

150A CHANNEL SERVICE UNIT

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

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- Balanced termination
- Signal level adjustment
- Dc isolation between the station equipment and the telephone facilities.

1. GENERAL

1.01 This section contains descriptive information and procedures required for installing and maintaining the 150A channel service unit (CSU) (Fig. 1).

1.02 This section is reissued to reflect a change in the level requirements for a polled network service. Since this reissue constitutes a general revision, arrows normally used to denote changes have been omitted.

1.03 The 150A CSU is a passive device which provides a 2-wire interface between voiceband data station equipment and a 2-wire private line (PL) service or polled network service such as the DATAPHONE® Select-A-Station and the Transaction Network.

1.04 The 150A CSU provides the following:

- 2-way transmission path
- 2-way protection against hazardous voltages
- 2-way current surge protection

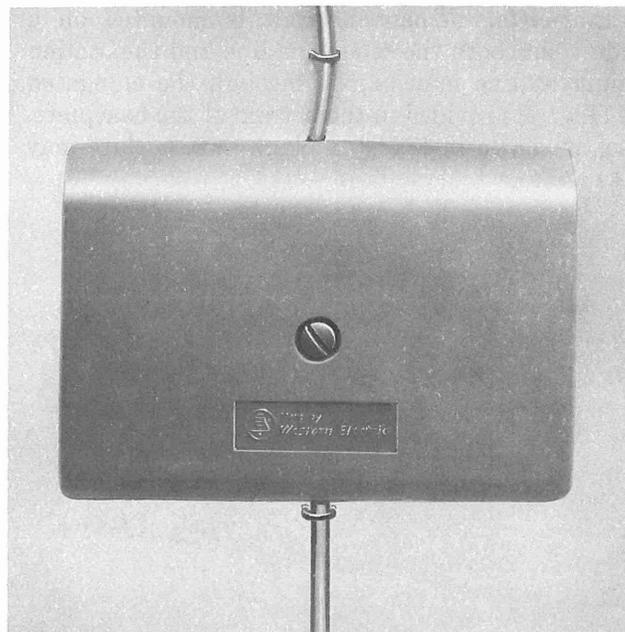


Fig. 1—Typical Installation of a 150A CSU

2. DESCRIPTION

A. Physical Description

2.01 The 150A CSU, when assembled, is 4 inches long, 2.75 inches wide, 1.6 inches high, and weighs 6 ounces. The CSU consists of a metal baseplate, a light gray plastic cover with center captive screw, and a printed wiring board (PWB). Two keyhole slots (Fig. 2) are provided in the baseplate for mounting the unit to a wall, a standard

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conduit box (Fig. 3), or other flat surface. The light gray plastic cover of the CSU is made of flame retardant plastic and should not be interchanged with other covers (ivory or light olive gray) which may not have flame retardant characteristics.

2.02 Two cutouts (Fig. 2) are provided in the sides of the baseplate to accommodate the telephone line and the station equipment line. Although not shown in Fig. 2, metal tabs and slots are provided in the baseplate next to these cutouts. These metal tabs, together with the plastic cover, provide a means to secure T- or L-type strain reliefs. The slots can be used to secure J-type strain reliefs. When the unit is mounted on a conduit box, both the telephone line and the station equipment line may be fed through the elongated slot (Fig. 2) provided in the bottom of the baseplate. Also, as shown in Fig. 3, a blank switch plate may

be provided by the customer. This blank switch plate must have two mounting holes on 3-9/32 inch centers and a large hole (1/2-inch or more in diameter) in the center to permit routing of the wiring. If it becomes necessary to remove or replace the wiring in the conduit box, telephone company (telco) assistance will be required.

2.03 The two screws for mounting the baseplate to the mounting surface are *not* packaged with the CSU. When a conduit box is used (without a blank switch plate), two 6-32 by 3/8 inch round-head screws, or equivalent, furnished by the customer should be used. When a blank switch plate is used with the conduit box, the screws are normally included with the blank switch plate. In other cases, local procedures should be followed in selecting the screws to be used.

