

**SWITCHED SERVICES NETWORKS
USING CENTRAL OFFICE SWITCHING MACHINES
TRANSMISSION TESTING METHODS AT PBXs**

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1. GENERAL

1.01 This section is issued to provide plant personnel with over-all transmission testing methods applicable at PBXs which have access lines to Switched Services Networks. Transmission tests on tie trunks and other local PBX facilities are described in Section 331-855-100 and associated sections.

1.02 Transmission tests on access lines are usually controlled by the switching center at the distant end. When the switching center is a 4-wire No. 5 crossbar office, the tests are directed from the 19A testboard in accordance with Section 310-200-500, Part 3. When the switching center is a 2-wire No. 5 crossbar office, the tests are directed from the 17E testboard in accordance with Section 310-200-501, Part 3. The testman at the PBX may refer to these sections in assisting with the transmission tests. This section adds information on test equipment, test access points, dial test lines, etc, which will aid the testman to work efficiently with the distant testboard.

1.03 This section assumes that the PBX will generally be unattended. Transmission testing will normally be done by prearrangement at the request of the control office. When

the testman arrives at the PBX, he should call the switching center and advise them when ready for tests.

1.04 This section uses the terms expected measured loss (EML) and actual measured loss (AML). These terms are applied in the same manner as in the DDD network. They are defined in Section A304.478.01/E26.040.01.

2. TEST EQUIPMENT

2.01 Test equipment for use at PBXs should be capable of making measurements at 900 ohms. Equipment arranged to operate at 600 ohms must be connected through a 2AB Auxiliary Test Set or equivalent. Measurements made in this manner must always be corrected for 0.5 db loss in the matching coil of the 2AB set.

2.02 If 600-ohm test equipment is used on a 900-ohm circuit, it will always result in an error. For example, a 600-ohm oscillator set for 0 dbm into a 600-ohm load will deliver -0.2 dbm to a 900-ohm line, and a 600-ohm TMS connected to a 900-ohm line will always indicate 0.2 db more than the actual loss.

2.03 Dialable test lines are used to the maximum extent possible in PBXs to make the tests more efficient. When dialable milliwatt supplies are provided, they should be calibrated regularly to provide 0 dbm at the connector in SXS PBXs and at the line link frame in No. 5 CENTREX's. The 22A Milliwatt Reference Generator or equivalent should be available for these tests.

2.04 A transmission measuring set is required for multifrequency tests and for 1000-cycle loss tests, if a dialable milliwatt supply is not available. Some suitable TMSs are:

23A TMS

21A TMS equipped with 2AB Auxiliary Test Set

Northeast Electronics TTS-4 equipped variable frequency cover.

Equivalent sets may be used. They should be capable of measurements at 900 ohms with an accuracy of ± 0.2 db or better, and should be arranged for DC blocking. When the 2AB set or equivalent is used, subtract 0.5 db from the measured loss to correct for the matching coil loss.

2.05 An oscillator is required for multifrequency tests and may be used in some cases for 1000-cycle loss tests. Some suitable oscillators are:

KS-19353 Oscillator

21A TMS equipped with 2AB Auxiliary Test Set

Northeast Electronics TTS-4 equipped with variable frequency cover.

Equivalent oscillators may be used if they are capable of sending up to +10 dbm at 900 ohms. They should be equipped for frequencies from 300 cycles to 4000 cycles with a setting accuracy of 2% or better. They should be arranged for DC blocking. A TMS should be used with the oscillator for calibration at all frequencies.

2.06 Steady noise measurements require the use of the 3A NMS. The 6A Impulse Counter is necessary for impulse noise measurements.

2.07 In addition to the usual test equipment, if the access lines are equalized to correct envelope delay distortion, delay measuring sets should be available. These consist of the KS-15877 Transmitter and the KS-15878 Receiver or equivalents. The 901, 902 and 903 portable data test sets should be available for trouble investigations.

