DIGITAL DATA SYSTEM
550A-TYPE CHANNEL SERVICE UNIT
DESCRIPTION

CONTENTS PAGE

1. GENERAL

1.01 This section contains physical and functional descriptions of the 550A-type channel service unit (CSU). Information pertaining to the associated customer-provided equipment (CPE) is not given. However, descriptions of interface signals and customer options are provided.

1.02 This section is reissued to include information on multiple mounting installations and a change in option designation. Since this revision constitutes a general revision, arrows ordinarily used to denote changes have been omitted.

1.03 The CSU is used only on the digital data system (DDS) and is primarily intended for full-duplex operation in 4-wire applications. It provides the CPE with access to the synchronous DDS while providing maintenance testing capability for the DDS with equalization and loop loss. For additional information, refer to the section entitled Digital Data System—Private Line Service—Overall Description (314-900-100). In order to interface with the CSU, the CPE must provide clock recovery and generate and detect DDS network control codes. The CSU accepts serial data in modified bipolar format from the CPE and transmits it over the local pair to the serving central office. Serial, modified bipolar signals are received by the CSU from the serving central office via the local cable pair and transmitted to the CPE. All transmission on the local channel is at the service bit rate.

1.04 The CSU provides a customer interface consisting of the following six leads:

- Two leads, status indicator and ground, which conform electrically to Electronic Industries Association (EIA) Standard RS-232-C. The status indicator (SI) lead is a control lead and the ground (GRD) lead provides ground return for the SI lead.

- Four data leads, DT, DR, DT1, and DR1. These leads provide a balanced, 135-ohm interface but do not conform to EIA standards.

1.05 The 550A-type CSU is apparatus-coded with respect to customer data rates as follows:

- 550A-L1/2—operates at 2.4 kb/s
- 550A-L1/3—operates at 4.8 kb/s
- 550A-L1/4—operates at 9.6 kb/s
- 550A-L1/5—operates at 56 kb/s.

2. PHYSICAL DESCRIPTION

2.01 The 550A-type CSU (Fig. 1) consists of a housing, power unit, and two circuit packs (CPs) interconnected by a flexible cable harness. The CPs are mounted in a gray plastic housing with a black plastic snap-on cover.

2.02 The CSU is approximately 8 inches wide, 5 inches high, and 2-3/4 inches deep; it weighs approximately 3-1/2 pounds.

2.03 The CSU will operate in an environment of +40 to +120°F with a relative humidity of less than 95 percent.

2.04 Power requirements for the self-contained 96A power unit are 105 to 129 volts ac at 57 to 63 Hz. The CSU is equipped with a 3-foot, 3-conductor power cord for connection to a customer-provided ac outlet which is not under control of a switch.

2.05 Two light-emitting diode (LED) indicators are visible through the CSU cover and have the following designations: TST, PWR.

2.06 For customer locations where access to the customer interface connector is restricted, the CSU may be mounted with the power cord and interface connector on either the right or left side. After mounting, the cover is replaced so that the lettering is right side up.

2.07 The CSU may be adapted for multiple installation. In the event that a multiple installation is required, refer to Section 595-100-200, 550A-Type Channel Service Unit—Installation.

2.08 Each CSU list code contains an HR-type transmitter CP and an HR-type receiver CP with speed sensitive circuits. The CSU list codes, with corresponding bit rates and HR-type transmitter and receiver CPs, are given in Table A.

2.09 All customer interface leads of the CSU are terminated in a 15-pin female connector. CPE to be used with the CSU must be equipped with a cable terminated in a CINCH DAMA-15-P plug (or equivalent).

2.10 The fixed line build-out (FLBO) network is located on the receiver CP and is switched into or out of the circuit (see 3.16) by means of switch S1 as shown in Fig. 2.

2.11 The signal ground option (see 3.15) screw switch (S2) is also located on the receiver CP as shown in Fig. 3.

3. FUNCTIONAL DESCRIPTION

3.01 This part contains a brief functional description of the CSU transmitting and receiving circuitry. Descriptions of the interface leads and CSU options are also provided.

