

Addendum To 785-1D and 785-1G Terminating Sets

1. GENERAL

1.01 This addendum is issued to Section 785-101/3 serving notification that the attached schematic diagram 191-0785XX issue 1, has been updated to revision level C.

2. CHANGES

2.01 Changes resulting from revision level C alter the values of capacitors C10,

11, 12, 13 and 14 in the 785-1D and capacitors C12, 13 and 14 in the 785-1G.

2.02 Table 1 lists the changes in capacitor values resulting from revision C.

2.03 The capacitor changes listed above were made to correspond with re-designed transformers.

Table 1. Changes in Capacitor Values

785-1D	Was, in revision B	Is now, in revision C
C10	2.15 uF	2.41 uF
C11	2.15 uF	2.41 uF
C12	4400 pF	4700 uF
C13	4400 pF	4700 uF
C14	.0012 uF	.001 uF
785-1G		
C12	3300 pF	3900 pF
C13	3300 pF	3900 pF
C14	620 pF	.001 uF

785-1D and 785-1G Terminating Sets

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1. GENERAL

1.01 This Section provides circuit description, installation, and basic testing information for the Wescom 785-1D and 785-1G Four-Wire Terminating Sets.

1.02 The 785-1D and 785-1G Terminating Sets (Figure 1) are plug-in, printed circuit modules designed for terminating any four-wire facility requiring a high-grade, coil-type terminating set.

1.03 The 785-1D and 785-1G modules feature XMIT and RCV sockets for use with 89 type plug-in pads. In addition, they include network building out capacitors (NBOC) and a compromise network.

1.04 The 785-1D and 785-1G modules are arranged to mount in either the 19 inch 781 mounting shelf or the 23 inch 782 shelf. The former mounts six modules and the latter, seven.

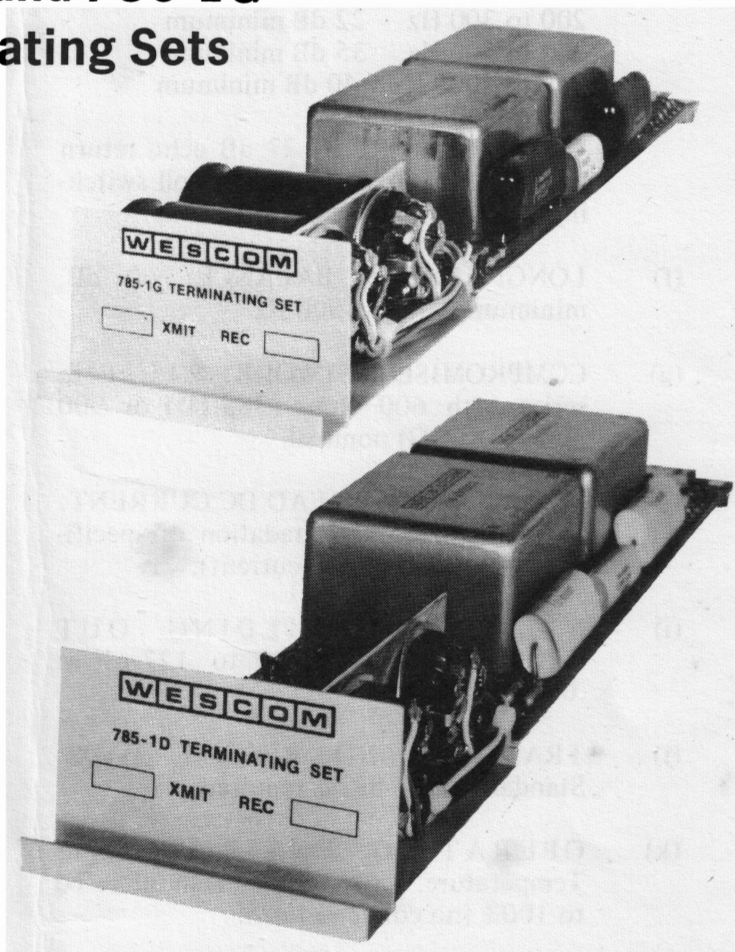


Figure 1. 785-1D and 785-1G Terminating Sets

2. SPECIFICATIONS

2.01 Electrical and physical specifications for the 785-1D and 785-1G modules are as follows:

- (a) TWO-WIRE IMPEDANCE:
785-1D; 600 ohms, nominal
785-1G; 900 ohms, nominal.
- (b) FOUR-WIRE IMPEDANCE: 600 ohms, nominal.
- (c) TRANSHYBRID LOSS: 50 dB, minimum from 300 to 4000 Hz. 45 dB, minimum at 200 Hz.