2.08 Practices providing information on sources of testing power are shown in Table 1.

2.09 Practices providing information on testing equipment are shown in Table 2.

2.10 Cords should be provided as needed to connect the test set. Cords equipped with 309 and 310 plugs will meet nearly all requirements. A 1011-type test handset will also be useful.

2.11 When access lines are equipped with echo suppressors at the PBX, it will be necessary to make functional tests. In addition to the test equipment previously listed, a 5M Echo Suppressor (Portable) Test Set and patch cords should be provided and used for patching and tests per Section E33.353.

TABLE 1

INFORMATION ON SOURCES OF TESTING POWER		
TYPE OF SOURCE	SECTIONS CONTAINING	
	DESCRIPTIONS	TESTING METHODS
71A Milliwatt Reference Generator	103-325-100	103-325-500
71B Milliwatt Reference Generator	103-326-100	103-326-500
71C Milliwatt Reference Generator	103-327-100	103-327-500
71F Milliwatt Reference Generator	103-330-100	103-330-500
Milliwatt Distributing Systems and Test Lines		
Initial and Periodic Test Intervals — 103-335-300		
Test and Adjustments — 103-335-500 thru 103-335-513		

TABLE 2

PRACTICES FOR TEST EQUIPMENT	
SET	SECTIONS
22A Milliwatt Reference Generator	103-222-100
23A TMS	103-223-100
21A TMS	103-221-100
	103-221-101
2AB Auxiliary Test Set	103-202-100
Northeast TTS-4 Test Set	103-204-100
KS-19353 Oscillator	103-302-105
KS-15877 Transmitter and Receiver	E4C.673.1
3A NMS	103-611-100
6A Impulse Counter	103-620-100
5M Echo Suppressor Test Set	103-105-100
903A or B Data Test Set	107-200-100
902A or B Data Test Set	107-300-100

3. TEST ACCESS POINTS

3.01 Test access points for access lines terminated in No. 5 CENTREX PBXs are shown in Fig. 1. The trunk circuit test jacks are found in the OGT bay. The jack ended test trunk usually is mounted in a miscellaneous jack strip at the MTF. The jack ended test trunk has its own holding coil and can be answered with the local battery telephone set in the MTF. The test jack is arranged to disconnect the telephone set when a meter is connected.

3.02 Test access points for dial PBXs equipped with dial test lines are shown in Fig. 2. The jack ended test trunk has its TM jack located at a convenient place in the equipment and is answered with a tel. set per SD-67025-01. The jack is arranged to disconnect the tel. set when a meter is connected.

3.03 Test access points for access lines terminated in manual PBXs or dial PBXs without dial test lines are shown in Fig. 3. The multiple appearance in the switchboard is used as the test jack. When dual appearance trunk circuits are used, tests are made at the terminating appearance. Test calls are answered and connections to test sets are made using position cords. When making measurements at this test appearance, the test sets must be arranged for DC blocking. The key associated with the posi-

tion cord must be closed to eliminate the bridge by the operator's headset.

3.04 Fig. 4 shows test access points for a typical arrangement at a PBX where an auxiliary service transfer is provided. This general arrangement may be found at either dial or manual PBXs. The auxiliary transfer provides for alternate connection of the circuit to a 4-wire station or data set. Additional information on tests on the 4-wire station termination is provided in Section 310-200-503.

4. TESTING METHODS

(A) General

4.01 Over-all testing methods on access lines are covered in Sections 310-200-500 and 310-200-501. These sections should be available at the PBX for guidance. Section 310-200-300, which contains test requirements, also contains extensive references to supplementary information on transmission testing.

4.02 In addition to the normal work associated with circuit orders in advance of transmission testing, certain other tests should be made which can have an effect on transmission. They require assistance at the PBX. They are:

- (a) Over-all pulsing tests, particularly when the circuit consists of various facilities in tandem, in accordance with Plant Series 179 sections.
- (b) Echo suppressor tests in accordance with Sections E26.171 and E33.353, if they are provided on the circuit.
- (c) Balance tests at the PBX, if required, in accordance with Section 310-350-500.