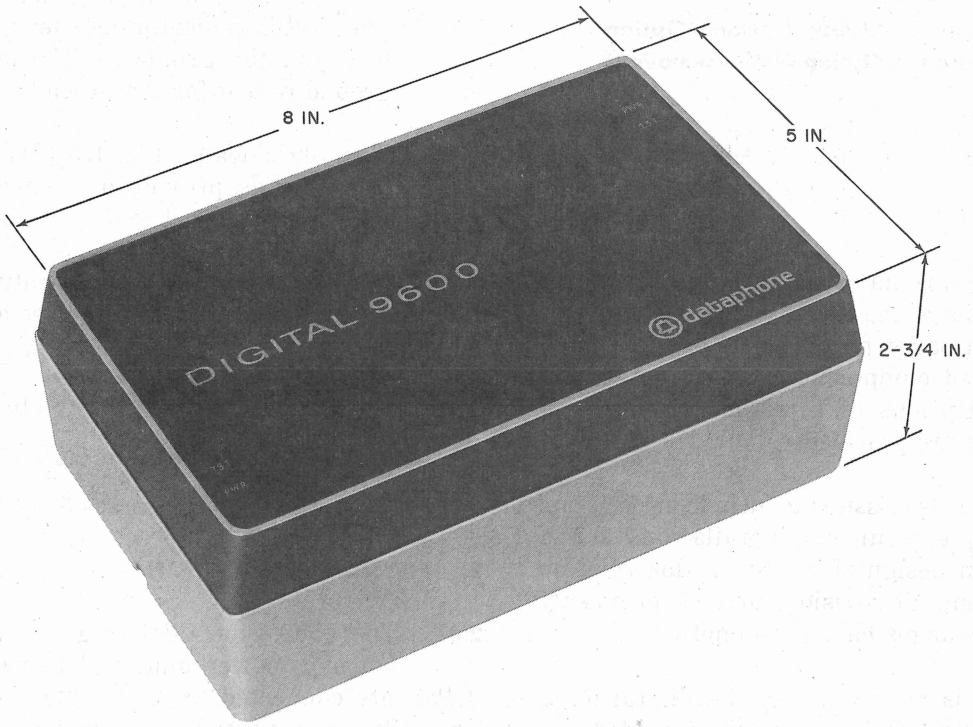

Fig. 1—550A-Type Channel Service Unit

TABLE A

CSU SERVICE BIT RATE AND CIRCUIT PACKS

CSU LIST CODE	SERVICE BIT RATE	TRANSMITTER CP	RECEIVER CP
550A-L1/2	2.4 kb/s	HR1	HR5
550A-L1/3	4.8 kb/s	HR2	HR6
550A-L1/4	9.6 kb/s	HR3	HR7
550A-L1/5	56 kb/s	HR4	HR8