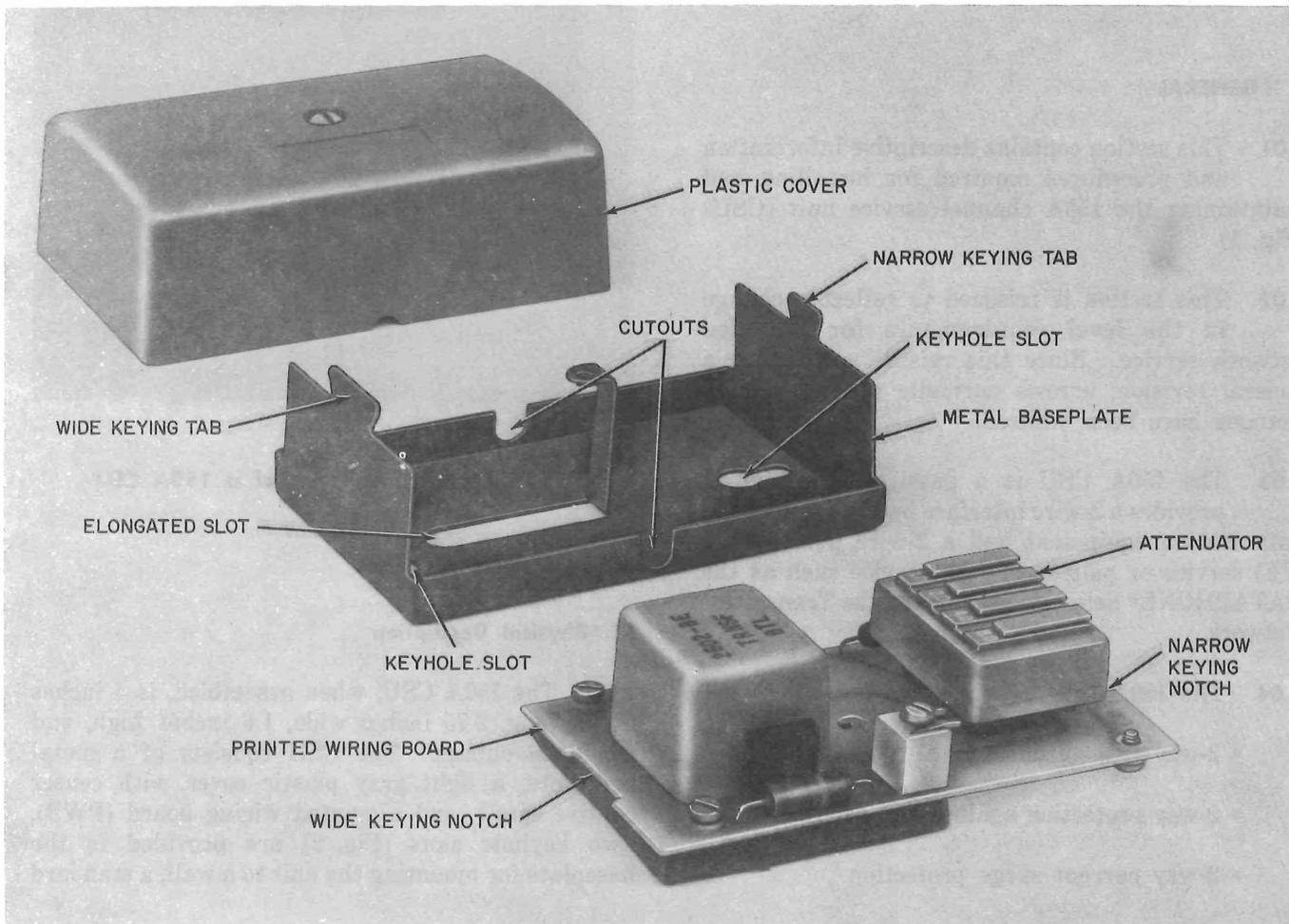


Fig. 2—Disassembled 150A CSU

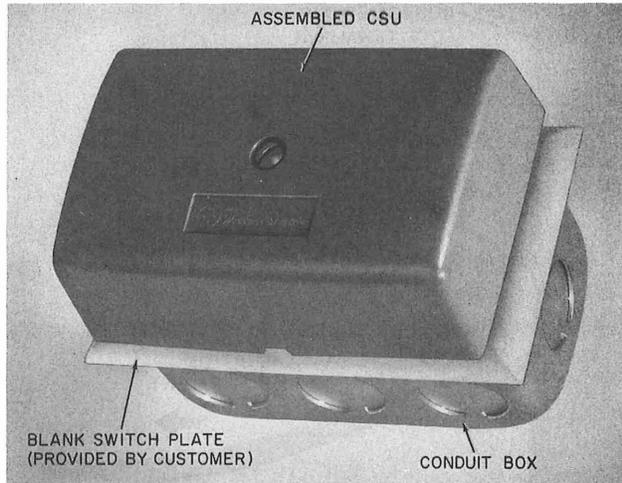


Fig. 3—CSU Mounted on Standard Conduit Box

2.04 Two screw terminals (size No. 4 screws) are provided on the component side of the PWB for connecting the telephone line, and two screw terminals (size No. 4 screws) are provided on the printed wiring side of the PWB for connecting the station line.

2.05 The PWB is secured to the baseplate by mating two keying notches (one in each end) with the two keying tabs on the baseplate (Fig. 2). The wide keying notch in the PWB mates with the wide tab on the baseplate; therefore, the PWB cannot be installed in the baseplate rotated 180 degrees end-to-end. This ensures that proper lead dress will be maintained when the PWB is inserted in the baseplate.

