

**SWITCHED SERVICES NETWORKS
USING CENTRAL OFFICE SWITCHING MACHINES
SERVICE MAINTENANCE**

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1. GENERAL

1.01 This section provides information on circuit order and periodic (routine or maintenance) tests and adjustments to be made on facilities assigned as part of the Switched Services Networks (SSN) using Central Office Switching Machines. These networks are described in general in Section 310-200-100. The tests apply to network trunks, access lines, 4-wire subscriber lines and key station lines.

1.02 Administrative procedures and test methods are specified in other sections of this series of practices. The requirements for local PBX facilities associated with these networks are covered in Section 331-855-100 and associated sections.

1.03 *Circuit order and routine tests are intended to provide an extremely high quality of performance and reliability. It is important that these tests and test schedules are followed regularly in order to retain this high quality of performance. The test routines specified in this section are considered to be the minimum objectives for good service.*

1.04 Some networks may have special requirements due to special features. Special routine intervals may be established in these cases, or automatic test facilities may be provided. In these cases, the information shown in this section will be superseded by the stricter requirements. Also, automatic tests may be substituted for routine tests.

2. CIRCUIT ORDER AND ROUTINE TESTS

2.01 These tests apply to network trunks, access lines, 4-wire subscriber lines, and key station lines. These circuits are defined in Section 310-200-100, Appendix A. Testing methods are specified in Section 310-200-500 and associated sections.

2.02 There may be several arrangements for each type of circuit. For example; an access line may consist of only carrier facilities or carrier facilities and cable extensions equipped with voice-frequency repeaters. The routine tests are, therefore, based upon the type of facilities as well as their use in the network.

2.03 Figures 1-14 show typical arrangements of the majority of circuits that will be used. Circuit order tests and routine test intervals are shown in Table VII for facilities designed in accordance with each figure. Tables VIII-XVII provide additional references.

2.04 As an example, assume a network trunk is to be placed into service between two 4-wire offices, using an "L" carrier channel. The circuit layout is similar to Figure 1. Table VII indicates the tests to be made and requires that a verification of over-all measurements on the carrier channel, adjustment of the pads and levels, etc, should be completed before the signaling tests are made. Table XI provides a reference to the sources of information for measurements on the various carrier systems used with the Switched Services Networks (SSN).

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2.05 PBX tie trunks, off-premises station lines and RX or FX services, terminated on one end at a PBX which has access to an SSN are not covered in this section. This type of facility will be installed and tested according to Section 331-855-500 and associated sections.

2.06 The types of facilities covered in this section, and illustrated in the attached Figures are as follows:

Fig. 1 — Network Trunk Between 4-wire Offices.

Fig. 2 — A. Network Trunk Between a 4-wire Office and a 2-wire Office.

B. Access Line Between a 4-wire Office and a No. 5 CENTREX.

Fig. 3 — A. Network Trunk Between two 2-wire Offices.

B. Access Line Between a 2-wire Office and a No. 5 CENTREX.

Fig. 4 — Access Line from a 4-wire Office on Cable Pairs.

Fig. 5 — Key Station Line from a 4-wire Office on Cable Pairs.

Fig. 6 — Access Line from a 4-wire Office on Carrier Facilities.

Fig. 7 — Key Station Line from a 4-wire Office on Carrier Facilities.

Fig. 8 — Access Line from a 2-wire Office on Cable Pairs.

Fig. 9 — Key Station Line from a 2-wire Office on Cable Pairs.

Fig. 10 — Access Line from a 2-wire Office on Carrier Facilities.

Fig. 11 — Key Station Line from a 2-wire Office on Carrier Facilities.

Fig. 12 — 4-wire Subscriber Line on Cable Pairs.

Fig. 13 — 4-wire Subscriber Line on Carrier Facilities.

Fig. 14 — Typical Termination of a Dual Use Line.

2.07 Reference tables included in this section cover the following general subjects:

Table I — Permissible Deviations from EML.

Table II — Multifrequency Test Requirements.

Table III — Steady Noise Requirements.

Table IV — Impulse Noise Requirements.

Table V — Equalization Requirements for Network Trunks.

Table VI — Equalization Requirements for 4-wire Subscriber Lines, Key Station Lines and Access Lines.

Table VII — Summary of Over-All Circuit Order and Routine Test Requirements.

Table VIII — Information on Circuit Layout Record Cards.

Table IX — Information on Sources of Testing Power.

Table X — Information on Testing Circuits and Communication Trunks.

Table XI — Circuit Layout Cards and Circuit Order Testing Information Carrier Telephone Systems.

Table XII — Information on Signaling Tests.

Table XIII — Information on Balance Testing Procedures.

Table XIV — Information on Transmission Testing Methods.

Table XV — Information on Noise Measurements.

Table XVI — Information on Special Grade Facilities.

Table XVII — Information on Testboards.

3. TEST REQUIREMENTS

A. General

3.01 Circuit order and routine maintenance tests are required for network trunks, access lines, 4-wire subscriber lines, and key station lines. The Circuit Control Office is responsible for coordinating all of the required tests. When a trouble condition is cleared on a facility, the final disposition of the trouble should be reported directly to the Circuit Control Office responsible for the facility, as quickly as possible. Procedures for the release and restoral of the circuits, are covered in other sections.

B. Expected Measured Losses (EML)

3.02 The permissible deviation from the EML depends somewhat on the type of facility. The Actual Measured Loss (AML) should not vary from the EML by more than the appropriate figure of Table I. When these requirements cannot be met on circuit order or routine tests, due to deviation in one section or cumulative deviations in several sections, and no actual trouble exists, the matter should be referred through lines of organization for corrective actions. Circuits with AMLs which deviate more than 3 db from the EML should be taken out of service immediately and investigated. All circuits exceeding the limits of Table I must be investigated or adjusted to be brought within limits. Tests are required in both directions of transmission.

TABLE I

PERMISSIBLE DEVIATION FROM EXPECTED MEASURED LOSS (EML) SHOWN ON CIRCUIT LAYOUT CARDS		
TESTS	CIRCUIT LENGTH IN MILES	
	UNDER 500	OVER 500
Circuit Order	± 1.0 db	± 1.5 db
Routine	± 1.5 db	± 2.0 db

C. Multifrequency Tests

3.03 Multifrequency tests are required on facilities that are not normally equalized for loss-frequency distortion (also called slope). The multifrequency test will detect irregularities which may not be found by single frequency

tests. These tests should be made on at least five frequencies and in both directions of transmission. The requirements are as follows for circuit order and routine tests:

TABLE II

MULTIFREQUENCY TEST REQUIREMENTS		
FREQUENCY— cps	RANGE OF MEASUREMENT	REFERRED TO
1000	Table I	EML on Circuit Order
300	+ 8 db to - 3 db	1 kc loss
700*	+ 3 db to - 1 db	1 kc loss
2300*	+ 3 db to - 1 db	1 kc loss
3000	+ 8 db to - 3 db	1 kc loss

* +2 db to - 1 db on Network Trunks

Note: (+) Values are lower levels (more loss)
 (-) Values are higher levels (less loss)

3.04 When attenuation equalization is required, the limits specified in the Table I shall be superseded as discussed in Part 3f.

D. Steady Noise Measurements

3.05 Steady noise requirements for SSN facilities are shown in TABLE III of this section. The values shown are based on use of a 3A Noise Measuring Set — “C” message weighting. The values refer to the “zero transmission level points” (0 TLP). With measurements made on voice-bandwidth facilities the 1000 cps AML (actual measured loss) from the “zero transmission level point” to the measuring point, should be used to make this correction. This method of adjustment insures proper signal-to-noise ratios regardless of the facility loss. TABLE III covers requirements for noncompandored facilities. Compandored facilities are covered in the associated notes. Table III applies on both circuit order and routine tests.

3.06 Noise measurements should be made in both directions of transmission. When testing toward a central office or PBX, the correction for “0” TLP can generally be obtained by taking a reading of the 3A NMS with a 1000-cycle milliwatt supply properly connected at the far end. The difference between 0 dbm and the

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level indicated by the meter reading will be the correction to be added to the noise reading. When testing on a subscriber station line or key station line at the test jack in the central office, add 2 db to the indicated meter reading. Information on the use of the 3A NMS is covered in Section 103-611-100. Code 100 or equivalent test lines may be used whenever available.