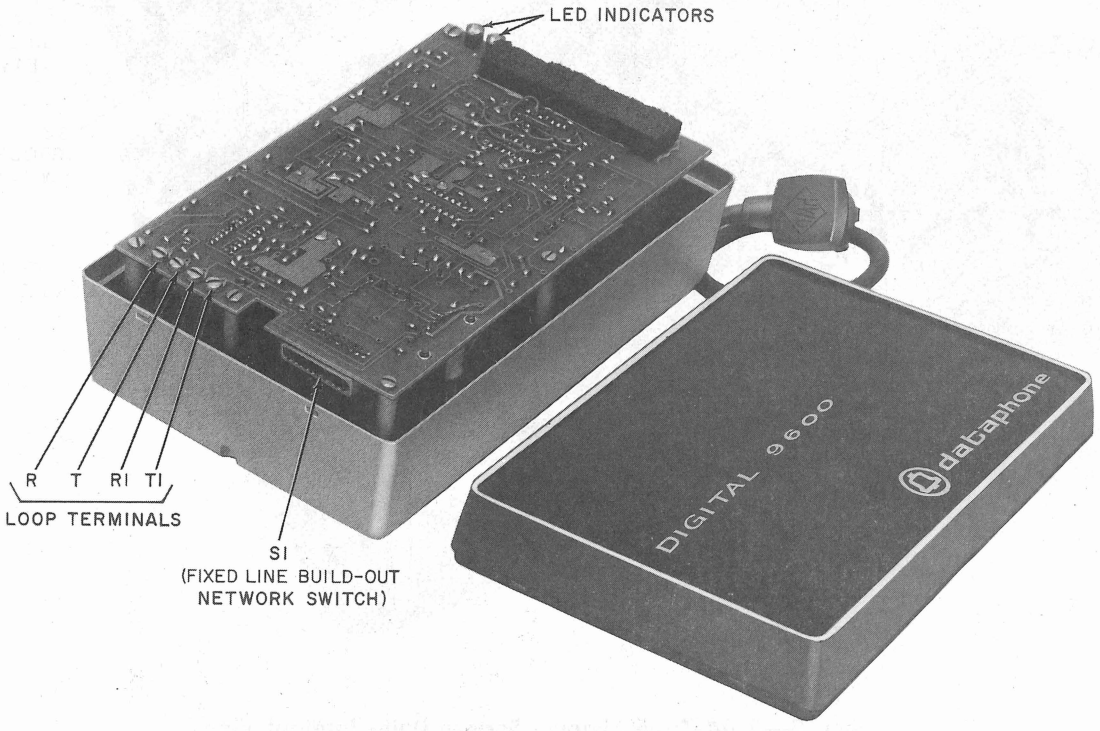

Fig. 2—550A-Type Channel Service Unit—Cover Removed

3.02 The 550A-type CSU provides for full-duplex transmission of data, in modified bipolar format, over local transmission facilities. In normal bipolar format, a binary zero is transmitted as zero volts and a binary one is transmitted as either a positive or negative pulse opposite in polarity to the previous binary one. The DDS modifies this format so that network control codes incorporate bipolar violations where two successive ones have the same polarity. To avoid dc buildup on the line, each bipolar violation has a polarity opposite that of the previous violation, thus making the sum of the signal voltages equal to zero.

A. Transmitter

3.03 Refer to Fig. 4 for a functional block diagram of the 550A-type CSU. The transmitter consists of a bipolar terminator and a line driver. Bipolar customer data of nominal 1.4 volts peak amplitude at 135-ohm termination is applied to DT1 and DR1. The bipolar pulses pass through the normally closed loop-back relay contacts and are transformer coupled to the bipolar terminator. The data signals are sliced, restored to a controlled ± 1.4 volt transmission level, and applied to a low-pass transmit filter. The filter prevents the