2.06 The PWB can be inserted in the baseplate by placing one of the keying notches in the PWB in the proper keying tab on the baseplate while pulling out on the other tab, permitting the PWB to be snapped into place. The process is reversed for removing the PWB. The PWB is installed in the baseplate with only the customer tip (CT) and customer ring (CR) terminals accessible with cover removed (Fig. 4). However, the PWB can be *temporarily* inserted in the baseplate with the tip (T) and ring (R) terminals accessible during installation and maintenance (Fig. 5).

2.07 The 150A CSU is designed to operate over an ambient temperature range of 0 to 120°F with a maximum relative humidity of 95 percent.

B. Functional Description

2.08 General: The 150A CSU is a passive unit designed to provide an interface between 2-wire voiceband data equipment and a 2-wire PL service or a polled network service. The CSU (Fig. 6) consists of an isolation transformer (T1), attenuator AT1, resistors R1 through R3, and diodes CR1 and CR2, to provide a balanced termination, current surge protection, hazardous voltage protection, dc isolation, and signal level adjustment. In addition, capacitor C1 and switch S1 are provided to aid in installation and maintenance of the CSU in a polled network service.

2.09 Detailed Description: Resistors R1 and R2 are used to limit possible current surges applied to the T and R terminals of the CSU from the telephone line. Resistor R3, which acts as a fuse, is used for protection against high currents which might be applied to the CT and CR terminals of the CSU.

2.10 Zener diodes CR1 and CR2 provide protection against hazardous voltages applied across the T and R terminals and across the CT and CR terminals of the CSU, respectively. CR1 and CR2 are designed to break down at a voltage of between 8.2 and 9 volts. The maximum voltage that can appear between the T and R terminals or between the CR and TR terminals is limited to the breakdown voltage of the diodes CR1 and CR2, respectively (8.2 to 9 volts).

2.11 Transformer T1 provides longitudinal balance, longitudinal voltage isolation, and isolation between the telephone line and the customer equipment. The transformation ratio of transformer T1 is 1:1. The CSU presents a fixed dc termination of 86 ohms between the telephone line (T and R) terminals. This termination is not affected by the equipment connected to the CT and CR terminals. A metallic sealing current of up to 30 mA may be used on the telephone line. The station equipment should not cause more than 1 mA of current to flow between the CT and CR terminals.

2.12 Attenuator AT1 is provided to reduce the input signal applied across the CT and CR terminals of the CSU to the correct level at the central office (CO). The loss through the CSU can be varied in 1-dB steps from 1.2 to 16.2 dB by a combination of switch settings. The insertion loss of the CSU at 1 kHz with the attenuator set