- (e) RETURN LOSS*: Two-wire drop compared with 600 or 900 ohms $\pm 0.1\%$ in series with $2.15 \mu\text{F} \pm 1.0\%$
- | | |
|----------------|---------------|
| 200 to 300 Hz | 22 dB minimum |
| 300 to 500 Hz | 35 dB minimum |
| 500 to 4000 Hz | 40 dB minimum |

*This hybrid exceeds 27 dB echo return loss requirements for all intertoll switching at class 3 (or higher) offices.

- (f) LONGITUDINAL BALANCE: 60 dB, minimum, 100 to 5000 Hz.
- (g) COMPROMISE NETWORK: $2.15 \mu\text{F}$ in series with 600 ohms (785-1D) or 900 ohms (785-1G) nominal.
- (h) MAXIMUM A & B LEAD DC CURRENT: 120 mA without degradation of specifications (signaling loop current).
- (i) NETWORK BUILDING OUT CAPACITANCE: $.001 \mu\text{F}$ to $.127 \mu\text{F}$ in $.001 \mu\text{F}$ steps.
- (j) TRANSMIT AND RECEIVE PADS: Standard, Type 89, as required.
- (k) OPERATING ENVIRONMENT: Temperature, 35 to 120°F ; Humidity, 10 to 100% (no condensation).
- (l) NON-OPERATING ENVIRONMENT: Temperature, -40° to 150°F ; Humidity, 10 to 100% (including condensation).
- (m) WEIGHT: 2 lbs. 9 oz. approximately.
- (n) DIMENSIONS: 1.65 inches high by 2.80 inches wide by 13 inches in depth.
- (o) MOUNTING: 781 (19 inch) or 782 (23 inch) mounting shelves.

3. INSPECTION

3.01 Inspect the equipment thoroughly, as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately. If the equipment is to be stored for some time before installation, make an operational check at once. The purpose of this

check is to make sure that the equipment is in proper working order when received from the factory. If this check indicates satisfactory performance, the equipment may be stored for future installation. If the system is to be installed at once, make an operational check after the installation is completed.

3.02 Wescom equipment is specifically identified by the model number and final-assembly number silk-screened on the front panel of the plug-in module. At the start of production, the final-assembly number is assigned an issue number of 1 which becomes an integral part of the final-assembly number. After the start of production, this issue number is advanced each time a major engineering change occurs. Therefore, be sure to use the model number and final-assembly number when making inquiries about the equipment. The issue number of the instruction manual and schematic diagram attached should be the same as the issue number assigned to the equipment. If a one-to-one correspondence does not exist between these items, request from Wescom the instruction manual required for your equipment.

4. MOUNTING

4.01 The 785-1D and the 785-1G Term Sets are designed to mount in either the 781 or 782 relay rack mounting shelves. The 781 has a capacity of six modules and the 782 can accommodate seven. The connectors of either shelf may be universally wired to accept any of the 780 modules on an interchangeable basis.

4.02 The 781 shelf mounts on a 19 inch rack while the 782 mounts on 23 inch racks. Either shelf, with a full complement of modules, requires 1-3/4 inches of vertical space.

5. INSTALLER CONNECTIONS

5.01 When mounted in either of the two mounting shelves, the modules interconnect with the associated equipment by way of the 20 pin wire-wrap card connectors into which they fit. Make all installer connections in accordance with Table 1.