(B) Over-all Transmission Tests

4.03 Attenuation Tests—These tests consist of 1000-cycle loss tests, attenuation-frequency tests, and attenuation-equalization tests. Tests are made in both directions of transmission. All circuit order tests and adjustments are made on a two-man basis. All routine tests are made on a two-man basis, except for 1000-cycle tests when dial test lines are provided. Test calls are always originated at the controlling test-board in order to include PBX switches and wiring in the measurements. Tests are made at fre-

quencies and in the order specified by the distant testboard.

When making tests at any frequency, the oscillator should always be checked for 0 dbm output, using a TMS, before connecting it to the circuit.

When the distant testboard sends tone or measures, a 2 db test pad is always included. At the PBX or No. 5 CENTREX, if pad control is provided, the switched pad functions as a 2 db test pad for test calls. In any case, the received level is always reported as read directly from the TMS.

4.04 Noise Measurements—Steady noise measurements are made with the 3A NMS. Impulse noise measurements are made with the 6A Impulse Counter. Tests are made to balance terminations whenever possible. If the terminations are not available, the tests must be made on a two-man basis.

Both measurements must be corrected. The correction is equal to the AML in the direction of measurement. When making steady noise measurements, report the uncorrected measurement. Also report the AML if requested.

The impulse noise objective is 59 dbrnc0. Lower this number by the correction factor, and set the resultant on the counter before starting a measurement. If it cannot be set exactly, use the next higher setting. When the measurement is completed, report it in counts/half hour.

4.05 Delay Distortion Tests—These tests are always made on a two-man basis and apply when the access line must meet envelope delay distortion requirements. The KS-15877 Transmitter and KS-15878 Receiver are required, and they should always be allowed to stabilize for 30 minutes before starting measurements. The sets are operated in accordance with Section E40.673.1. The tests should be made and results reported at the direction of the distant testboard.

5. TROUBLE INVESTIGATION

5.01 The control office is responsible for investigation of trouble reports. Tests may be required at the PBX as well as at intermediate locations. Some of the circuit order tests may be required to be made at the PBX. In addition,

other tests may be necessary which require assistance at the PBX. The following paragraphs provide supplementary information on these tests.

5.02 Carrier Systems Tests—When access lines are provided on carrier facilities terminated directly at the No. 5 CENTREX or other PBX, assistance is required to check carrier system line-up tests and channel net loss tests. These tests are made in accordance with the sections covering the specific system.

5.03 DC Tests on Cable Pairs—When access lines are made up partially or entirely of cable pairs, DC tests on the cable pairs are made by the intermediate office or the serving office and may require the provision of open, short or ground terminations at the PBX.

5.04 SF Unit Tests—When access lines are provided on carrier facilities terminated directly at the PBX, the associated SF unit may require tests in accordance with its appropriate section.

5.05 DX Unit Tests—When DX signaling is provided on access lines at the PBX, unit tests may be in accordance with the appropriate section.

5.06 Over-all Pulsing Tests—The testman may require equipment and provide assistance in making over-all pulsing tests as specified in Sections E36.224 or E36.225.

5.07 Repeater Gain Tests—When V4 or similar repeaters are installed at the PBX, the testman may be requested to check gain adjustments and measurements in accordance with appropriate sections to verify gain requirements indicated on the CLR card.

5.08 Echo Suppressor Tests—If a 1A echo suppressor is installed at the PBX, the testman may assist in verifying that it is functioning properly. This may be done per Section E33.353 by strapping it out and using the 5M Portable Test Set. Verification of its operation may also be done in accordance with Section E26.171.

5.09 Balance Tests—When PBX balance is required, the testman may be requested to verify that the requirements are met as specified in Section 310-350-500. If PBX balance is

not required, active balance tests on term sets may be required against the balance test line or a balance termination at the switchboard appearance.