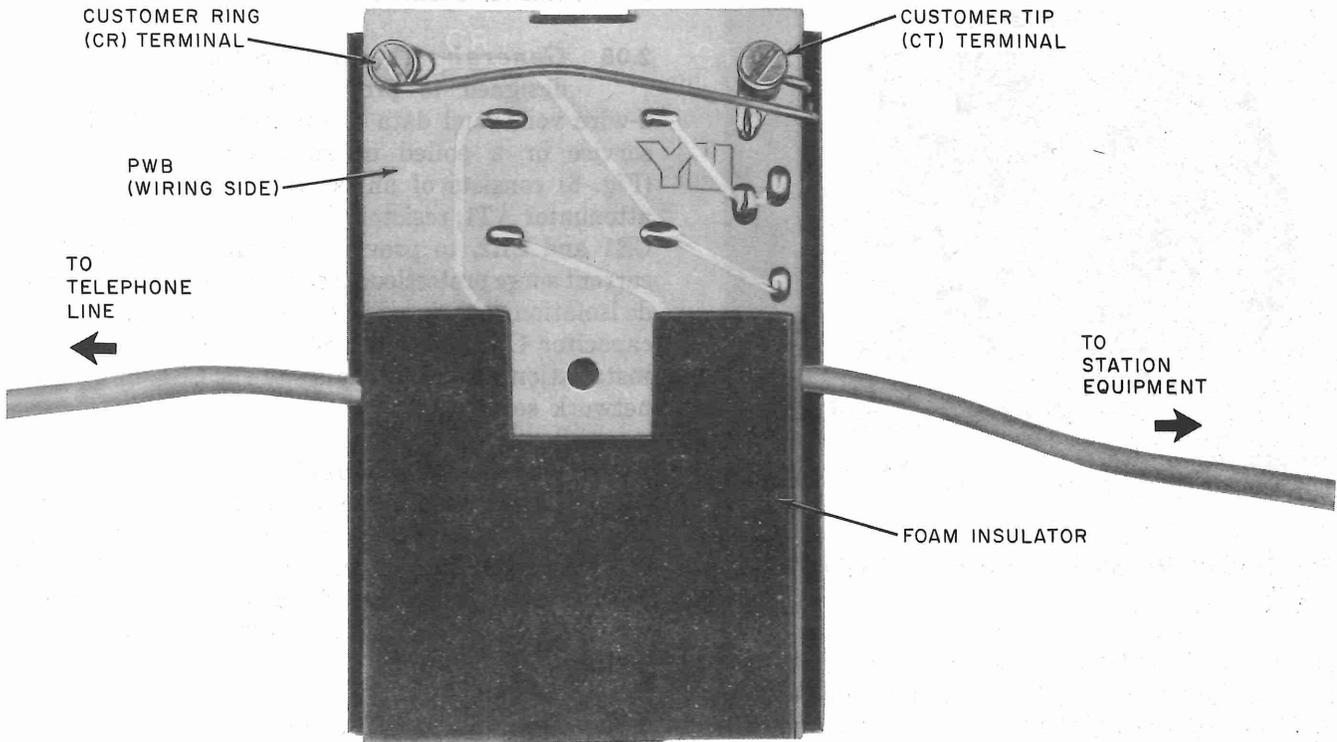


Fig. 4—150A CSU With PWB Inserted for Normal Operation

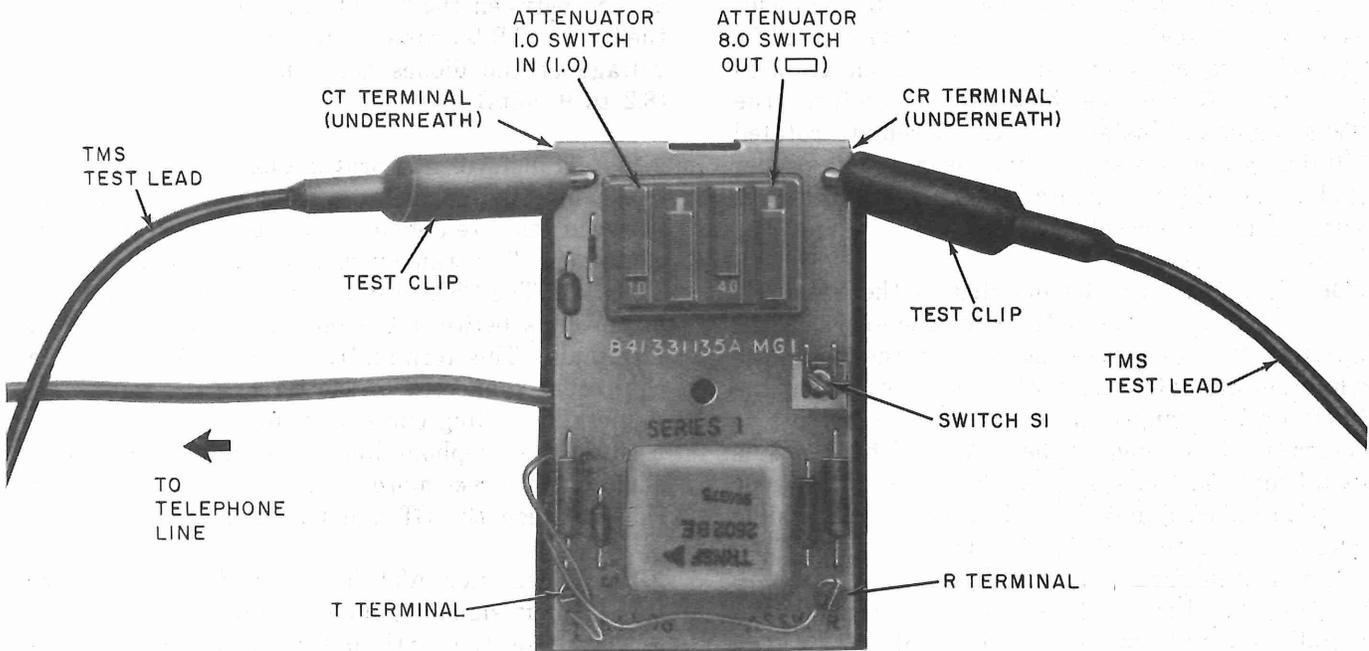


Fig. 5—150A CSU With PWB Inserted for Maintenance

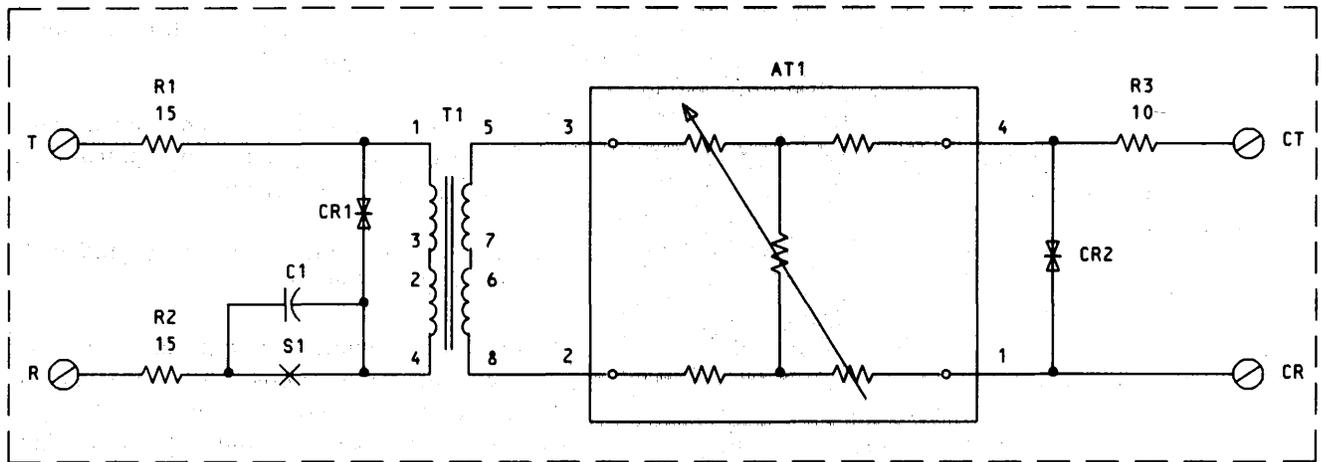


Fig. 6—CSU Schematic Diagram

to 0 dB is 1.2 dB when the source impedance and load impedance are 600 ohms. The total loss through the CSU is the value of the attenuator setting plus 1.2 dB. The attenuation is set by the telco employee during installation and maintenance visits. The impedance of attenuator AT1 is 600 ohms. The station equipment should present a nominal impedance of 600 ohms at voiceband frequencies between the CT and CR terminals.

2.13 Capacitor C1 is provided to block dc current in the T-to-R circuit of the CSU when S1 is open. In normal operation S1 is closed, shorting capacitor C1, thus providing a dc path through the T-to-R circuit. This feature (the combination C1 and S1) is utilized in the polled network service **only**, to operate control circuitry at the CO to connect a 1-kHz tone to the telephone line for installation or maintenance testing at the CSU. This feature **cannot** be used in the 2-wire PL service and S1 **must** remain closed for normal operation. To obtain a 1-kHz tone for 2-wire PL service, the installer uses a nearby telephone to make a request in accordance with local procedures.

3. INSTALLATION AND ADJUSTMENTS

3.01 The installation of the 150A CSU should comply with general practices to ensure orderly station arrangement and must be located within the range of the station equipment line.



(1) All installation connections and tests must be performed prior to connecting station equipment to the CSU.

(2) The polled network service may have 48 Vdc applied to the telephone line at the central office.

3.02 The CSU is mounted on a wall or other surface or, where provided by the customer, a standard conduit box. When a conduit box is used, the customer equipment line and telephone line must have been run to the conduit box prior to installing the CSU. This is necessary in order to enable the telco employee to route the wiring through the elongated slot in the baseplate of the CSU.



