J99343TN FACILITY MATCHING TEST SET
DESCRIPTION AND OPERATION
METALLIC FACILITY TERMINAL

CONTENTS PAGE

1. GENERAL

1.01 This section provides descriptive information on the new J99343TN Facility Matching Test Set for the Metallic Facility Terminal (MFT). CD/SD-7C041-01 provides additional information on this unit.

1.02 This section is reissued to update the information on the use of the facility matching test set and associated FWRL meter readings. Revision arrows have been included to indicate those areas which have been changed.

1.03 The main function of this test set is to automatically determine the best precision balance network (PBN) settings for any MFT repeater interfacing a 2-wire metallic facility. The major advantage of this unit, over other means of obtaining the PBN settings, is that its settings are generated from the actual cable facility and not from office records, which may not be accurate. It is intended for use when prescription settings cannot be determined due to the lack of accurate cable make-up information. It should be noted that prescription design is by far the most economical means of circuit lineup.

1.04 Access to the facility, selected for test, may be made through the MFT Test Extender (J99343TB) at the transmission unit location.

2. DESCRIPTION

2.01 The following paragraphs describe the features of the facility matching test set.

A. Unit Features (Fig. 1)

2.02 The J99343TN test set is a portable unit, housed in a standard case assembly (12 × 10 × 10 inches) with all electrical access through connectors or jacks on the front panel. A metal

cover, containing the AC power cord, is also provided to protect the device in transport.

▶Front Panel Features◀

2.03 Front panel features to the test set are:

(1) The TALK/DIAL, HOLD, and OPEN (Normal) switch conditions the 2-wire circuit for testing.

(2) 2W LINE and HANDSET jacks for access and interface to the 2-wire line.

(3) Power ON Switch and AC POWER connector for applying 117 VAC to the test set.

(4) LBOC switch, needed when testing loaded cable, to build out the end section of the cable to 6 kft. (Conversion of capacitor values to kilofeet are shown in Table A.)

(5) The FWRL LOSS (dB) meter indicates the level of balance. (See paragraph 2.12.)

(6) ADD dB switch provides four ranges to the Return Loss meter from 0 dB to +40 dB in 10 dB increments.

(7) MODULE SEL switch operates in association with the two plug-in slots in the front panel. The L, R designations of the switch correspond directly to the left and right slots to activate the plug-in module in that slot.