5.02 The 785-1D and 785-1G modules require Type 89 Plug-In Pads. In order to change these pads it is necessary to remove the module

Table 1. Table 1. 785-1D and 785-1G, Installer Connections

INSTRUCTION	SCHEMATIC DESIGNATION	ASSIGNMENT
Connect:	To:	At:
Transmit Line	XMIT T&R	1,A
Receive Line	RCV T&R	L,10
Two-Wire Drop	2W DROP T&R	D,E
A Lead	A LEAD	8
B Lead	B LEAD	F
D Lead	D LEAD	K
F Lead	F LEAD	9
G Lead	G LEAD	H
external balance network	BAL NET	B,C
ground	GRD	J

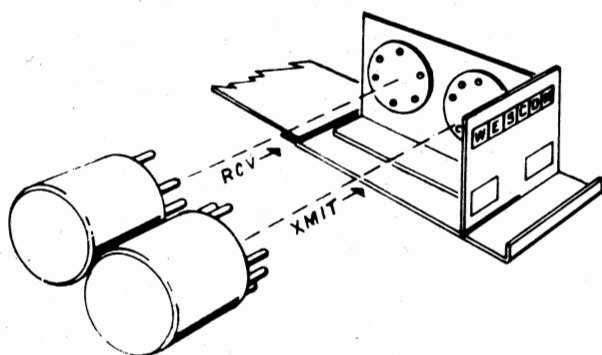


Figure 2. Pad Insertion

from the shelf. The pads are removed (or inserted) from the left side of the card as observed from the front. (See Figure 2.) The transmit pad is located nearest the front plate and the receive pad is nearest the printed circuit card. After the proper value pads have been inserted into the XMIT and RCV sockets, the pad values should be indicated in the appropriate boxes on the front of the unit using a grease pencil or marking tape. If no strapping is required, the unit may be replaced in its mounting position.

strapping

5.03 Figure 3 is an illustration of the printed wiring side of the 785-1D or 785-1G module showing the strapping posts. Refer to this illustration, as necessary, in the following paragraphs.

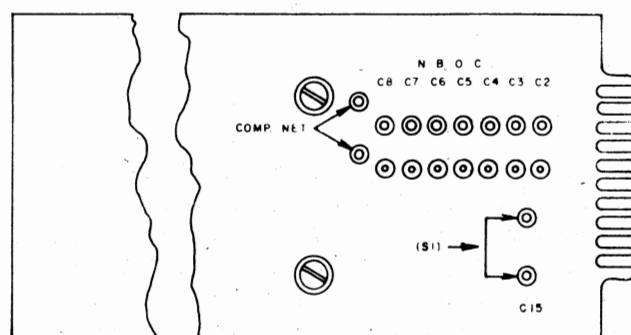


Figure 3. Strapping Post Location

CAUTION: If it is necessary to add or remove straps, use insulated strap wire and NOT larger than a 30-watt soldering iron.

5.04 Unless an external balancing network is specified on the job order and has been provided separately, the internal compromise network should be strapped in. If the COMP NET strap is not in place, using insulated wire, solder this strap in place. If a precision network is specified on the job order, the COMP NET strap (if any) should be removed. Cabling from an external precision network to the term set is made on the rear wire-wrap terminal strip of the term set plug-in connector. These terminals are designated BAL NET and the terminal assignments are B and C as shown in Table 1.

5.05 Unless otherwise specified on the job order, the S1 option is not required and, therefore, should be strapped out. If the S1 strap is not in place, using insulated wire, solder this strap in place.

5.06 Network building out capacitors are normally required but at this point should not be strapped in. If strapped in, remove any such straps.

5.07 At this point preliminary strapping is complete and the term set may be replaced in its mounting position.

CAUTION: Do not force any module into place. If excessive resistance is encountered, the module should be removed and the card guides checked for improper alignment and the presence of foreign particles.

6. LINE-UP

6.01 The alignment procedure for the 785-1D and 785-1G Terminating Sets consists of injecting a test tone into the 2W DROP pair and measuring it at the 4W XMIT side while inserting different fixed value pads into the XMIT socket until the desired transmission level is obtained. The same procedure is used for the receive side with various fixed value pads inserted into the RCV socket until the desired transmission level is obtained at the 4W RCV side.