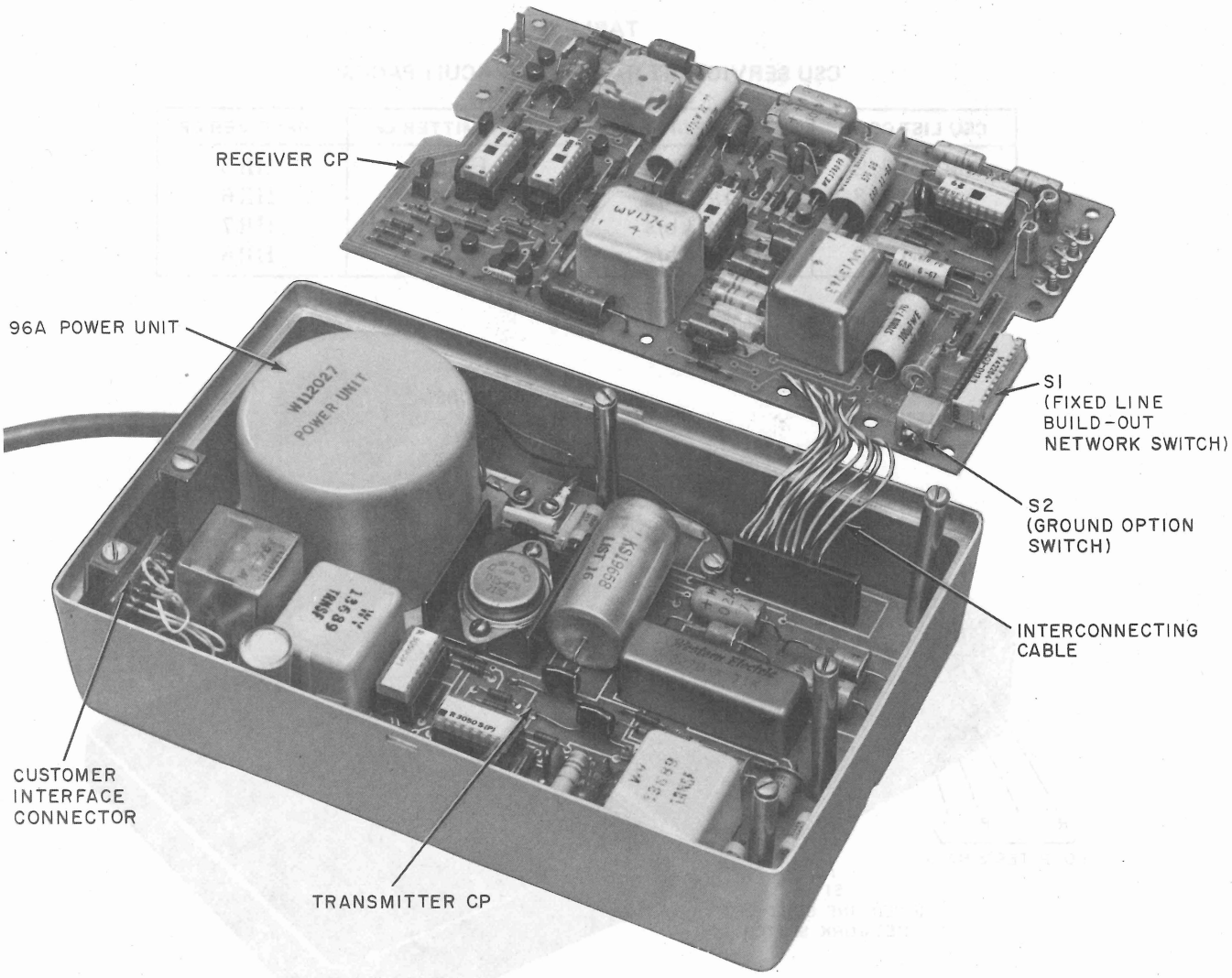

Fig. 3—550A-Type Channel Service Unit—Internal View

transmission of unnecessary high-frequency energy over the channel. From the filter, the data signals are amplified and transformer coupled to the local cable pairs of the local channel.

B. Receiver

3.04 The CSU receiver consists of a switch selectable FLBO network, a multistage amplifier, a slicer, and a bipolar driver. The amplifier includes line equalization and an automatic line build-out (ALBO) network. The receiver functions will be discussed in reverse order to simulate signal flow.

3.05 Since local cable pairs may vary in length and gauge, an ALBO network is provided to compensate for these variations. The ALBO network automatically inserts attenuation which varies with frequency in order to make the net transmission loss simulate a maximum length of local cable pairs. Because the range of adjustment provided by the ALBO network is limited, a switch-selectable FLBO network is needed. The FLBO network provides additional loss in cases where cable pairs have such a low transmission loss that the ALBO network cannot insert enough attenuation to simulate a maximum length of local cable pairs.