The Plug-In Units

2.04 At present, there are two types of plug-ins associated with the test set. The ED-7C140

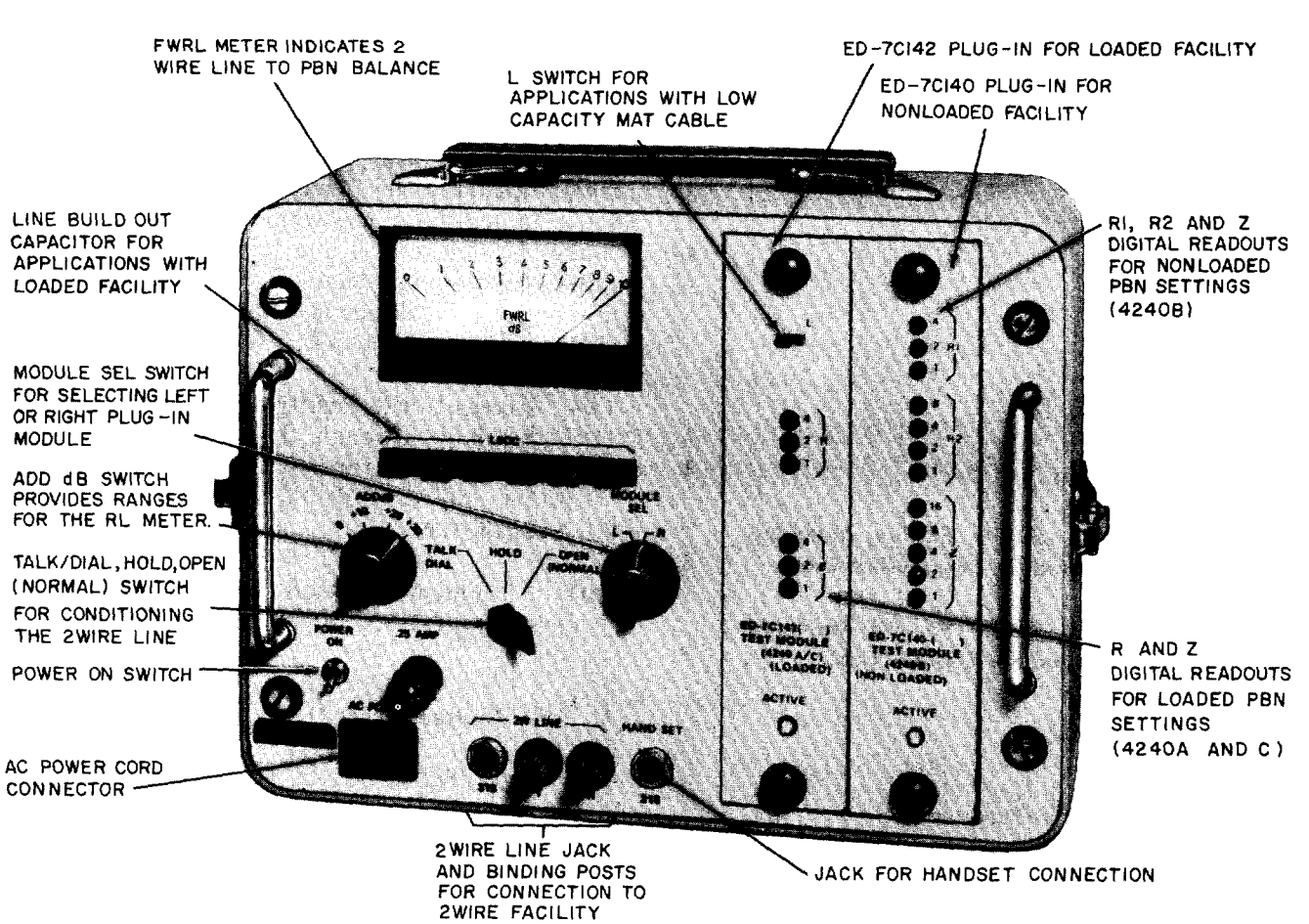

Fig. 1—Facility Matching Test Set

TABLE A

LBOC SWITCH CONVERSION

END-SECTION LENGTH (FEET)	CAPACITANCE VALUE HI-CAP.	SWITCH IN	CAPACITANCE VALUE MAT	SWITCH IN
1450 — 1549	.080	DF	.064	F
1550 — 1649	.078	ABCF	.062	ABCDE
1650 — 1749	.076	BCF	.060	BCDE
1750 — 1849	.076	BCF	.060	BCDE
1850 — 1949	.074	ACF	.058	ACDE
1950 — 2049	.072	CF	.058	ACDE
2050 — 2149	.070	ABF	.056	CDE
2140 — 2249	.068	BF	.054	ABDE
2250 — 2349	.068	BF	.054	ABDE
2350 — 2449	.066	AF	.052	BDE
2450 — 2549	.064	F	.052	BDE
2550 — 2649	.062	ABCDE	.050	ADE
2650 — 2749	.060	BCDE	.048	DE
2750 — 2849	.060	BCDE	.048	DE
2840 — 2949	.058	ACDE	.046	ABCE
2950 — 3049	.056	CDE	.046	ABCE
3050 — 3149	.054	ABDF	.044	BCE
3150 — 3249	.052	BDE	.042	ACE
3250 — 3349	.052	BDE	.042	ACE
3350 — 3449	.050	ADE	.040	CE
3450 — 3549	.048	DE	.040	CE
3550 — 3649	.046	ABCE	.038	ABE
3650 — 3749	.044	BCE	.036	BE
3750 — 3849	.044	BCE	.036	BE
3850 — 3949	.042	ACE	.034	AE
3950 — 4049	.040	CE	.032	E
4050 — 4149	.038	ABE	.032	E
4150 — 4249	.038	ABE	.030	ABCD
4250 — 4349	.036	BE	.030	ABCD
4350 — 4449	.034	AE	.028	BCD
4450 — 4549	.032	E	.026	ACD