TABLE III

BUSY HOUR NOISE MAINTENANCE LIMITS DBRN C MESSAGE WEIGHTING REFERRED TO O TLP			
Length of Circuit in Miles	Circuit Order & Maintenance Requirements Met if Noise is Below	OBJECTIONABLE NOISE	
		Requires Investigation and Analysis	Requires Immediate Action if Above
	(A)	(B)	(C)
0-50	31	31-44	44
51-100	34	34-44	44
101-400	37	37-44	44
401-1000	41	41-50	50
1001-1500	43	43-50	50
1501-2500	45	45-50	50
2501-4000	47	47-50	50

Notes:

1. When noise is in the range of Col. B but below the immediate action requirement (Col. C), the circuit can be placed in service. However, corrective action must continue until the circuit order and maintenance requirement is met per Col. A.
2. If it is not possible to meet the maintenance requirement (Col. A) by available maintenance techniques, changes in the engineering of the system or in the maintenance methods used are indicated. The appropriate engineering group should be notified, through the lines of organization.
3. A trunk requiring immediate action should be brought to the attention of the supervisor. It should be removed from service unless the supervisor at the control office determines that it is needed because of traffic load conditions.
4. The noise requirements apply to the total length of the circuit contributing noise at the point of measurement. These limits can

be used as a guide to isolate a trouble to a portion of an over-all circuit.

5. COMPANDORED FACILITIES

- a. When a trunk is made up of compandored facilities, a combination of compandored and voice cable facilities, or two or more compandored facilities in tandem, make above limits 5 db more strict.
- b. When a trunk is made up of compandored plus noncompandored carrier facilities, such as N plus L, the requirements as listed in the table shall apply.

6. The above requirements may be converted to "dba — F1A weighting" by subtracting 6 db.

E. Impulse Noise Measurements

3.07 Since, the facilities used in connection with the SSN may be used for data transmission as well as voice transmission it will be necessary for *all facilities* to meet the impulse noise requirements. Impulse noise is a primary source of errors in data transmission. Impulses are of short duration, often lasting only a millisecond or less. Since the human ear is insensitive to short noise peaks, impulse noise of this type will not be noticed on voice transmission, however, when the same circuit is used for data transmission, impulse noise will be a serious problem. With data transmission, the bit durations are short, for example, 0.8 millisecond in a 1200 bit frequency shift serial system. If impulse noise hits are of sufficient magnitude and occur very often, they can seriously degrade the error rate of the facility. Peaks of "steady" noise, if of sufficient magnitude, will also contribute to increased error rates.

3.08 A 6A Impulse Counter or equivalent is used to measure impulse noise on a facility. Information involving the use of the 6A Impulse Counter will be found in Section 103-620-100. *The magnitude and frequency of the occurrence of the impulse noise voltages are used to specify the impulse noise requirement. The requirement is expressed as the peak noise level (referred to the zero transmission level point) which will be exceeded no more than a specified number of times per half hour.* TABLE IV shows the impulse noise requirements for voice-frequency facilities. This information covers

4-wire subscriber lines, key station lines, access lines and network trunks for both circuit order and routine tests. *Where compandored facilities are involved, the compandored section should be measured separately, as specified in Table IV.* Measurements should be made in both directions on network trunks and access lines. They should also be made on 4-wire subscriber lines and key station lines if they are arranged for data or secure voice operation.

TABLE IV

IMPULSE NOISE REQUIREMENTS ALL VOICE-BAND FACILITIES			
NONCOMPANDORED SECTIONS AND OVER-ALL TRUNK OR LINE		COMPANDORED FACILITY SECTIONS (SEE NOTE 1)	
COUNTS/ 30 MIN.	LEVEL (dbm)	COUNTS/ 30 MIN.	LEVEL (dbm)
90	59	90	45

Notes:

1. *Compandored Objectives* assume the expander is in "FULL LOSS" condition. This can be done in N, O, and ON carrier by replacing tube V44 in the expander with a 408A tube having pins 1, 5 and 6 cut off.
2. All measurements are referred to "0" TLP. The correction may be obtained by measurement to code 102 or equivalent as specified in Para. 3.06. Where a milliwatt test line is not available, a nominal value of correction may be obtained from the CLR card.
3. When the requirement calls for a meter switch setting that is not available on the meter, use the next higher setting.

3.09 Impulse noise measurements are referred to the "0" TLP for comparison with requirements. With measurements made on a "voice-band basis" the 1000 cps AML (Actual Measured Loss) from the "zero transmission level point" to the measuring point, should be used to make this correction. The correction may be measured or computed as in Para. 3.05.

F. Equalization Tests

3.10 The customer may request voice grade facilities, or may order special grade facilities equalized to the degree necessary to

insure that data transmission will be satisfactory. The customer may request schedule 4, 4A or 4B treatment or specialized treatment.

3.11 The requirement for equalization will be indicated in the CLR information or by local instruction. When the equalization is in accordance with schedule 4A or 4B, the requirements are provided in Table V or VI. When the equalization is special, the requirements will be furnished by supplement to the CLR card or by local instruction.

3.12 Over-all equalization requirements are established for a network, since the station-to-station characteristics of a connection determine its capability for data transmission. It is therefore necessary to know how many links can be connected in tandem in a network. The requirements for each link can then be specified to make it possible for any built-up connection to meet the over-all requirements. The selection of switching centers and arrangements of trunk groups are always made with these requirements in mind.

3.13 Schedule 4A requirements can be met on an over-all connection with up to five network trunks in tandem in the connection. Schedule 4B requirements can be met if there are not more than three trunks in tandem. To equalize individual facilities properly, it is necessary to know the maximum number of trunks that can be connected in tandem. This will be specified in the CLR information or by local instruction.

3.14 When network trunks are to be equalized, the requirements of Table V must be met. Table VI is used for all other facilities. Caution must be observed, however, in the case of access lines, since the local PBX facilities must also be considered. If the data services are to be furnished from on-premise extensions of the main PBX, the local facility can be neglected. If an off-premise extension or tie trunk is involved, however, the requirements will apply between the switching center and the station location.

3.15 Envelope delay measurements are made with the KS-15877 Transmitter and KS-15878 Receiver. These sets test in the voice-frequency range and display all the necessary information.

TABLE V

EQUALIZATION REQUIREMENTS FOR NETWORK TRUNKS TO MEET AN OVER-ALL REQUIREMENT						
SCHEDULE	ATT.-FREQ.* REQ. (db) WHEN MAXIMUM NETWORK TRUNKS IN TANDEM IS			ENV. DELAY REQ. (microsec.) WHEN MAXIMUM NETWORK TRUNKS IN TANDEM IS		
	1 TRK	3 TRKS	5 TRKS	1 TRK	3 TRKS	5 TRKS
4A						
300-999 CPS	-1.0 to +3.5	-1.0 to +2.0	-0.8 to +2.0	-	-	-
1000-2400 CPS	-0.7 to +1.5	-0.5 to +1.0	-0.5 to +1.0	300	200	150
2401-2700 CPS	-1.0 to +3.5	-1.0 to +2.0	-0.8 to +2.0	-	-	-
4B (or secure voice)						
300-499 CPS	-1.0 to +3.5	-1.0 to +2.0	-	-	-	-
500-2800 CPS	-0.7 to +1.5	-0.5 to +1.0	-	-	-	-
2801-3000 CPS	-1.0 to +3.5	-1.0 to +2.0	-	-	-	-
1000-2600 CPS	-	-	-	150	100	-
600-2600 CPS	-	-	-	450	300	-
500-2800 CPS	-	-	-	900	600	-

* With respect to 1000-cycle loss (+) is more loss and (-) is less loss.