6.02 The network build out capacitors NBOC should be strapped for maximum return loss as detailed in paragraph 6.06.

test equipment

6.03 Test equipment required at both the local and distant terminals to align and test the 785-1D or 785-1G Term Sets is as follows:

- (a) Transmission Measuring Set (TMS): Northeast Electronics TTS4C or W.E.Co. 23A (or equivalent) capable of measuring to at least -60 dBm will be required.
- (b) Variable Frequency Oscillator (VFO): Hewlett Packard 200 CD (or equivalent) capable of generating 300 to 3000 Hz signals.

NOTE: If the Northeast Electronics TTS4C is used, the VFO is not required.

- (c) Test Cords: As required.
- (d) Capacitor Decade Box: General Radio 1419 or 1419A (or equivalent) capable of simulating .001 to .127 μ F in .001 μ F steps.

6.04 Perform the following preliminary steps to prepare for the alignment procedure:

- (a) Verify the two-wire impedance of the term set. The 785-1D Term Set two-wire impedance is 600 ohms and that of the 785-1G is 900 ohms. The four-wire impedance of both term sets is fixed at 600 ohms.
- (b) Verify the need for the S1 option and whether the internal COMP NET strap or an external precision balance network is required. (The internal network is normally used.) Also, verify that the NBO capacitors are NOT strapped in at this time.

transmit and receive level

6.05 Adjust the transmit and receive levels of the term set as follows:

- (a) Set the local VFO to produce a 1000 Hz test tone at the level and impedance specified on the CLR card. Open the line to the two-wire drop and apply the test tone to the tip and ring leads of the two-wire side of the term set.
- (b) Connect the TMS (set for 600 ohm termination) to the four-wire transmit pair (XMIT T&R) of the term set.
- (c) Plug pads of different impedance values into the XMIT socket to determine which produces a transmit level closest to that specified on the CLR card.

NOTE: It may be necessary to remove the term set from its mounting when changing pads.

- (d) Disconnect the VFO and the TMS; connect the TMS to the two-wire T&R pair of the term set.
- (e) Open the line to the four-wire receive (4W RCV) T&R pair and connect the VFO to the four-wire receive side of the term set.
- (f) Plug pads of different impedance values into the RCV socket to determine which produces a receive level closest to that specified on the CLR card.

hybrid balance (return loss)

6.06 Perform the hybrid balance procedure for the 785-1D and 785-1G term sets as follows:

- (a) With conditions as described in paragraph 6.05 step (e) connect the capacitor decade box (set to 0 μ F) to the balance network (BAL NET) connections. Connect the TMS (set for 600 ohms terminating measurement) to the four-wire transmit (4W XMIT) side.
- (b) Increase the capacitance of the capacitor decade box (in .001 μ F steps) until the TMS indicates the lowest level (best hybrid balance).

NOTE: If no capacitor decade box is available, step (b) may be accomplished by using the NBO capacitors in the term set itself.

Increasing the capacitance in .001 μ F increments (using Table 2 as a guide) until best hybrid balance is achieved will accomplish the same purpose. It will, however, be necessary to remove the term set from its mounting each time a strap is changed.

- (c) When the capacitance value which produces the best hybrid balance is determined, strap in the appropriate NBO capacitor(s) (per Table 2) and solder the strap(s) in place.
- (d) Replace the term set in its mounting, disconnect all test equipment and reconnect the original wiring. This completes the hybrid balance procedure.

7. CIRCUIT DESCRIPTION

7.01 Both the 785-1D and 785-1G use the same circuit arrangement and differ only in the transformer ratios, the impedance correcting networks, the midpoint capacitance in the two-wire side and compromise networks to provide 900 ohm or 600 ohm two-wire impedance. Each set is composed of a two-coil hybrid circuit, a series blocking capacitor at the midpoint of the two-wire windings to derive a d-c path for loop signaling, a compromise network, building out capacitors NBOC, transmitting and receiving impedance matching networks and two plug-in pads.