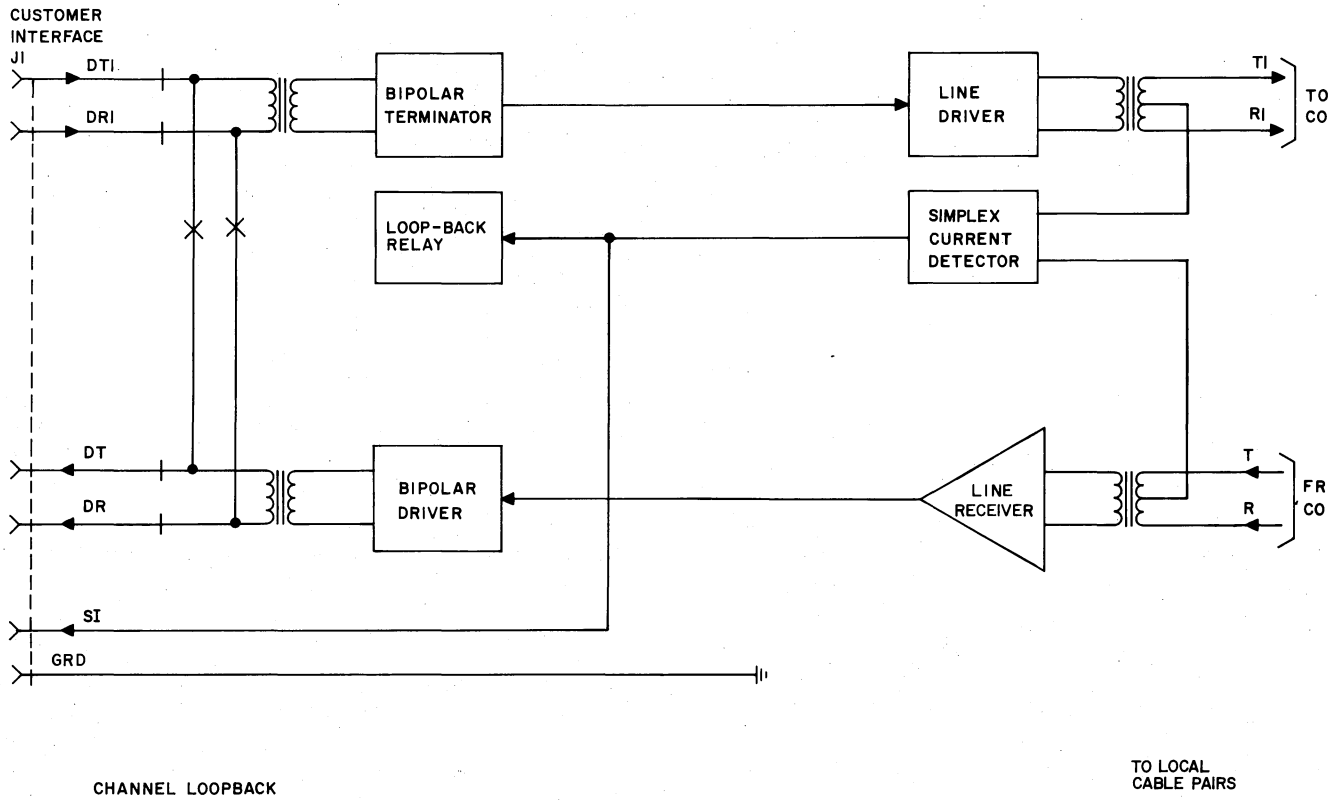

Fig. 4—550A-Type CSU Functional Block Diagram

3.06 The amplifier provides gain and frequency compensation to equalize the loss of a maximum length cable pair. The combination of the AGC and line build-out network provides equalization for a cable loss characteristic which is the average of the loss characteristics of standard cable pair gauges (19 through 22).

3.07 The slicer establishes a reference level for the signal input to the bipolar driver. The data signals are converted to controlled amplitude pulses before being transformer coupled to DT and DR interface leads.

C. Simplex Current Detector

3.08 Reversal of the local channel simplex current by the Office Channel Unit (OCU) will operate a polarity-sensitive relay circuit (located on the transmitter CP) wired between the center taps of the transmit and receive transformers. Operation of this relay will cause a loop-back of the local channel at the customer interface and simultaneously disconnect the CPE. Functionally, this is the remote CHAN loop-back which is controlled by the serving test center (STC).

D. Interface Leads

3.09 The 550A-type CSU is provided with six interface leads for connection to the CPE. These leads and corresponding pin numbers are given in Table B.