TABLE VI

EQUALIZATION REQUIREMENTS FOR 4-WIRE SUBSCRIBER LINES KEY STATION LINES AND ACCESS LINES INCLUDING LOCAL PBX FACILITIES TO MEET AN OVER-ALL REQUIREMENT						
SCHEDULE	ATT.-FREQ.* REQ. (db) WHEN MAXIMUM NETWORK TRUNKS IN TANDEM IS			ENV. DELAY REQ. (microsec.) WHEN MAXIMUM NETWORK TRUNKS IN TANDEM IS		
	1 TRK	3 TRKS	5 TRKS	1 TRK	3 TRKS	5 TRKS
4A						
300-999 CPS	-1.0 to +3.5	-1.0 to +3.5	-0.8 to +2.5	-	-	-
1000-2400 CPS	-0.7 to +1.5	-0.5 to +1.5	-0.5 to +1.0	400	250	200
2401-2700 CPS	-1.0 to +3.5	-1.0 to +3.5	-0.8 to +2.5	-	-	-
4B (or secure voice)						
300-499 CPS	-1.0 to +3.5	-1.0 to +3.5	-	-	-	-
500-2800 CPS	-0.7 to +1.5	-0.5 to +1.5	-	-	-	-
2801-3000 CPS	-1.0 to +3.5	-1.0 to +3.5	-	-	-	-
1000-2600 CPS	-	-	-	200	120	-
600-2600 CPS	-	-	-	600	375	-
500-2800 CPS	-	-	-	1200	750	-

* With respect to 1000-cycle loss (+) is more loss and (-) is less loss.

3.16 Attenuation-frequency requirements cannot be satisfied by a single measurement in each frequency band of interest, unless a sweep type measuring set is available. Measurements should be made on at least five different frequencies in each band of interest, and more should be made if there is doubt that the requirements are met. Oscillators with limited frequency steps will not be satisfactory for these measurements.

G. Other Measurements

3.17 Carrier Frequency Error — On carrier systems used in connection with SSN, the over-all carrier frequency error should be kept down to ± 5 cps or less. Individual carrier facility sections should have carrier frequency errors of no more than ± 2 cps. There will not be a frequency error problem on the "transmitted carrier" type of carrier systems, such as the Western Electric "N", "O" and "ON". When this type is used, carrier used for modulation is transmitted directly to the distant terminal for demodulation. "J", "K" and "L" systems are of the suppressed carrier type, where the carrier is suppressed at the transmitting terminal and re-supplied at the receiving terminal. Where this function is accomplished by the use of a generator that is held in synchronization with the generator at the transmitting end, carrier frequency error will be at a minimum and should not cause data distortion. Carrier frequency error exists primarily in suppressed carrier systems where there has been no provision for synchronizing the carrier terminals at the ends of the system. Nonsynchronized Western Electric type "J", "K", "L" and "C5" systems, use carrier supply generators with long-term stability. These systems should not present any problems as far as carrier frequency error, providing they are adequately aligned and maintained at the intervals specified in the practices. Western Electric type "C" and "H" carrier systems may present more serious problems, depending upon operational environment and the maintenance routines. Carrier systems that are not supplied by the Western Electric Co. can be roughly classified in the same way as the Western Electric Co. systems. Actual carrier frequency error performance of any system in the questionable category should be determined prior to the actual start of service of the system and corrective action instituted if necessary. The measurements

should be repeated at intervals as specified in the practices for the carrier system.

3.18 Carrier Amplitude Variation — Carrier systems of the "N" and "ON" type may be subject to rapid variation in amplitude. This does not, in general, affect binary digital data transmission, however, an analogue data signal may become distorted. Information regarding troubles of this nature should be forwarded through lines of organization for further investigation.

4. TEST EQUIPMENT

4.01 Installation and maintenance tests are made using a 19A Testboard in the 4-wire No. 5 crossbar offices. Operation of the 19A Testboard is covered in Sections 310-280-100 through 501 of the Plant Series of Bell System Practices.

4.02 The 17E Testboard is available for tests in 2-wire No. 5 crossbar offices. Operation of the 17E Testboard is covered in Sections 310-281-100 through 501 of the Plant Series of B.S.P.s.

4.03 In connection with installation and maintenance tests on access lines and 4-wire subscriber lines, the following items of test equipment should be available for use at a subscriber's premises for test purposes:

1. 21A TMS and 2AB AUX TMS (or equivalent) or
2. KS-19353 oscillator and 23A TMS or
3. Northeast TTS4 e/w variable frequency cover (or equivalent)
4. Envelope delay measuring sets —
KS-15877 Transmitter and KS-15878 Receiver
5. 3A Noise measuring set
6. 6A Impulse measuring set
7. 901A or B Data Test Set
8. 902A or B Data Test Set
9. 903A or B Data Test Set
10. 1011 Type Handset

An optional V.O.M. (KS-14510 meter or equivalent) and an oscilloscope are always considered to be useful additional equipment for trouble analysis.

TABLE VII

SUMMARY OF OVER-ALL CIRCUIT ORDER AND ROUTINE TEST REQUIREMENTS																		
TYPE OF TEST	NETWORK TRUNKS FROM			ACCESS LINES*						KEY STATION LINES				4-WIRE* SUBSCRIBER LINES ON		MAKE TEST ON CIRCUIT ORDER AND AT INTERVALS OF	#REFERENCES	NOTES
	4-WIRE OFC. TO		2-W OFC. TO	FROM 4-WIRE OFFICE TO			FROM 2-WIRE OFFICE TO			FROM 4-WIRE OFFICE ON		FROM 2-WIRE OFFICE ON						
	4-W OFC.	2-W OFC.	2-W OFC.	CTX OFC.	PBX		CTX OFC.	PBX		CABLE	CXR	CABLE	CXR	CABLE	CXR			
					CABLE	CXR		CABLE	CXR			CABLE	CXR					
1. DC Tests on Cable Pairs	-	-	-	-	X	X	-	X	X	X	X	X	X	X	-	As Req.		Verify requirements for opens, shorts, grounds and leakage have been met.
2. Carrier Systems Tests	X	X	X	X	-	X	X	-	X	-	X	-	X	-	X	As Req.	Table XII	Verify system line-up has been completed.
3. Carrier Channel Net Loss Tests	X	X	X	X	-	X	X	-	X	-	X	-	X	-	X	As Req.	Table XII	Verify routines were made.
4. Repeater Tests & Repeater Gains	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	As Req.	E33.130.00 E43.130.00	
5. SF Unit Tests	X	X	X	X	-	X	X	-	X	-	X	-	X	-	X	As Req.	Table XII	Verify unit tests were made.
6. DX Unit Tests	-	-	-	-	X	X	-	X	X	X	X	X	X	X	X	As Req.	Table XII	Verify unit tests were made.
7. Over-All Pulsing Tests	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	As Req.	Table XII	
8. Echo Suppressor Tests	X	X	X	X	-	X	X	-	X	-	X	-	X	-	-	As Req.	E23.353 E26.171	If provided.
9. Office or Terminal Balance Tests	-	X	X	X	X	X	X	X	X	-	-	X	X	-	-	As Req.	Table XIII	
10. Drop Loss Tests	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	As Req.		See Test Board Practices.
11. 1000-Cycle EML Tests	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Quarterly Monthly	Table XIV	On manual test. To dial test lines. See Para. 3.02.
12. Multifrequency Tests	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Annually	Table XIV	If atten. equal. is not provided. See Para. 3.03.
13. Steady Noise Tests	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Quarterly	Table XV	See Para. 3.05.
14. Impulse Noise Tests	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Quarterly Annually	Table XV	On special grade circuits. On all other circuits. See Para. 3.07.
15. Delay Equalization Tests	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Annually	Table XVI	For special grade circuits See Para. 3.09.
16. Attenuation Equalization Tests	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Annually	Table XVI	For special grade circuits See Para. 3.09.
17. Station Equipment Inspections	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	Annually		
18. Operation of Emergency Transfer Circuit	X	X	-	X	-	-	-	-	-	-	-	-	-	-	-	Semi-Annually		If provided.
Reference Figure	1	2	3	2	4	6	3	8	10	5	7	9	11	12	13			
* Dual use lines should be tested in both modes. A typical arrangement is shown in Fig. 14. # Circuit order test should be made on trouble investigations and all circuit rearrangements.																		