A Northeast 4BNH or 37BAQ transmission measuring set (TMS), or a Wilcom T105B reference level test set, or equivalent (input impedance: 600 ohms; range: 0 to -45 dBm; frequency: 1-kHz), is required to perform the installation adjustments.

Note: The 3A noise measuring set can be used for installation adjustments; however, a conversion from dBrn0 to dBm0 is required. To convert dBrn0 to dBm0, subtract 90 from the dBrn0 indication. For example, if indication is 61 dBrn

(61 -90) = -29 dBm.

3.03 Install the 150A CSU as follows.

- (1) On the CSU, loosen the captive screw located in the center of the plastic cover and remove the cover. (Do not remove screw from cover which is to be reused on same unit.)
- (2) Remove the PWB from the baseplate by pressing outward on one of the two metal tabs of the baseplate.



Do not remove the foam insulator (Fig. 4) from the PWB. This insulator is provided to prevent contact with the telephone line printed wiring circuits.

- (3) If a conduit box is used, label the T, R, CT, and CR leads so they can be identified after the CSU baseplate and PWB have been installed. If a conduit box is *not* used, proceed to Step (5).
- (4) Route the wiring from the telephone line and the customer equipment through the elongated slot (Fig. 2) in the baseplate.
- (5) Position the baseplate against the mounting surface at the correct location for the CSU. Secure the baseplate in place with two screws through the two keyhole slots provided (Fig. 2). (See 2.03 concerning screws to be used.)
- (6) Temporarily insert the PWB in the baseplate with the T and R terminals and the attenuator switches accessible (Fig. 5).
- (7) Using an ohmmeter, ensure that switch S1 on the PWB is closed before proceeding. (Screw switch S1 is shipped in the closed position.) A reading of approximately 86 ohms between the T and R terminals indicates that S1 is closed.



Refer to Fig. 5 for routing of telephone line T and R leads before performing Step (8).