Table 2. Network Building Out Capacitors

SCHEMATIC DESIGNATION	CAPACITY
C2	.001
C3	.002
C4	.004
C5	.008
C6	.016
C7	.032
C8	.064

Combinations of these capacitors allow for strapping in values of Capacity from .001 microfarads to .127 microfarads. One hundred twenty seven combinations between .001 and .127 microfarads are possible. Since parallel connection of capacitors is additive in value, strapping in additional capacitors will yield any value in .001 microfarad steps.

Example:

.001 strap in C2
.009 strap in C2 and C5

7.02 Speech currents from the two-wire drop flow through line windings 5-4 and 3-2 of transformers T1 and T2 and the midpoint capacitor associated with the A & B leads. Since the balancing network winding 1-6 of transformer T1 is connected in series, but with a reverse polarity with respect to the network winding 1-6 of transformer T2, no signal voltages appear across the compromise network and, therefore, the incoming speech power will divide equally between the 7-9 and 8-10 windings of transformers T1 and T2. The power across T2 is fed to the receive line where it is usually blocked by one-way devices in the connecting equipment. The power developed across T1 (one-half of the input power) is applied through the impedance improving network (C10,C12) and then through the plug-in pad to provide the proper levels for transmission to the transmitting side of the four-wire circuit.

7.03 Speech signals which enter the receiving side of the circuit through terminals 10 and L are attenuated by the loss of the plug-in pad and then pass through the impedance improving network (C11,C13) to windings 7-9 and 8-10 of transformer T2. The transformer design is such that equal voltages appearing across 3-2, 5-4, 1-6 of T2 will result in equal currents flowing through the 3-2, 5-4 and 1-6 windings of transformer T1. The network windings 1-6 have opposing polarity, therefore, the fluxes cancel and no signal is induced in the transmitting branch. In the ideal condition, the impedance of the network exactly matches the impedance of the two-wire line in both magnitude and phase. Approximately one-half of the receive power will, therefore, be dissipated in the compromise network and the remaining energy will be transmitted to the two-wire drop through connections E and D.

7.04 Each terminating set has a compromise network to balance the office two-wire impedance, a capacitor between the hybrid coil network windings and a network building out capacitor adjustable from .001 μ F to .127 μ F in .001 μ F steps, to balance the office cabling on the two-wire line. Adjustment of the network building out capacitance is made by changing the strapping on the strapping posts located on the bottom side of the printed circuit card. Terminals B-C on the mounting shelf connector allow for cross-connection of precision-type networks, when required.

7.05 The capacitor inserted at the midpoint of the two-wire windings of transformers T1 and T2 is used to derive A & B leads for loop signaling. Direct current up to 100 mA can be applied through the two-wire line without degrading the performance of the set. If the capacitor is included in the trunk circuit then this capacitor can be removed from the terminating set circuit by removing the unit from its mounting shelf and cutting the strap designated S1 located on the bottom of the printed circuit card. For flexibility, leads A, B, F, D and G are brought out to the socket connector for developing pad control and signaling functions. In some applications the trunk circuit opens the mid-point of the two-wire line for signaling and closes the connection for transmission. By opening the strap for the capacitor, a D lead is made available for the signaling circuit to open and close leads B and D for this type of operation.

7.06 A compromise network consisting of a 900 ohm (785-1G) or 600 ohm (785-1D) resistor connected in series with a 2.15 μ F capacitor is built into each set. By opening the strap across the terminal post marked COMP NET, the internal compromise network can be disconnected from the circuit. Terminals B and C on the connector socket can be cross-connected to an external precision network.

8. TESTING

8.01 If trouble is encountered with the operation of the 785-1D or 785-1G, check for the most obvious causes of system malfunction first. Verify that all installer connections (Table 1) have been properly made. Make certain that the module is making good connection with the mounting assembly card connector; snap the module out and in several times. If the trouble persists, perform the alignment procedure (Part 6) to determine that the module provides signal continuity and/or attenuation.

8.02 Field repairs involving replacement of components within a module are not recommended. All Wescom systems and component boards are warranted for one year from the date of purchase. Return to Wescom, Inc., 501 Rogers Street, Downers Grove, Illinois 60515. For technical assistance, call 312-971-2010, or TWX 910-695-4735.