TABLE VIII			
INFORMATION ON			
CIRCUIT LAYOUT RECORD CARDS —			
CODES AND ABBREVIATIONS USED ON FORMS E2350, E2351, E2352 AND E2353			
SUBJECT	SECTION	SUBJECT	SECTION
USE OF FORMS E2350 TO E2353	E14.001.0	OTHER EQUIPMENT ENTRIES	E14.001.6
CODES FOR TRUNK DETAILS	E14.001.1	Signal Path Assignment	E14.001.6
Trunk Number and Name	E14.001.1	By-Pass Arrangements for	
Operation and Class	E14.001.1	20-Cycle Signaling with	
Test Frequencies	E14.001.1	V-3 Type Repeaters	E14.001.6
Mileage	E14.001.1	4-Wire Terminating Sets	E14.001.6
Trouble Units	E14.001.1	Pads	E14.001.6
D-C Signal Circuit Data	E14.001.1	Miscellaneous Pads	E14.001.6
Design Data	E14.001.1	Adjustable Potentiometer	
Echo Suppressor	E14.001.1	Demodulator Pads	E14.001.6
Labor Units	E14.001.1	Receiving Pads	E14.001.6
Control Office	E14.001.1	Transmitting Pads	E14.001.6
Circuit Order Details	E14.001.1	Patching Pads	E14.001.6
		Test Pads	E14.001.6
CODES FOR REPEATER DATA	E14.001.2	MISCELLANEOUS ITEMS OF	
Office	E14.001.2	EQUIPMENT	E14.001.6
Types of Repeaters	E14.001.2	Test Hybrid Coil	E14.001.6
Filters	E14.001.2	Regulating Networks	E14.001.6
Gains	E14.001.2	Echo Suppressors	E14.001.6
Levels	E14.001.2	Companders	E14.001.6
Singing Points	E14.001.2	Filters	E14.001.6
Networks or Equalizers	E14.001.2	Drop Loss	E14.001.6
Ringings	E14.001.2	Through Channel Unit	E14.001.6
CODES FOR LINE ASSIGNMENT		Special Services Channel Unit	E14.001.6
ENTRIES	E14.001.3	Switching Units for VF	
Cable or Line	E14.001.3	Carrier Telegraph	E14.001.6
Circuit Unit or Channel	E14.001.3	Special Entries	E14.001.6
Pair or Pin	E14.001.3	TRUNK NUMBERING	E14.001.8
Gauge and Loading	E14.001.3	Intertoll Trunks	E14.001.8
Length	E14.001.3	Plant Patching Units	E14.001.8
Line Loss Data	E14.001.3	Order Circuits	E14.001.8
CODES FOR LINE EQUIPMENT	E14.001.4	Built-Up Spares	E14.001.8
Simplex Circuit	E14.001.4	Traffic Spares	E14.001.8
Composite Equipment	E14.001.4	Reference Frequency Circuits	E14.001.8
Filters	E14.001.4	Special Services	E14.001.8
Coil Equipment	E14.001.4	ABBREVIATIONS AND SYMBOLS	
Other Line Equipment	E14.001.4	USED IN PREPARING TOLL	
CODES FOR SIGNALING		MESSAGE AND SPECIAL	
EQUIPMENT	E14.001.5	SERVICE LAYOUT RECORD	
D-C Signaling	E14.001.5	CARDS	E14.001.7
Single Frequency Signaling	E14.001.5		F28.106
Converters	E14.001.5		M25.83
Pulse Link Equipment	E14.001.5	DC SIGNALING PATHS USED	
Signal Link Equipment	E14.001.5	WITH TOLL MESSAGE	
Signal Lead Extension Circuits	E14.001.5	CIRCUITS	E14.011
Ringdown Signaling Equipment	E14.001.5		M43.71

TABLE IX

INFORMATION ON SOURCES OF TESTING POWER		
TYPE OF SOURCE	SECTIONS CONTAINING	
	DESCRIPTIONS	TESTING METHODS
2A Sending Panel	103-341-100	103-341-500 103-341-501
71A Milliwatt Reference Generator	103-325-100	103-325-500
71B Milliwatt Reference Generator	103-326-100	—
71C Milliwatt Reference Generator	103-327-100	103-327-500
71F Milliwatt Reference Generator	103-330-100	103-330-500
Milliwatt Distributing System and Test Lines		
Initial and Periodic Test Intervals — 103-335-300 Tests and Adjustments — 103-335-500 thru 103-335-513		

TABLE X

INFORMATION ON TESTING CIRCUITS AND COMMUNICATIONS TRUNKS	
SUBJECT	SECTION
General Information — Test Line Circuits	A702.680.00 — E26.001.00
Code 100 — Noise and Balance Test Termination	A702.680.01 — E26.001.01
Code 101 — Testboard Communication Trunk	A702.680.02 — E26.001.02
Code 102 — 1-MW, 1000-Cycle Testing Power	A702.680.03 — E26.001.03
Code 103—Supervisory and Signaling Test Termination	A702.680.04 — E26.001.04
Code 104 — Far-End Transmission Measuring and Noise Checking Circuit	A702.680.05 — E26.001.05
Codes 104 — Directory of Test Line Locations	A702.680.06 — E26.001.06
Code 161-X — Trouble Reporting to Multi- Testboard Locations	A702.680.19 — E26.001.19
Code 958 — Switching Systems Communication Trunk	A702.680.20 — E26.001.20
Code 959 — 1-MW, 1000-Cycle Testing Power — No. 4 Offices	A702.680.21 — E26.001.21
Code 970-XXX — Directing Code for Reaching OGT Test Frames	A702.680.22 — E26.001.22

TABLE XI

CIRCUIT LAYOUT RECORD CARDS AND CIRCUIT ORDER TESTING INFORMATION CARRIER TELEPHONE SYSTEMS		
TYPE OF EQUIPMENT OR SYSTEM	SECTION CONTAINING	
	CIRCUIT LAYOUT RECORD CARD CODES AND ABBREVIATIONS	INITIAL LINE-UP AND CIRCUIT ORDER TEST INFORMATION
Type C Systems	E14.003.1	E24.025
Type K Systems	E14.002	355-100-300
Type L1 Systems	E14.004	358-010-300
Type L3 Systems	E14.004	359-010-300
Type N Carrier Channel Groups	E14.013	362-101-300
Type O Carrier Systems	E14.003.5	362-101-300
Type ON Carrier Units and Channel Groups	E14.017	362-101-300

TABLE XII

INFORMATION ON SIGNALING TESTS		
SUBJECT	SECTION CONTAINING	
	DESCRIPTION	TESTS
Single Frequency Signaling Circuits Over-All Signaling and Pulsing Tests Using 2A or 2B Signal Test Sets	—	A220.254/ E36.225
Type B, CX, DX, SX Signaling Circuits Using Pulse Repeating Test Set	—	A220.684/ E36.224
DX Signaling System	975-230-100	—
E-Type SF Signaling System	975-240-100	A204.568 to A204.584
MF Pulsing System	975-210-100	A204.446 to A204.449

TABLE XIII

INFORMATION ON BALANCE TESTING PROCEDURES	
SUBJECT	SECTION
OFFICE CABLING BALANCE TESTS Office Balance Methods and Requirements — 2-wire No. 5 Crossbar Class SS-3 Offices	310-200-550
PBX BALANCE TESTS General Description Methods and Requirements	310-350-100 310-350-500

TABLE XIV

INFORMATION ON TRANSMISSION TESTING METHODS	
SUBJECT	SECTION
TRANSMISSION TESTS	
2W — No. 5 Crossbar Offices — Using 17E Testboard	310-281-501
2W — No. 5 Crossbar Offices — Using Master Test Frame	A275.833 —
4W — No. 5 Crossbar Offices — Using 19A Testboard	310-280-501
Far-End (Code 104) and Near-End Transmission Measuring and Noise Checking Circuit	103-235-100
Manual 2-Way Transmission Measurements and Noise Check Using Code 104 Far-End Equipment — 2-Wire Switching Offices	— E36.001
Trunk Transmission Testing — Using the Loop- Around Method	A804.468 — E46.300
Net Loss and Transmission Level Measurements on Toll Circuits	E36.050
Expected Measured Loss Calculations for E Repeated and Nonrepeated 2-Wire Trunks	A804.467.1 — M35.01
SINGING POINT TESTS	
For Voice-Frequency Trunks	E26.150 E36.150