- (8) Leaving enough wire length for the PWB to be repositioned so that the CT and CR terminals are accessible (Fig. 4), connect the T

and R leads from the telephone line to the T and R terminals on the PWB.

Note: If a conduit box is *not* used, route the D station wire through the appropriate cutout (Fig. 2) in the baseplate.

- (9) Set attenuator switches 1, 2, 4, and 8 to the OUT (☐) position.

Note: An attenuator switch is in the IN position when the number (1.0, 2.0, 4.0, or 8.0) is visible. A switch is in the OUT (☐) position when the number is completely covered. Detents in both positions (IN and OUT) can be felt when the attenuator switches are operated. In setting the attenuator switches, ensure that all switches are moved all the way in the appropriate direction and engaged in the detent. Do not set any switch in the slight detent found in the approximate center position of the switch travel.

- (10) For a 2-wire PL service, proceed to Step (11). For a polled network service (see note), proceed to Step (18).

Note: Certain polled network services use nonmetallic facilities such as T-carrier on remote office facilities which preclude the use of switch S1 for obtaining and releasing the special service lineup tone. In these instances, proceed to Step (11).

- (11) If the desired loss of the CSU is specified on service order, obtain switch settings from Table A and proceed to Step (12). If the expected measured loss (EML) of the loop including CSU is specified on service order, proceed to Step (13).
- (12) Set attenuator switches as indicated in Table A, record switch settings on the circuit layout record card (CLRC), and proceed to Step (26).
- (13) Connect the TMS between the CT and CR terminals of the PWB. Set TMS for a 600-ohm terminated measurement.
- (14) Using a nearby telephone, request that the CO 1-kHz, 1-milliwatt tone be placed on the telephone line to the CSU.

TABLE A

CSU ATTENUATOR SWITCH SETTINGS FOR A 2-WIRE PL SERVICE

DESIRED LOSS OF CSU (dB)	CSU ATTENUATOR SWITCHES				ATTENUATOR SETTING (dB) (SEE NOTE)
	1.0 SWITCH POSITION	2.0 SWITCH POSITION	4.0 SWITCH POSITION	8.0 SWITCH POSITION	
0.0 to 1.7	OUT (<input type="checkbox"/>)	0			
1.8 to 2.7	IN (1.0)	OUT (<input type="checkbox"/>)	OUT (<input type="checkbox"/>)	OUT (<input type="checkbox"/>)	1
2.8 to 3.7	OUT (<input type="checkbox"/>)	IN (2.0)	OUT (<input type="checkbox"/>)	OUT (<input type="checkbox"/>)	2
3.8 to 4.7	IN (1.0)	IN (2.0)	OUT (<input type="checkbox"/>)	OUT (<input type="checkbox"/>)	3
4.8 to 5.7	OUT (<input type="checkbox"/>)	OUT (<input type="checkbox"/>)	IN (4.0)	OUT (<input type="checkbox"/>)	4
5.8 to 6.7	IN (1.0)	OUT (<input type="checkbox"/>)	IN (4.0)	OUT (<input type="checkbox"/>)	5
6.8 to 7.7	OUT (<input type="checkbox"/>)	IN (2.0)	IN (4.0)	OUT (<input type="checkbox"/>)	6
7.8 to 8.7	IN (1.0)	IN (2.0)	IN (4.0)	OUT (<input type="checkbox"/>)	7
8.8 to 9.7	OUT (<input type="checkbox"/>)	OUT (<input type="checkbox"/>)	OUT (<input type="checkbox"/>)	IN (8.0)	8
9.8 to 10.7	IN (1.0)	OUT (<input type="checkbox"/>)	OUT (<input type="checkbox"/>)	IN (8.0)	9
10.8 to 11.7	OUT (<input type="checkbox"/>)	IN (2.0)	OUT (<input type="checkbox"/>)	IN (8.0)	10
11.8 to 12.7	IN (1.0)	IN (2.0)	OUT (<input type="checkbox"/>)	IN (8.0)	11
12.8 to 13.7	OUT (<input type="checkbox"/>)	OUT (<input type="checkbox"/>)	IN (4.0)	IN (8.0)	12
13.8 to 14.7	IN (1.0)	OUT (<input type="checkbox"/>)	IN (4.0)	IN (8.0)	13
14.8 to 15.7	OUT (<input type="checkbox"/>)	IN (2.0)	IN (4.0)	IN (8.0)	14
15.8 to 16.7	IN (1.0)	IN (2.0)	IN (4.0)	IN (8.0)	15

Note: The 1 kHz loss through CSU between 600 ohm source and 600 ohm load is equal to attenuator setting plus 1.2 dB.

- (15) Using the TMS, measure in dBm the level of the 1-kHz tone between the CT and CR terminals on the CSU.