TABLE DESIGNATIONS	FRONT PANEL SWITCHES
A	.002 μF
B	.004 μF
C	.008 μF
D	.016 μF
E	.032 μF
F	.064 μF

Test Module conditions the test set for testing with nonloaded cable facility. ED-7C142 is used for similar results with loaded facilities. The binary-display indicators on the front panels of these plug-ins correspond directly to the switches on the PBNs of the MFT repeaters. Lighted indicators mean the corresponding PBN switches are to be operated. The type PBN(s) each module relates to is specified on the front panel of that module. ED-7C140 provides settings for the 4240B or equivalent integrated circuit (IC) type PBN used on nonloaded cable. ED-7C142 provides similar settings for the 4240A, 4240C, and IC type PBNs used on loaded facilities. The 4240A was the original PBN for loaded cable before the advent of Metropolitan Area Trunk (MAT) cable. The 4240C and IC type PBNs have been developed for applications with all H88-loaded cables including MAT. When operating with MAT, which is low-capacitance, the front-panel L switch should be in the L position. For all other high-capacitance loaded facilities, the L switch should be operated away from the L position.

2.05 The ACTIVE indicator on either plug-in should be lighted when that module has been selected by the MODULE SEL switch.

2.06 There are no restrictions as to which slot the plug-ins can be used in. Test set wiring allows each module to be completely interchangeable with the other and, in addition, only one plug-in is required for operation of the test set.

B. Electrical Features

2.07 The general electrical features associated with the test set are described in the following paragraphs. For operation description, see Part 3.

2.08 The facility matching test set operates on standard utility power (117 VAC @ 60 Hz, 10 watts) which is provided through the front panel AC POWER connector. From this, an internal regulated power supply develops the desired test set operating voltages.

2.09 Another electrical feature of the test set is the 2-wire line conditioning feature which is associated with the OPEN (Normal), HOLD, and TALK/DIAL switch. With these three positions, the test set can:

OPEN (Normal)—Provide testing on a "dry" circuit or release a "wet" circuit which has been tested.

TALK/DIAL—Connect a "wet" 2W line to the HANDSET Jack for external input to the 2-wire circuit.

HOLD—Seize and hold, by loop closure, 2-wire circuits with battery .feed at the far end.

C. Measurement Features

2.10 With the ED-7C140 plug-in, the test set has the ability to generate PBN settings for nonloaded metallic facilities. By following procedures given in Part 4, the set can automatically generate accurate PBN settings for all common nonloaded arrangements including bridge taps.

2.11 ED-7C142 conditions the test set for loaded cable applications. The test set is capable of determining PBN setting for all common gauges of H88 loaded facilities. The actual length of the cable end section (including bridge taps) at the test set is required before accurate PBN settings can be obtained. ▶Office records should be used to determine the length of the end section. If the records do not contain this data, then an average length of 3 kft should be assumed. The LBOC setting would be .056 (see Table A).◀

▶FWRL Meter Reading

2.12 With each new PBN setting output, the test set also provides an associated FWRL (flat-weighted return loss) reading. This reading is only an indication of broad-band facility match. It cannot be translated directly to ERL (Echo return loss). SRL (singing return loss) or SRL-Hi which are used to specify system or equipment balance requirements. (For more information on the theory of return loss, see Section 332-015-100).◀

2.13 Although the reading of the ▶FWRL◀ meter has a direct relationship to the balance provided by the test set, the type of facility, termination, and cable irregularities drastically affect the readings of this meter. ▶However, under normal conditions the readings in the following table are "ballpark" limits of what could be expected for the various type facilities.