TABLE XV

INFORMATION ON NOISE MEASUREMENTS	
SUBJECT	SECTION
3A Noise Measuring Set	103-611-100
6A Impulse Counter	103-620-100
Noise and Crosstalk Tests on Toll Circuits — Routines	E26.101
— Methods	E36.101
Investigation of Specific Noise and Crosstalk Troubles on Voice-Frequency Toll Circuits	E36.102

TABLE XVI

INFORMATION ON SPECIAL GRADE FACILITIES	
SUBJECT	SECTION
Distortion Measurements on Data Circuits by Scope Observation	E40.625
Delay Measuring System for Data Circuits (Action Sets)	E40.673.1
Data Pulse Measuring Set DPMS-1	103-110-100
Private Line Data Circuits — Voice-Bandwidth Circuits for Miscellaneous Data — Over-all Tests and Requirements (Schedule 4, 4A, 4B)	314-410-500
V4 Telephone Repeater (359-Type Equalizers)	E43.130.00
Data Systems — Common Circuits, Equipment and Procedures — Envelope Delay Characteristics of 200-Type Equalizers	314-820-100
Envelope Delay Characteristics of 366- and 367-Type Equalizers	314-820-103
Attenuation Equalizers and Noise Filters for Telephoto and Other Special Services	314-820-105
Data Systems — Testing of Pairs for Private Line Data Circuits	314-850-500
Binary Data Transmission — General Description of Data and its Terminology	972-050-100
Voice-Frequency Data Channels — Technical Characteristics	972-055-100

TABLE XVII

INFORMATION ON TESTBOARDS	
SECTION	CONTENTS
310-280-100	General Description of the 19A Testboard.
310-280-300	Adjustment of testboard pads.
310-280-500	Measurement of Drop Losses.
310-280-501	Transmission Testing Methods.
310-281-100	General Description of the 17E Testboard.
310-281-300	Adjustment of Testboard Pads.
310-281-500	Measurement of Drop Losses.
310-281-501	Transmission Testing Methods.

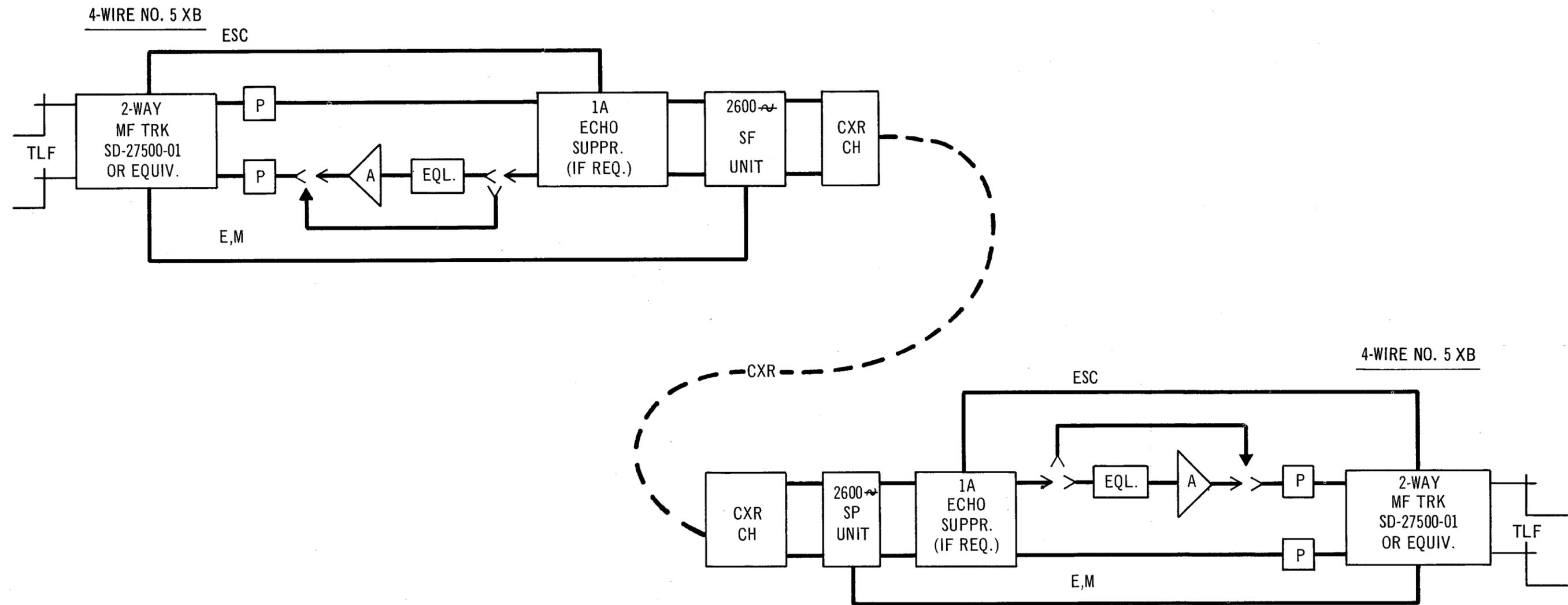


Fig. 1 - Typical Arrangement for Network Trunk Between Two 4-Wire No. 5 Crossbar Offices

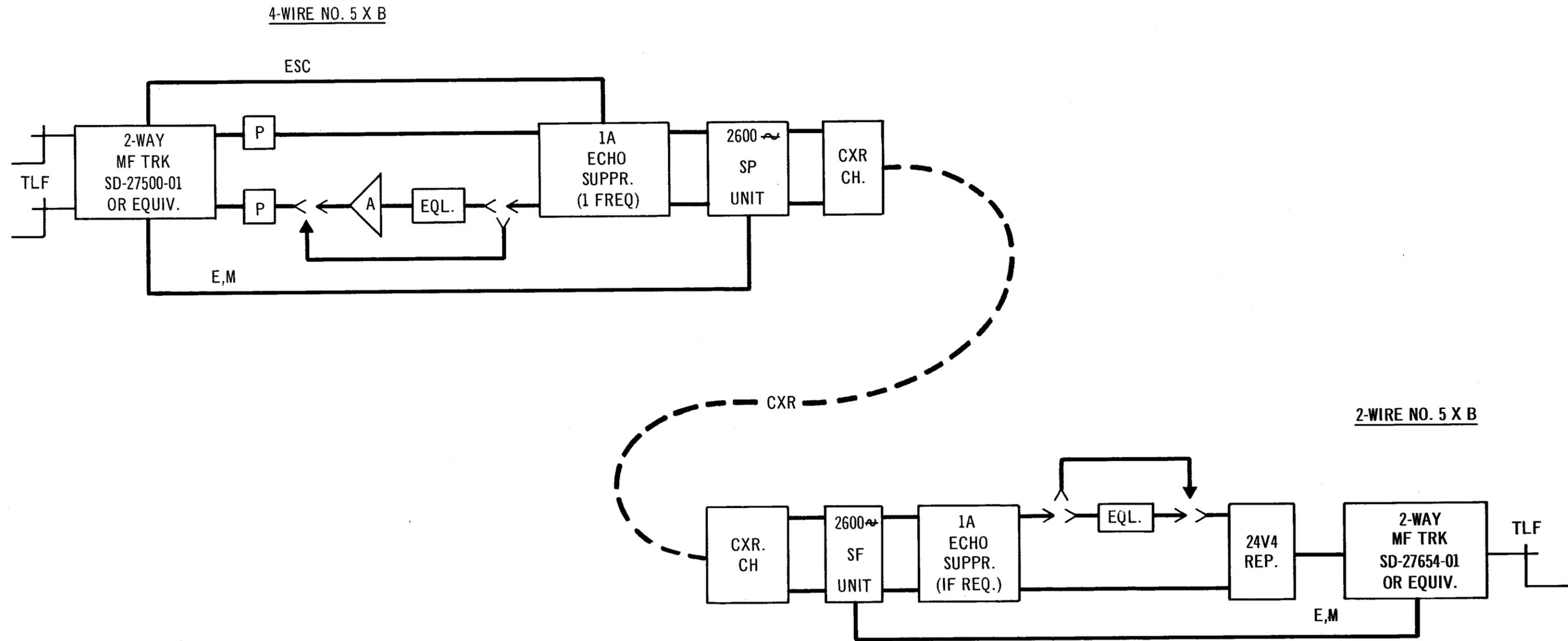


Fig. 2 - Typical Arrangement for:
 A. Network Trunk from 4-Wire Office to 2-Wire Office
 B. Access Line from 4-Wire Office to Centrex