Note: If the measured level [with all attenuator switches OUT ()] is more than 0.5 dB below the EML specified on the service order, then the facility is defective or requires redesign. For example, if the EML specified on the service order is -12.0 dBm, -12.6 dBm is more than 0.5 dB below the specified value.

- (16) On the CSU, adjust the attenuator switch settings, as necessary, for a TMS indication of within ± 0.5 dB of the EML specified on the

service order (refer to Table B for a step-by-step procedure, if necessary).

- (17) Using a nearby telephone, request that the CO 1-kHz, 1-milliwatt tone be removed from the telephone line to the CSU. Proceed to Step (22).

- (18) Connect the TMS between the CT and CR terminals of the PWB. Set TMS for a 600-ohm terminated measurement.

- (19) After the telephone line is connected in Step (8) above, allow switch S1 to remain closed for at least 10 seconds before proceeding. While observing the TMS, loosen (about one complete turn) the screw in switch S1 (Fig. 5)

TABLE B

PROCEDURE FOR SETTING CSU ATTENUATOR FOR 2-WIRE PL
OR POLLED NETWORK SERVICE

STEP	PROCEDURE	TMS INDICATION	REQUIRED ACTION
1	Switch 8 dB in.	a. Within ± 0.5 dB of specified value. b. Above upper limit (see Note). c. Below lower limit (see Note).	a. None (Attenuator is set correctly) b. Leave 8 dB in. c. Switch 8 dB out.
2	Switch 4 dB in.	a. Same as 1a. b. Same as 1b. c. Same as 1c.	a. None (Attenuator is set correctly) b. Leave 4 dB in. c. Switch 4 dB out.
3	Switch 2 dB in.	a. Same as 1a. b. Same as 1b. c. Same as 1c.	a. None (Attenuator is set correctly) b. Leave 2 dB in. c. Switch 2 dB out.
4	Switch 1 dB in.	a. Same as 1a. b. Same as 1b. c. Same as 1c.	a. None (Attenuator is set correctly) b. Leave 1 dB in. c. Switch 1 dB out.

Note: For example, if -12.0 dBm is the specified value, -12.6 dBm is below the lower limit of -12.5 dBm and -11.4 dBm is above the upper limit of -11.5 dBm.

on the CSU. An abrupt increase in signal level should be noted (to a level of between -17.5 and -30.5) (see note). Switch S1 is now open and the CO 1-kHz special service lineup tone is on the line to the CSU.

Note: If the special service lineup tone does not appear at the CSU when S1 is open, report to the local test desk (LTD) and await further instructions.

(20) Using the TMS, measure in dBm the signal level of the 1-kHz tone between the CT and CR terminals of the CSU.

(21) On the CSU, adjust the attenuator switches as necessary for a TMS indication of between -29.5 and -30.5 dBm. Refer to Table B

for a step-by-step procedure if necessary. Proceed to Step (22).

(22) Record TMS signal level reading and attenuator switch settings on the CLRC.

(23) For a 2-wire PL service, proceed to Step (25). For a polled network service, proceed to Step (24).

(24) While observing the TMS, tighten the screw in switch S1 on the CSU until an abrupt decrease in signal level is noted. Switch S1 is now closed and the CO 1-kHz special service lineup tone is disconnected from the line to the CSU.

Note: If the special service lineup tone does not disconnect when S1 is closed, report to the LTD and await further instructions.

- (25) Disconnect the TMS from the CT and CR terminals of the CSU.
- (26) Using care not to change attenuator switch settings, reposition the CSU PWB in the baseplate so that the CT and CR terminal screws are accessible (Fig. 4). The telco employee will not connect the customer interface leads to the CSU unless requested by and under the direction of the customer.

Note: For polled network service, follow local procedures in connecting the station equipment to the CT and CR terminals of the CSU.

- (27) Install the plastic cover on the CSU and secure the cover in place with the screw provided.

4. MAINTENANCE PROCEDURES

4.01 The maintenance procedures are provided to assist the telco employee during maintenance visits to a station using a 150A CSU. In all cases, the station equipment line must be disconnected in order to make tests and/or replace a defective CSU. The following precautions must be taken.



(1) For CPE stations, permission to disconnect the customer equipment leads must be obtained from the customer. For polled network service, follow local procedures before disconnecting the station equipment.

(2) Where possible, it is recommended that the power on the station equipment be turned OFF before the CT and CR leads are disconnected.

(3) After all testing is completed and the customer interface leads are reconnected, the customer must be asked to verify that the leads from the customer equipment have been reconnected properly.

4.02 All repair forces should be familiar with the tariff provisions which generally provide for a "maintenance of service charge" for each customer-requested repair visit to a 150A CSU station when the trouble report is closed out as a FOK (found ok), TOK (test ok), or similar clearance.

4.03 When a customer requests such a repair visit and it is subsequently determined that the trouble is **not** in the telephone equipment, the employee must advise the customer and notify the plant service center (PSC) to complete form E-5855 in conformance with Section 660-101-312.