CABLE	TERMINATION	READING
Nonloaded	900C, 600C, and 4066H	20 dB
Loaded	900C, 600C, and 4066H	15 dB

Note: FWRL readings, lower than specified in the table, indicate that the facility being measured differs significantly from standard circuit design criteria. In these situations, the determined PBN setting (test set readout) is still the best facility match possible. These PBN settings can be used when the circuit is initially turned up. However, gain and equalization settings may need to be reduced to avoid singing conditions until the facility problems can be eliminated.◀

2.14 In all cases of measurement, the test set requires varying periods of time to stabilize on the settings. In general, the coding process requires less than 30 seconds to reach a stable code and final return loss value. However, cases where facility characteristics are such that the coding is at a code boundary, a slightly longer time may be required.

3. OPERATION

3.01 The following paragraphs describe the facility matching test set from the standpoint of general unit operation. For more detail, see SD/CD-7C041-01.

3.02 The test set works on the basis of a typical 4-port hybrid circuit. The 2-wire facility to be tested is connected to the 2-wire port, the noise source connects to one of the two 4-wire ports, and the PBN is across the 2-wire balance port. See Fig. 2 and 3 for block diagrams of the test set arranged for both nonloaded (Fig. 2) and loaded operations (Fig. 3).

3.03 From the basic principles of hybrid operation, best balance is obtained when the PBN exactly matches the resistive and reactive components of the cable. When this match occurs, the voltage across the balance network will match that across the cable in both magnitude and phase.

3.04 To obtain this balance, the set provides sense circuits (CP4) which monitor the 2-wire port and the PBN. The outputs of these sense circuits feed the control signals circuitry on the plug-in module (CP1 or 2) where individual balance setting feedback loops are developed. The analog/digital processor (CP3) converts these control signals into the actual PBN analog/digital drive signals which feed the PBN and readout display drivers. The readouts are constantly active and reflect the present balance settings. (This is the reason for allowing time for the test set to converge on readout settings before using them.)

3.05 The feedback loops are completed when the associated signals actually change the setting of the PBN. Changing the PBN changes the outputs from the sense circuit, thus changing the feedback loop signals, etc, thus the feedback loop.

3.06 This looping cycle is continuously repeated as long as the test set is active. Eventually (approximately 30 seconds), the readout should stabilize on some setting. ▶The readout setting can be applied directly to the PBN of the repeater to be used on that 2-wire facility.◀

4. APPLICATION AND TEST PROCEDURE

4.01 The test set may be used to derive PBN code settings for 19-, 22-, 24-, 25- and 26-gauge H88 loaded and nonloaded 2-wire cable facilities consisting of pure or mixed gauge makeups.

A. CO to Customer Location

4.02 The following steps give the general test procedures for a central office to customer location.

(1) Terminate the facility far end at the customer premise with an appropriate network; eg, 600C, 900C or 4066H. ▶See Note in Step 8.◀

(2) At the CO, insert into the MFT transmission slot the MFT test extender (J99343TB).

(3) Connect the test set 2W LINE terminals to the appropriate test extender LINE jack.

(4) Operate the test set MODULE SEL to the L or R position and select the appropriate test module.

(5) If the loaded test module is selected, set the L and LBOC switches to the appropriate