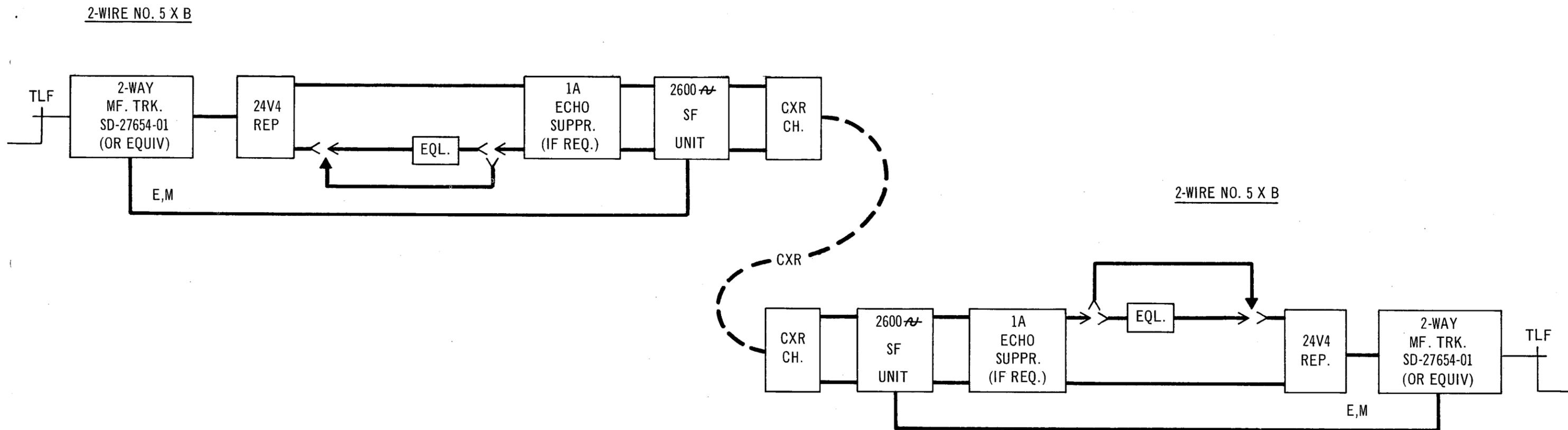


Fig. 3 - Typical Arrangement for:
 A. Network Trunk Between Two 2-Wire No. 5 Crossbar Offices.
 B. Access Line from 2-Wire Office to Centrex.

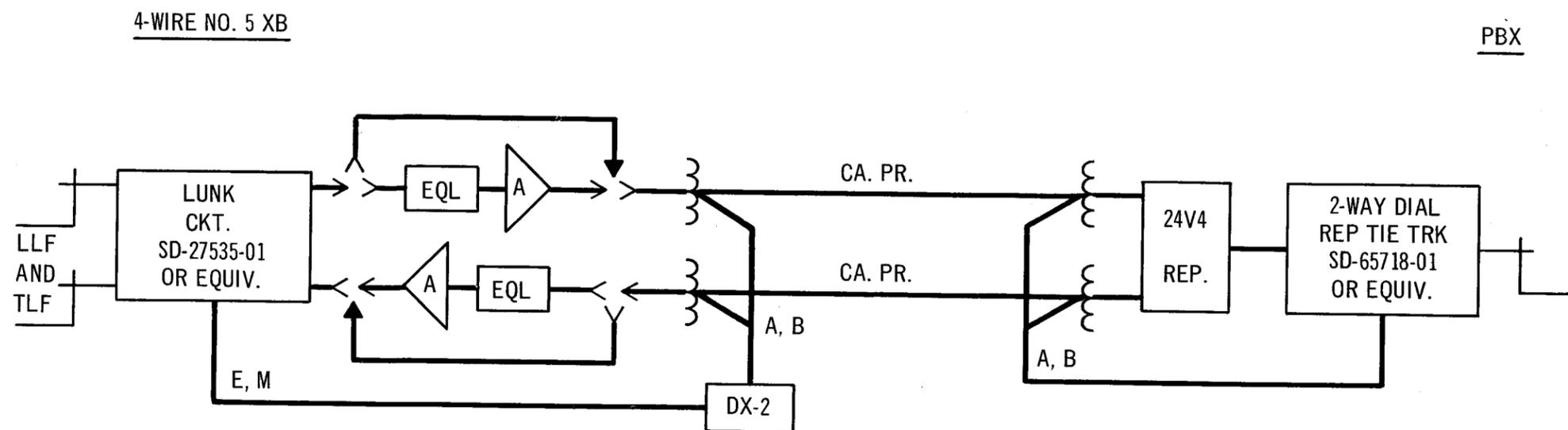


Fig. 4 - Typical Arrangement for an Access Line from a 4-Wire Office on Cable Pairs

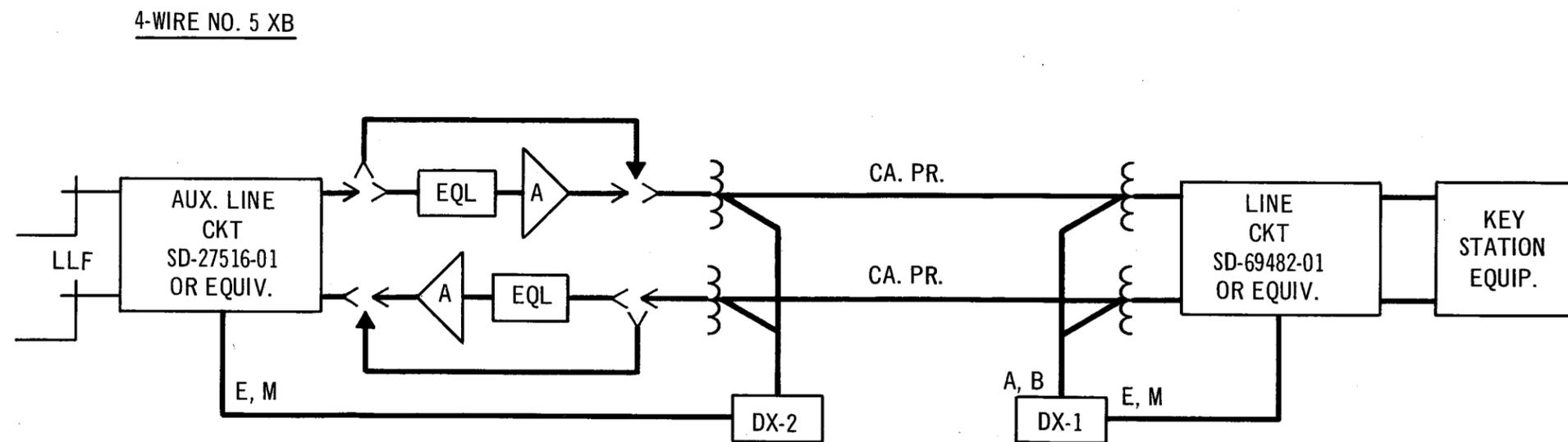


Fig. 5 - Typical Arrangement for a Key Station Line from a 4-Wire Office on Cable Pairs

