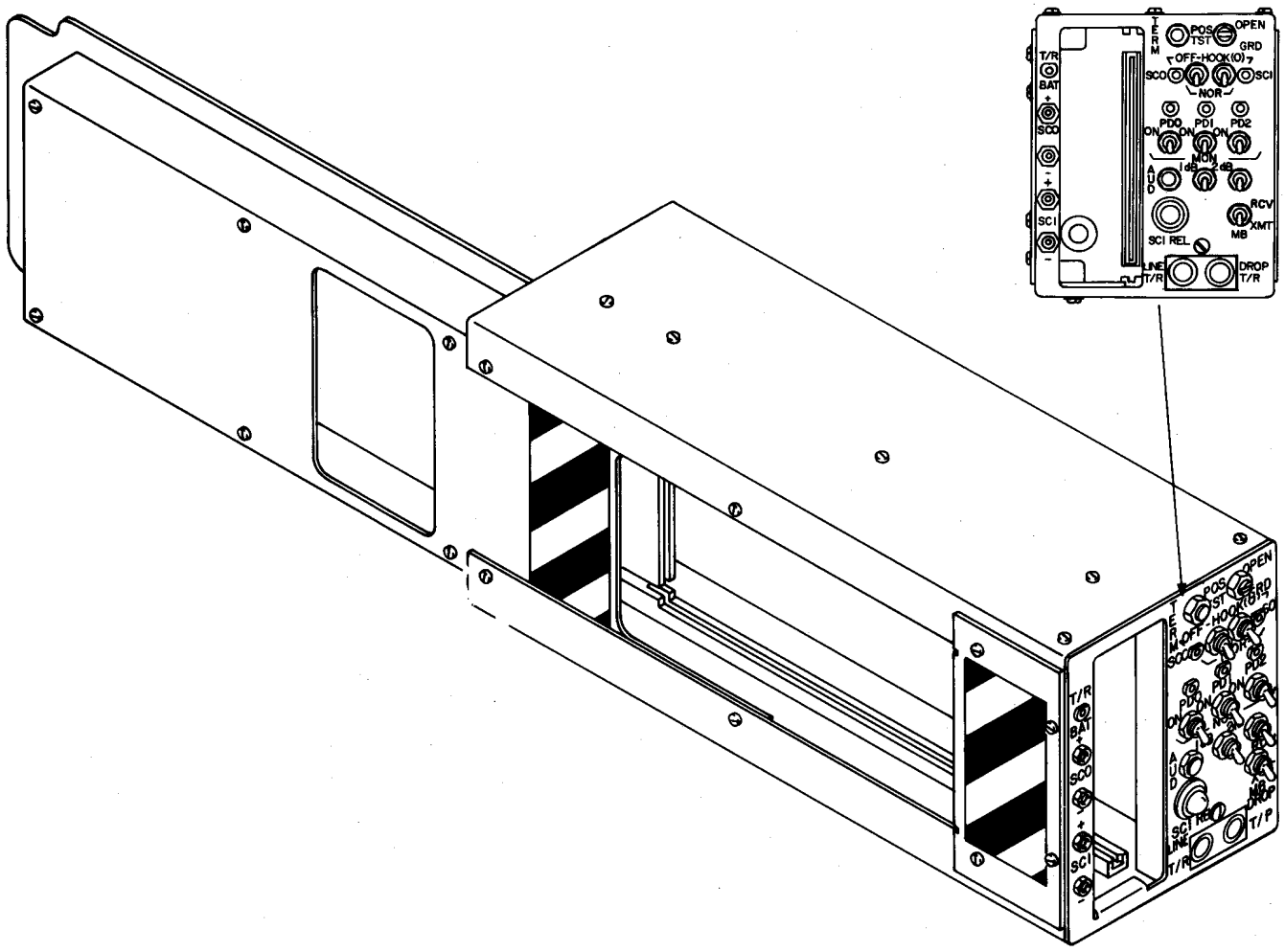

Fig. 2—D4/ES2 Test Extender

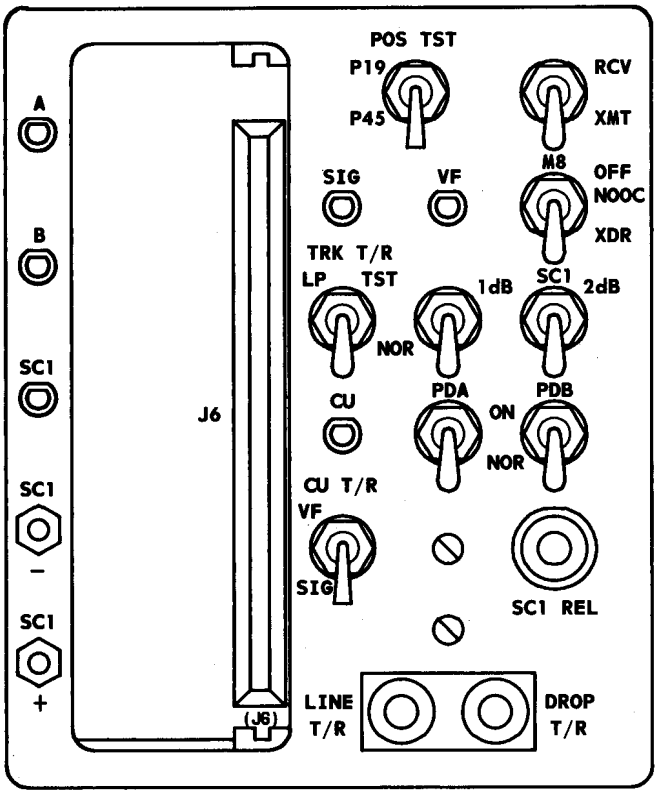