5.10 *Data Transmission Tests* — When data transmission troubles are reported, the control office may request tests using the 900

series portable data test sets. These are intended to sectionalize the trouble, if possible, and eliminate the need for the more complicated delay distortion measurements. These tests may also be requested between the PBX and a data station if station equipment troubles are expected. Test procedures are provided in Sections 107-200-100 and 107-300-100.

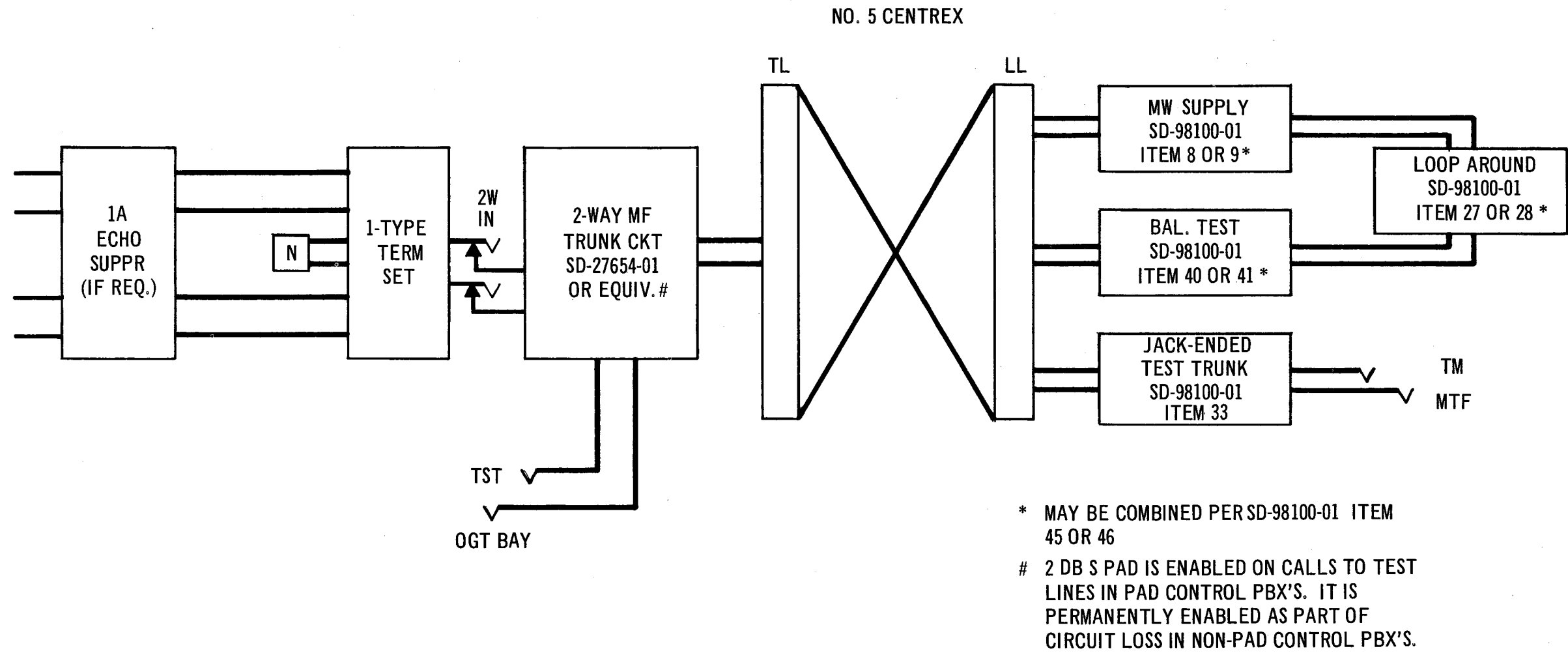


Fig. 1 - Test Access Points for Access Lines in No. 5 CENTREX PBX

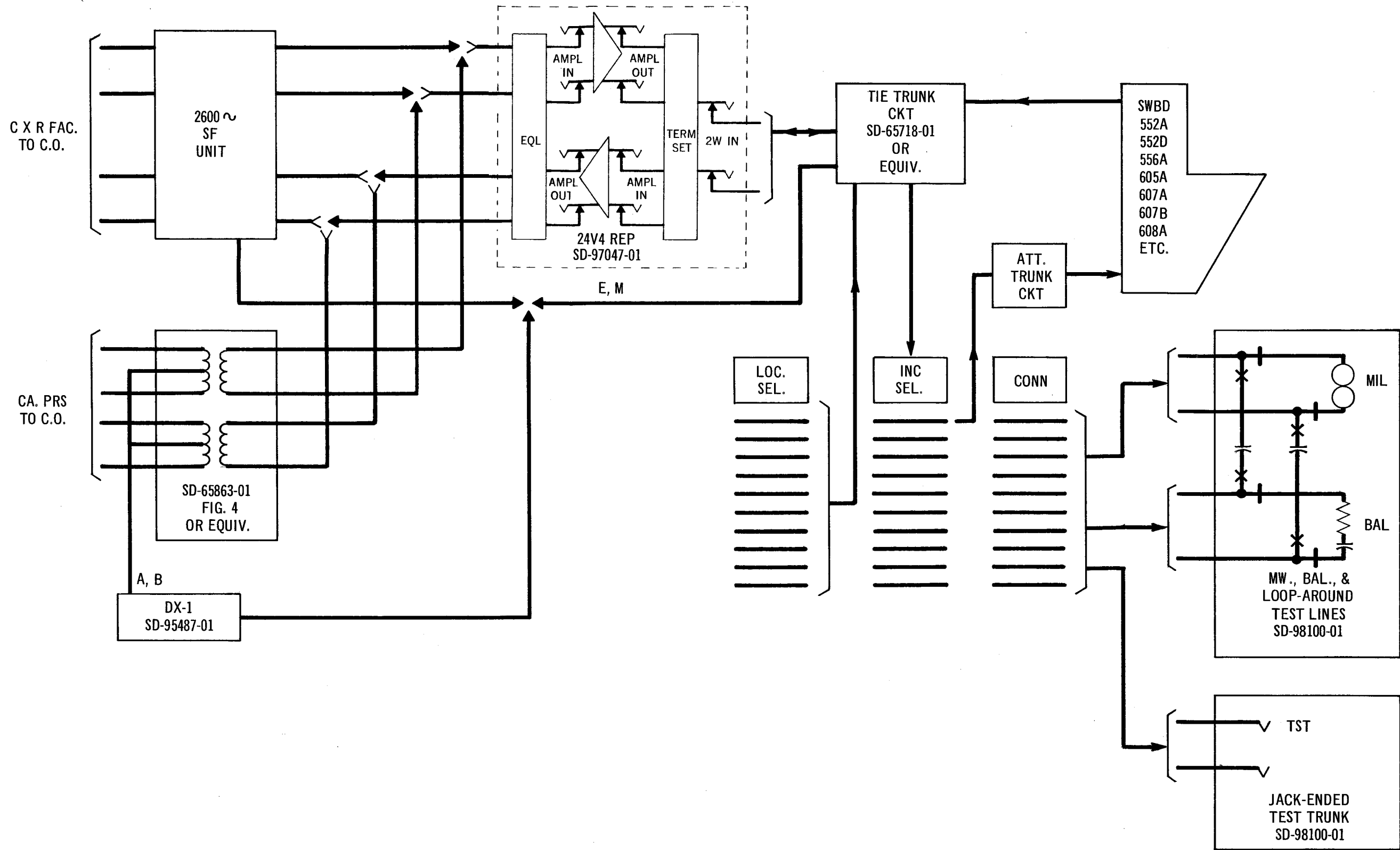


Fig. 2 - Test Access Points at Dial PBXs Equipped with Dial Test Lines