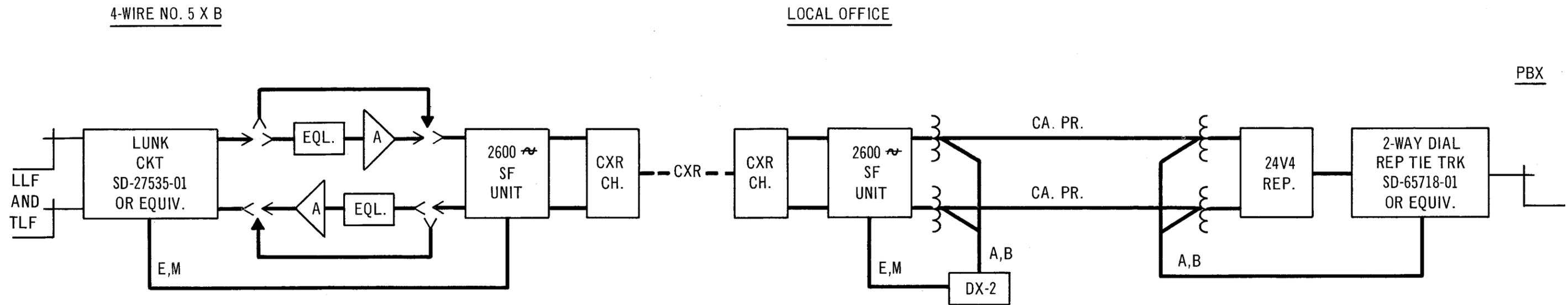


Fig. 6 - Typical Arrangement for an Access Line from a 4-Wire Office on Carrier Facilities

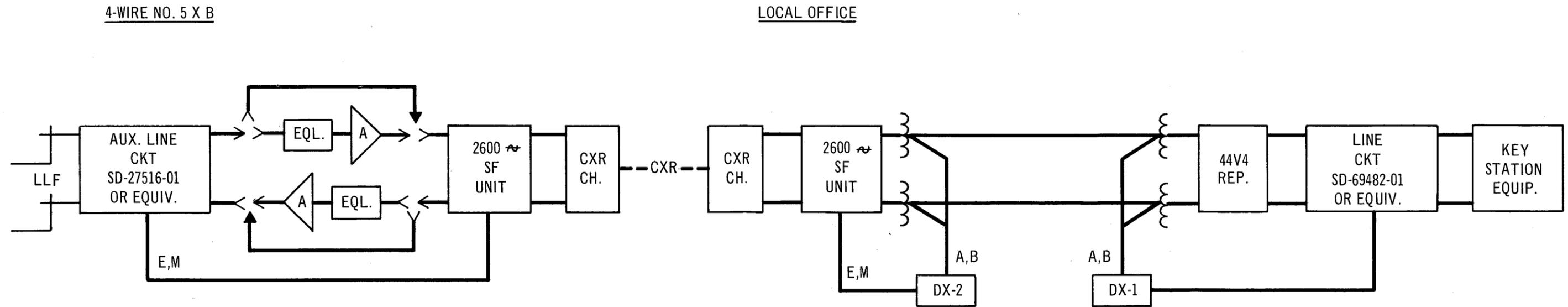


Fig. 7 - Typical Arrangement for a Key Station Line from a 4-Wire Office on Carrier Facilities

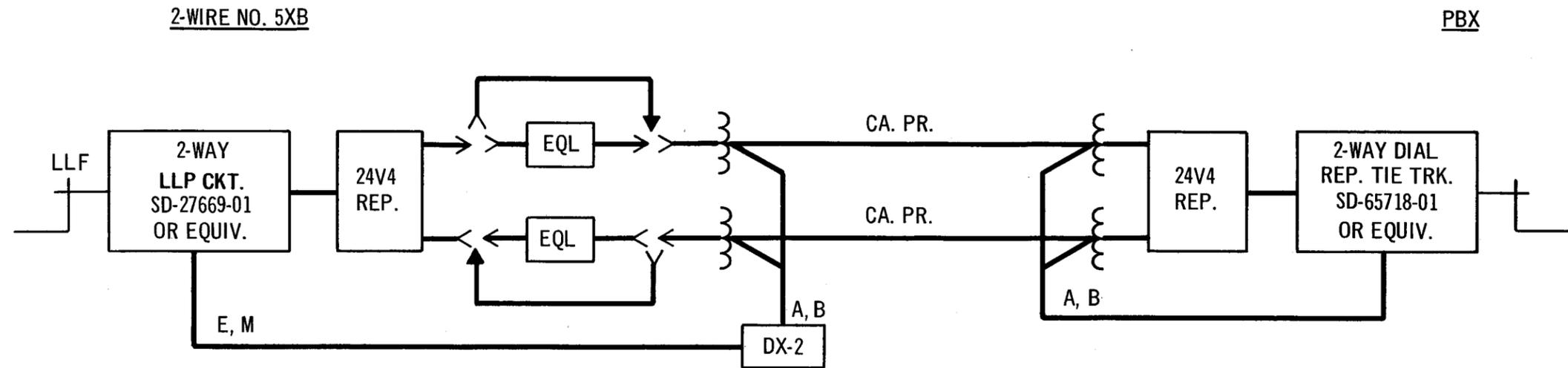


Fig. 8 - Typical Arrangement for an Access Line from a 2-Wire Office on Cable Pairs

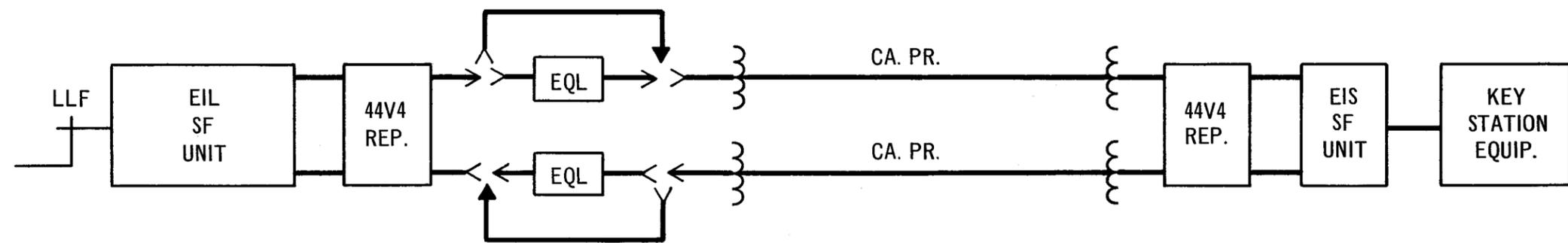


Fig. 9 - Typical Arrangement for a Key Station Line from a 2-Wire Office on Cable Pairs

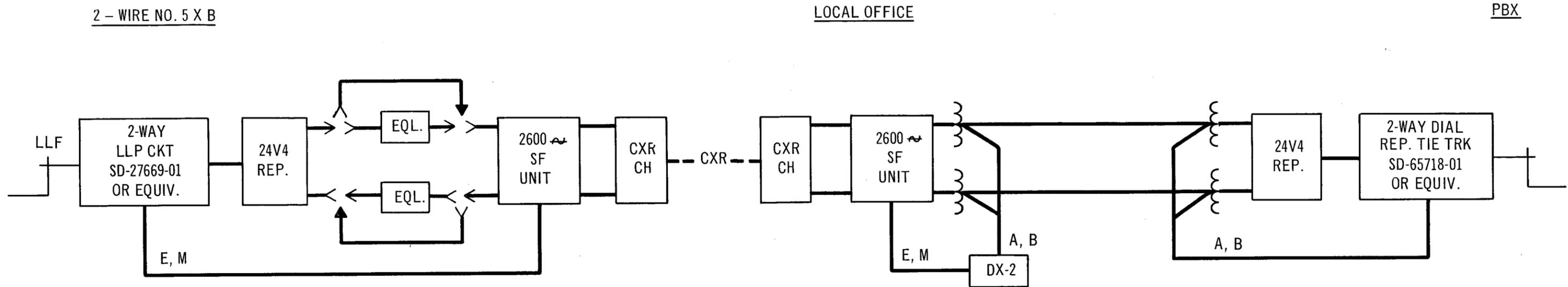


Fig. 10 - Typical Arrangement for an Access Line from a 2-Wire Office on Carrier Facilities