Fig. 3—D4/ES3 Test Extender Faceplate

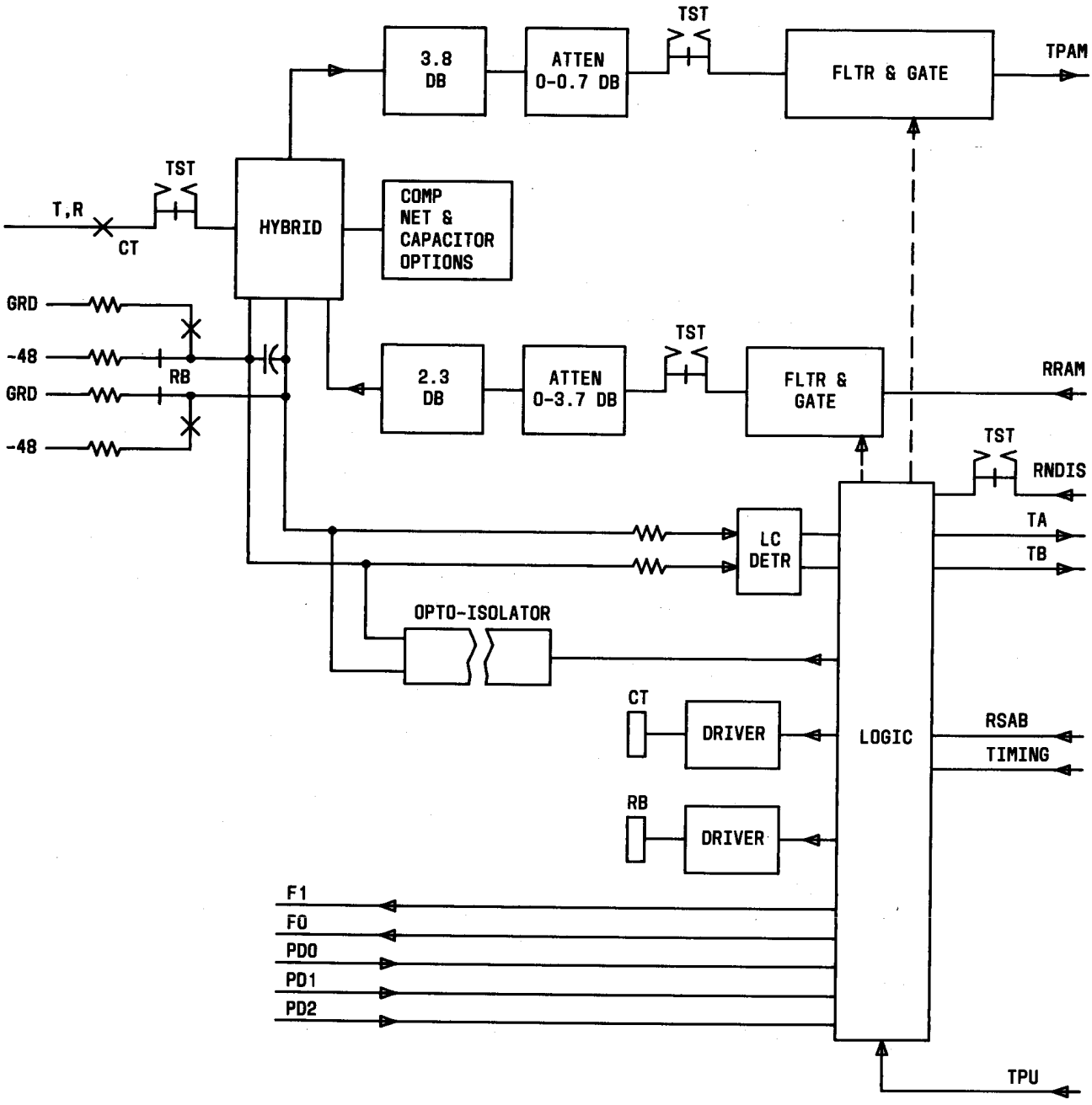