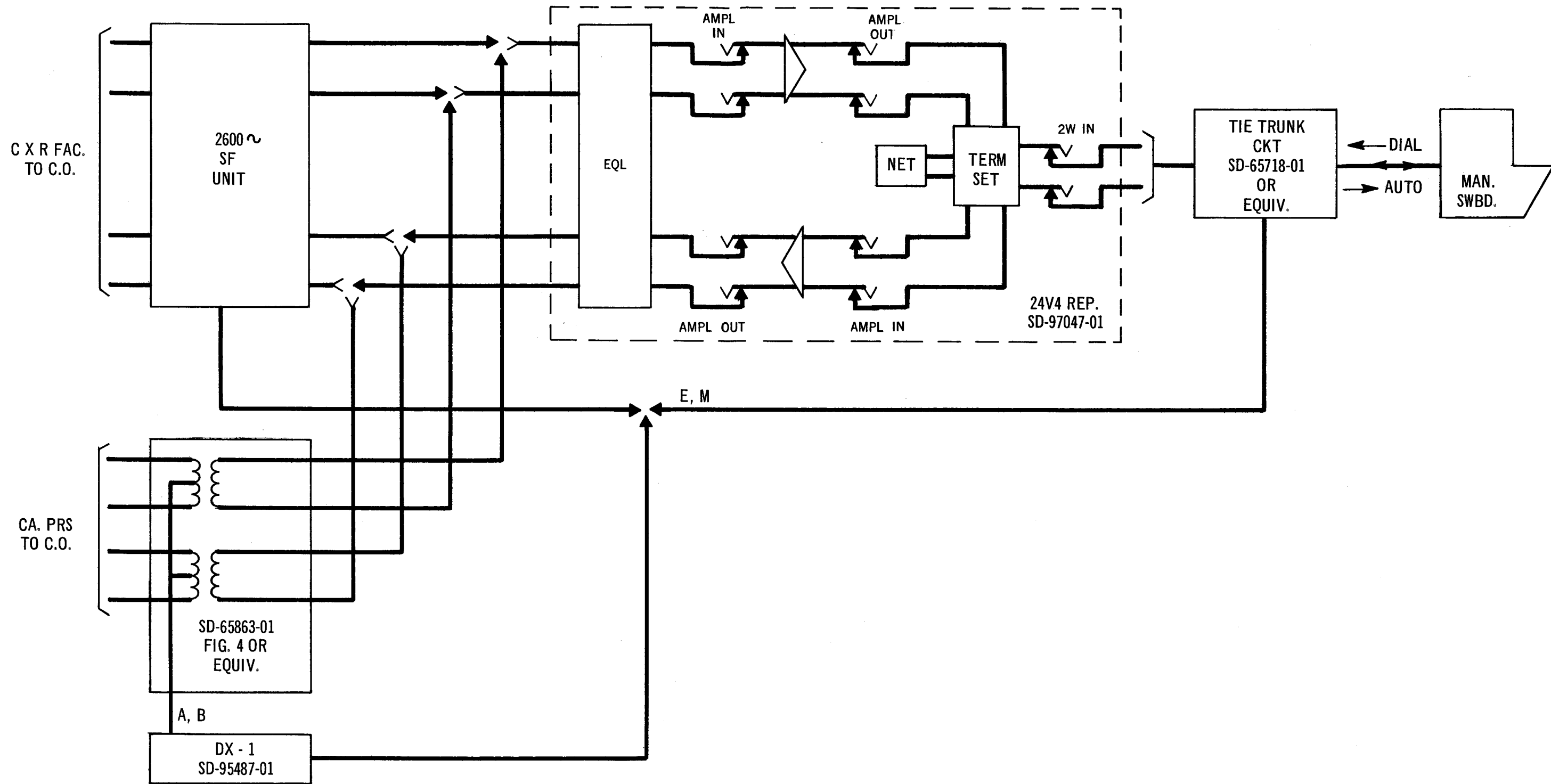


Fig. 3 - Test Access Points At Manual PBXs

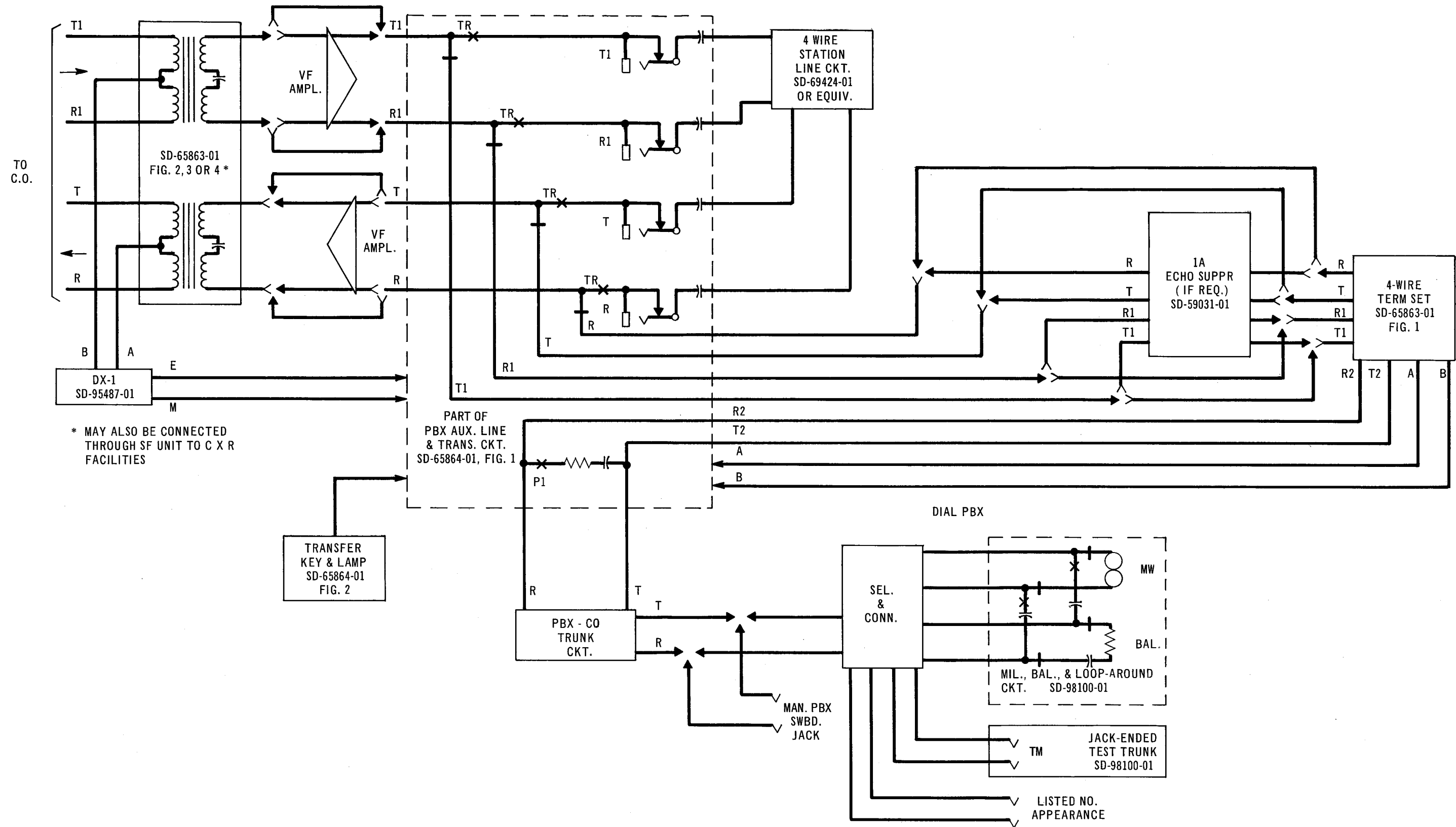


Fig. 4 - PBX Termination per SD-65863-01 for Access Line with Auxiliary Service Transfer