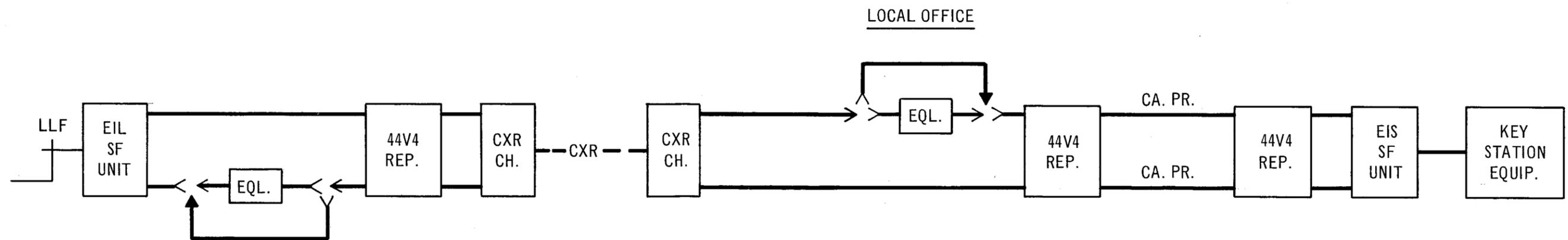


Fig. 11 - Typical Arrangement for a Key Station Line from a 2-Wire Office on Carrier Facilities

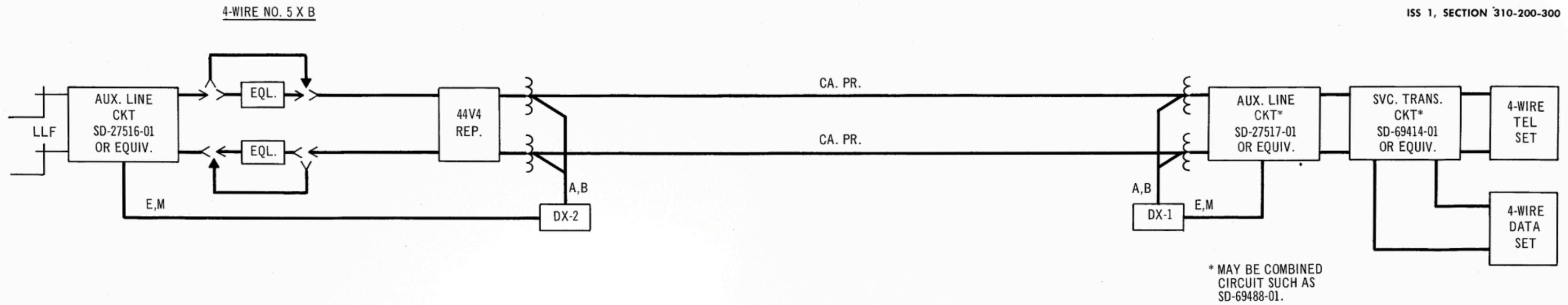


Fig. 12 - Typical Arrangement for a 4-Wire Subscriber Line on Cable Pairs

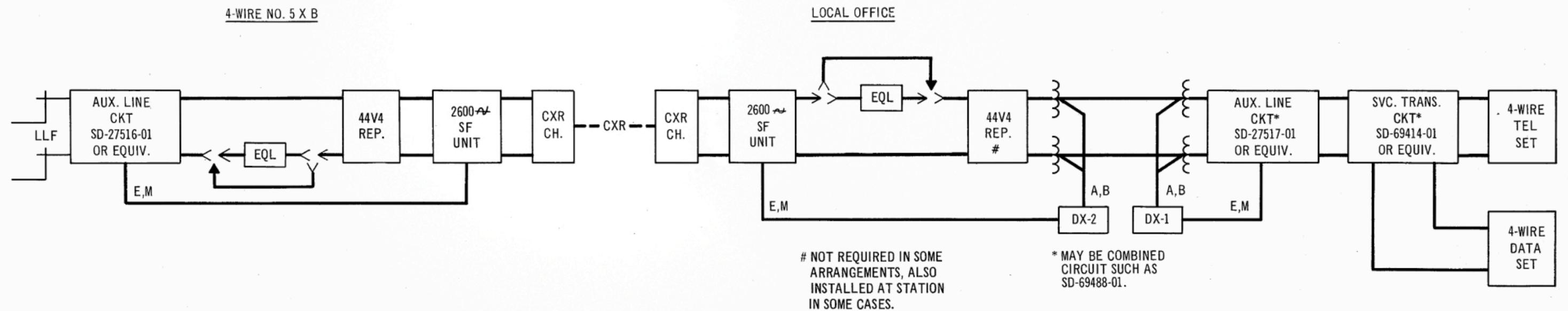


Fig. 13 - Typical Arrangement for a 4-Wire Subscriber Line on Carrier Facilities

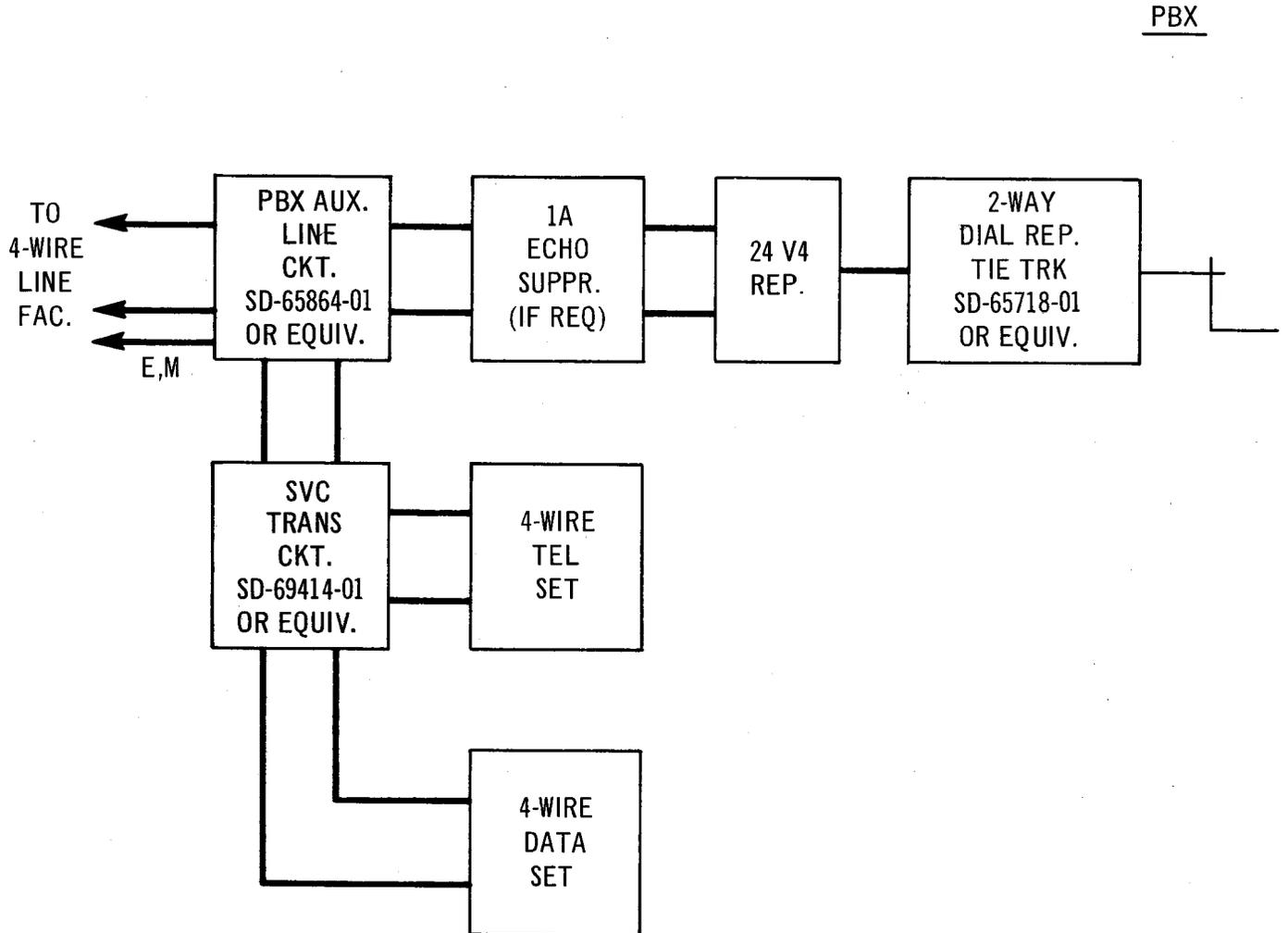


Fig. 14 – Typical Arrangement for Termination of a Dual Use Line (Combined Access Line and 4-Wire Subscriber Line)