3.10 ***Transmitted Data (DT1 and DR1):*** The direction of signal flow on these leads is from the CPE to the CSU. The balanced, modified bipolar data signals on these leads are generated by the CPE for transmission to the distant CPE. The CSU will transmit data only if the SI interface lead presents a positive voltage to the CPE.

3.11 ***Received Data (DT and DR):*** The direction of signal flow on these leads is from the CSU to the CPE. Balanced, modified bipolar data signals are presented to the CPE. The customer

TABLE B

550A-TYPE CSU INTERFACE

INTERFACE PIN NO.	550A-TYPE CSU LEAD	DESIG-NATION
1	Ground	GRD
2	Status Indicator	SI
3	Received Data	DT
4	Received Data	DR
5	Transmitted Data	DT1
6	Transmitted Data	DR1
7-15	Not Used	

is responsible for extracting timing, detecting DDS network control codes, and processing the data.

3.12 ***Status Indicator (SI):*** The direction of signal flow on this lead is from the CSU to the CPE. The SI lead conforms to the electrical characteristics of EIA Standard RS-232-C. When the CSU is connected to ac power and is not in a test mode, a positive voltage is present on the SI lead. A negative voltage on the SI lead indicates to the CPE that the CSU is in the remote test mode (CHAN loop-back) and data cannot be transmitted or received. If no voltage is present, either a power OFF or CSU malfunction is indicated.

3.13 ***Signal Ground (GRD):*** This lead provides a ground return for the SI interface lead. The GRD lead may be optionally disconnected (3.15) from frame ground which is provided through the CSU power cord, local codes permitting.

E. LED Indicators

3.14 Two LEDs are located on the receiver circuit board and give the following indications:

- PWR—This LED is illuminated when ac power is supplied to the CSU and 8.2 volts dc is available from the 96A power unit.
- TST—This LED is illuminated when the STC has remotely looped the CSU interface for testing.

F. Signal Ground Option (Option YK—Connected, Option YL—Disconnected)

3.15 The factory-installed signal ground option (option YK) internally connects signal ground to frame ground. This may be removed (option YL) on customer request subject to local noise conditions, ground potentials, and local safety regulations.

G. Fixed Line Build-Out Option (Option WV—Installed, Option WW—Removed)

3.16 The CSU is provided with an FLBO network (option WV) which must be switched into or out of the circuit by the telephone company (telco) employee on initial installation of the CSU. If the ALBO network cannot compensate for local loop loss, the FLBO network must be switched into the circuit to provide additional attenuation. Installation or removal of this option will be specified on the circuit layout record card by the circuit design engineer.

4. REFERENCES

4.01 Documents listed in this section contain information pertaining to the 550A-type CSU.

4.02 The following Bell System Practices are listed for reference.

SECTION	TITLE
314-410-310	Digital Data System—Private Line Local Channel—Trouble Analysis
314-410-510	Digital Data System—Private Line Local Channel—Tests and Requirements
314-900-100	Digital Data System—Private Line Service—Overall Description
314-900-300	Digital Data System—Private Line Service—Overall Maintenance

SECTION	TITLE
314-901-300	Digital Data System—Serving Test Center—Private Line Circuit—Maintenance Procedures
590-102-139	48A1 Data Mounting—Identification
595-100-150	Digital Data System—550A-Type Channel Service Unit—Test Access Arrangement
595-100-180	Digital Data System—550A-Type Channel Service Unit (CSU)—Summarizing Specification
595-100-200	Digital Data System—550A-Type Channel Service Unit—Installation and Connections
595-100-300	Digital Data System—550A-Type Channel Service Unit—Maintenance
595-100-500	Digital Data System—550A-Type Channel Service Unit Test Procedures
880-601-115	Digital Data System—Local Loops—Engineering Guidelines

4.03 The following technical reference contains descriptive information pertinent to the DDS.

PUB. 41021	Digital Data System—Description and Channel Interface Specifications

4.04 Additional detailed information pertaining to the 550A-type CSU is contained in CD- and SD-1D234-01.