Fig. 4—Block Diagram, ES20 Unit

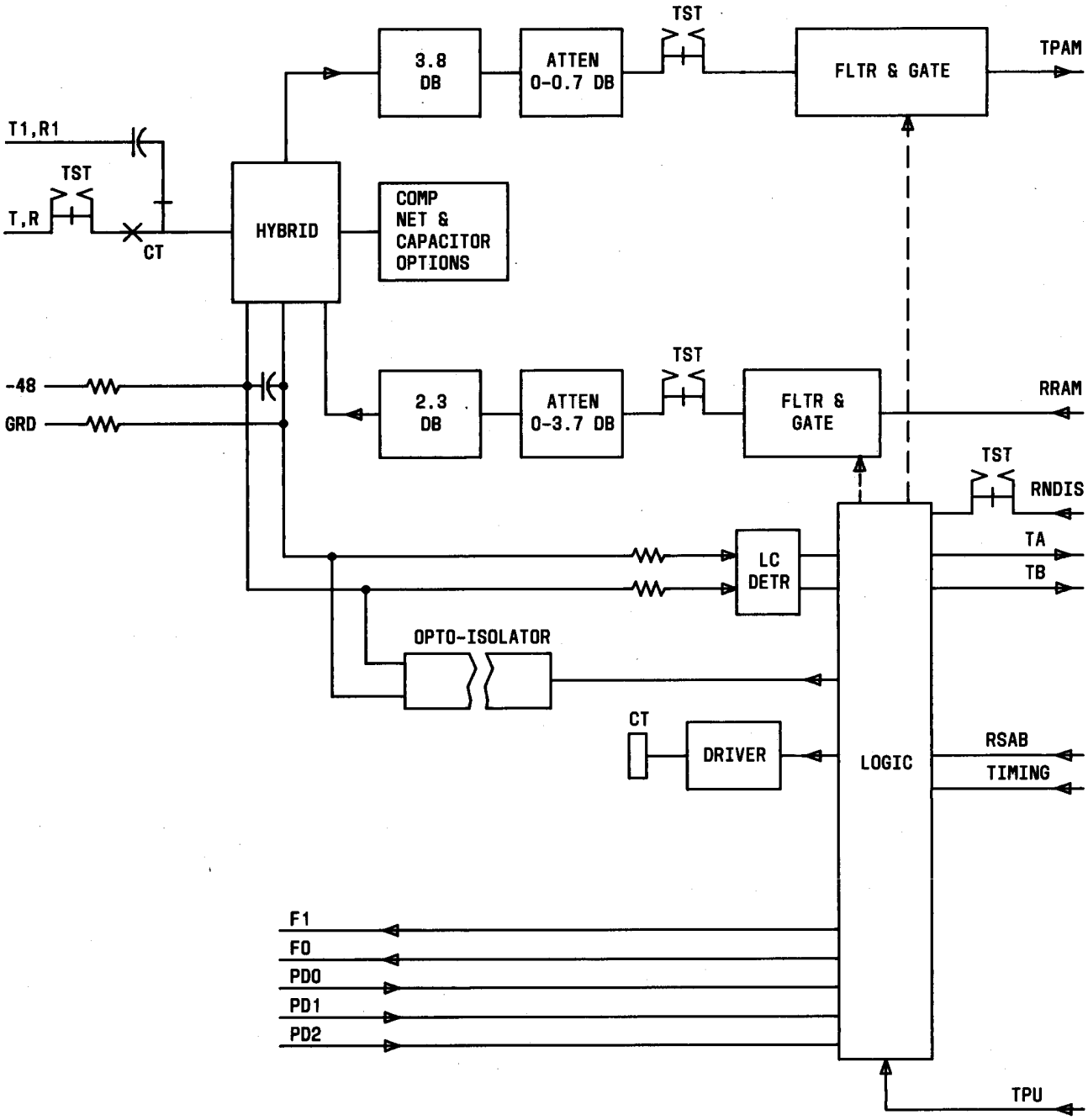