4.04 Maintenance of a 150A CSU station at the customer premises is limited to local testing, testing with serving or test offices, or replacing a defective unit.

Note: Do not attempt individual component repair or replacement on the PWB.

4.05 When a CSU is found to be defective, a new unit is installed and adjusted in accordance with the procedures listed in 3.03.

4.06 If replacing the CSU does not correct the problem, perform a visual inspection of the installation. Correct any trouble found during the inspection. Adjust the CSU attenuator switches (if required) until the signal level requirement of 4.07 (3) is met. If trouble is **not** corrected, inform the LTD and await further instructions.

4.07 To localize and correct the trouble, the employee proceeds as follows.

- (1) On the CSU, loosen the captive screw located in the center of the plastic cover and remove the cover.
- (2) Disconnect the station equipment line from the CT and CR terminals on the CSU.
- (3) Reposition the CSU PWB in the baseplate so that the attenuator switches are accessible (Fig. 5).
- (4) For 2-wire PL service, perform Steps (13), (14), and (15) in 3.03. The TMS reading should be within ± 1 dB of the signal level recorded on the CLRC. For a polled network service, perform Steps (10), (18), (19), and (20)

in 3.03. The TMS reading should be between -29.0 and -31.0 dBm.

Note: Certain polled network services use nonmetallic facilities such as T-carrier on remote office facilities which preclude the use of switch S1 for obtaining and releasing the special service lineup tone. In these instances, proceed as for a 2-wire PL service.

(5) If the TMS reading is within the specified limits, a station equipment fault is possible. Inform the LTD and await further instructions. If the TMS reading is outside specified limits, proceed to Step (6).

(6) Compare the CSU attenuator switch settings with the latest settings listed on the CLRC. If the switch settings agree with latest settings listed on the CLRC, proceed to Step (9). If the switch settings are different from the settings listed on the CLRC, proceed to Step (7).

(7) On the CSU, set the attenuator switches to agree with the latest switch settings listed on the CLRC. The TMS reading should be within ± 1 dB of value recorded on the CLRC.

(8) If the TMS reading is within ± 1 dB of the value recorded on the CLRC, proceed to Step (15). If the TMS reading is **not** within ± 1 dB of value recorded on the CLRC, proceed to Step (9).

(9) While observing the TMS, vary the attenuator switch settings to determine whether the TMS reading tracks the attenuator switch settings (ie, increasing the CSU attenuator switch setting 1.0, 2.0, 4.0, or 8.0 dB causes a corresponding decrease of 1.0, 2.0, 4.0, or 8.0 dB in the TMS reading and vice versa).

(10) If the TMS reading tracks the CSU attenuator switch setting, proceed to Step (11). If the TMS reading does **not** track the attenuator switch setting or if the TMS indicates no (or very low) signal level [with all attenuator switches set to OUT (☐)], proceed to Step (14).

(11) Vary the CSU attenuator switch setting until the requirement in Step (4) is met (refer to Table B for a step-by-step procedure if necessary). When the requirement in Step (4)

is met, proceed to Step (15). If the requirement in Step (4) cannot be met, proceed to Step (12).

(12) Disconnect the telephone line from the T and R terminals on the CSU. Using the TMS, check the loop loss by measuring the level of the 1-kHz tone between the T and R wires of the telephone line. For 2-wire PL service, the minimum permissible level is 1.2 dB above the required signal level at the CO.

Example: Signal level required at the CO
= -12.0 ± 0.5 dBm.

Example: Minimum permissible level for
loop loss check = -12.5 dBm
+ 1.2 dB = -11.3 dBm.

For a polled network service, the minimum permissible level of the 1-kHz tone is -29.4 dBm.

(13) If the loop loss requirement is met, proceed to Step (14). If the loop loss requirement is **not** met, report to the LTD and await further instructions.

(14) Replace the CSU with a new one and adjust it in accordance with the instructions listed in 3.03.

(15) For 2-wire PL service, by visual inspection, ensure that screw switch S1 on the PWB is closed and proceed to Step (16). For polled network service, tighten screw in switch S1 on the PWB until an abrupt decrease in level is noted on the TMS. Switch S1 is now closed and the CO 1-kHz special service lineup tone is disconnected from the line to the CSU.

Note: If the special service lineup tone does not disconnect when S1 is closed, report to the LTD and await further instructions.

(16) Record the attenuator switch settings and the TMS level reading on the CLRC and restore the CSU station to normal.



Use care in repositioning the CSU PWB in the baseplate (so that the CT and CR terminals are accessible) to ensure that the attenuator switch settings are not accidentally changed.

5. REFERENCES

5.01 Detailed information on the 150A CSU is contained in SD- & CD-1D266-01. The following section is listed for reference:

SECTION	TITLE
660-101-312	Maintenance of Service Charge on Services With Customer-Provided Equipment (CPE).