Fig. 5—Block Diagram, ES2T Unit

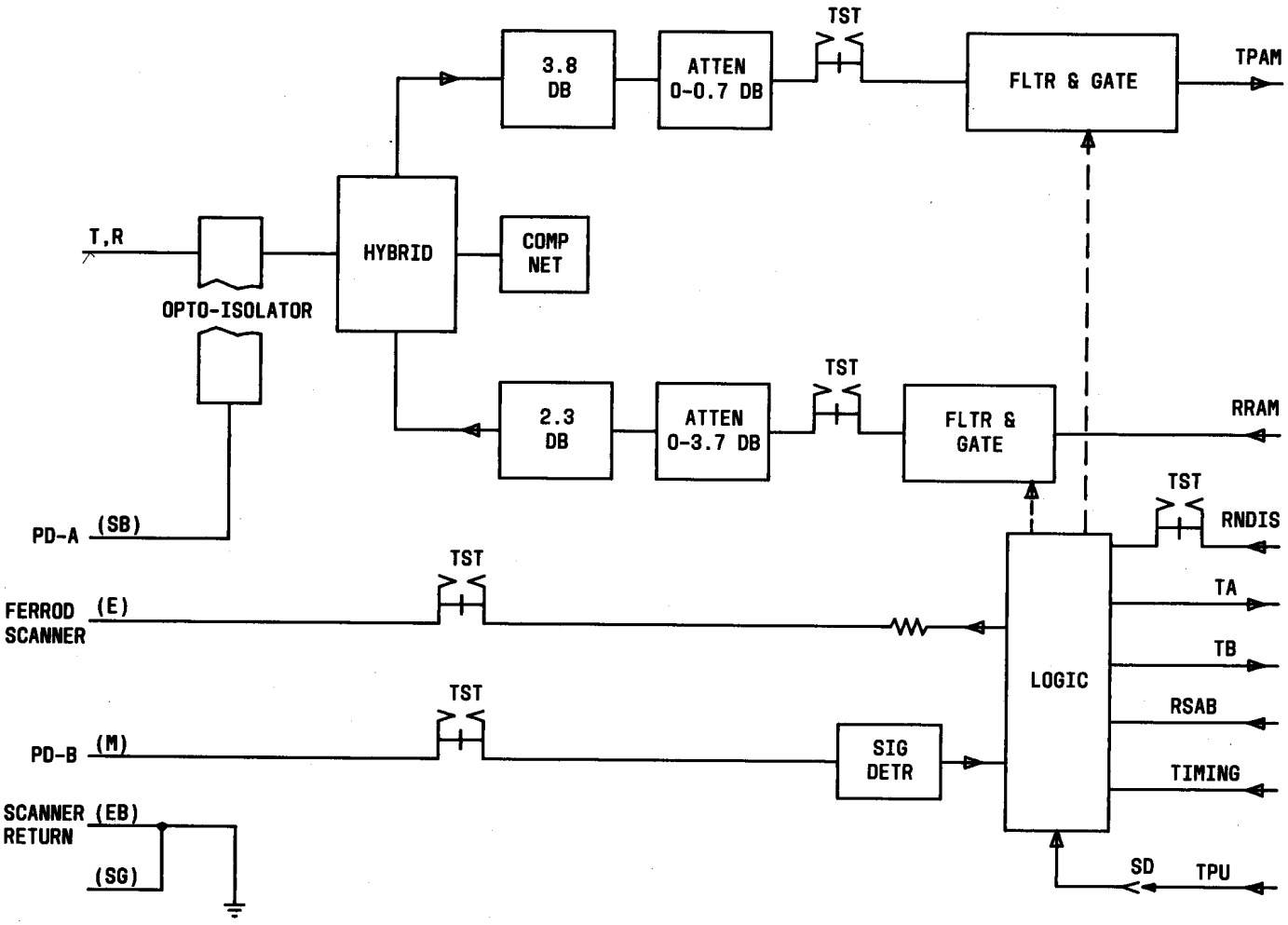

Fig. 6—Block Diagram, ES3 Unit