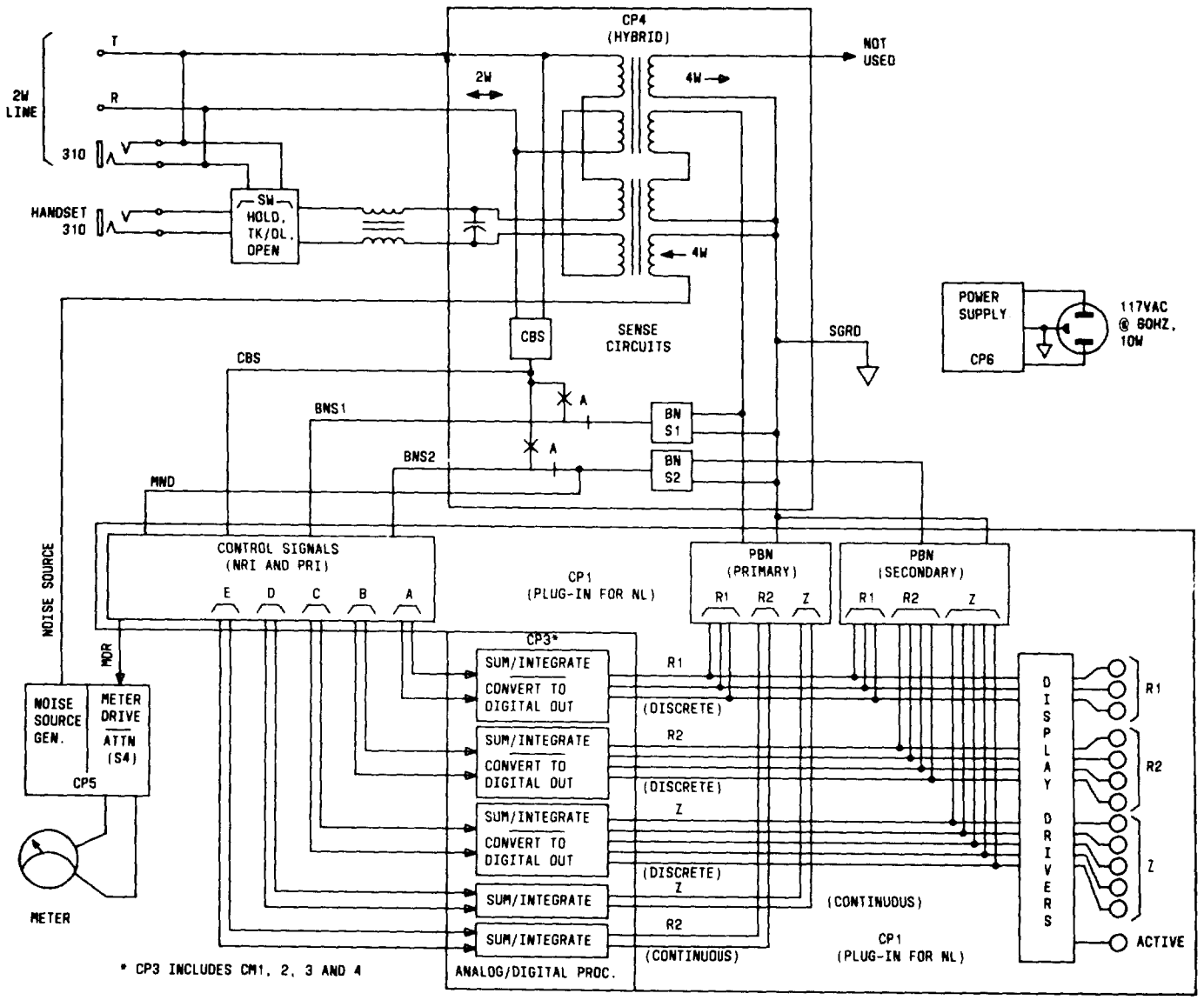

Fig. 2—Block Diagram of the Facility Matching Test Set Arranged for Nonloaded Cable

position. The L switch should be to the left for all gauges other than 25 MAT cable.

(6) Operate the test set power switch to ON.

(7) Allow sufficient time for all coding displays to converge to a steady state condition. ▶The final test set settings (both PBN readout and LBOC settings) are the actual circuit layout values to be used. These settings should be installed on the repeater that interfaces the 2-wire facility.◀

(8) Perform other required tests on the repeater unit.

▶***Note:*** 600C is 600 ohms in series with 2.15 microfarads, 900C is 900 ohms in series with 2.15 microfarads, and 4066H telset simulating network set for proper DC current values. See 332-852-108 for description.◀

B. CO (Transmission Unit Location) to Far CO

4.03 The following steps give the general test procedures for a central office to a far central office.

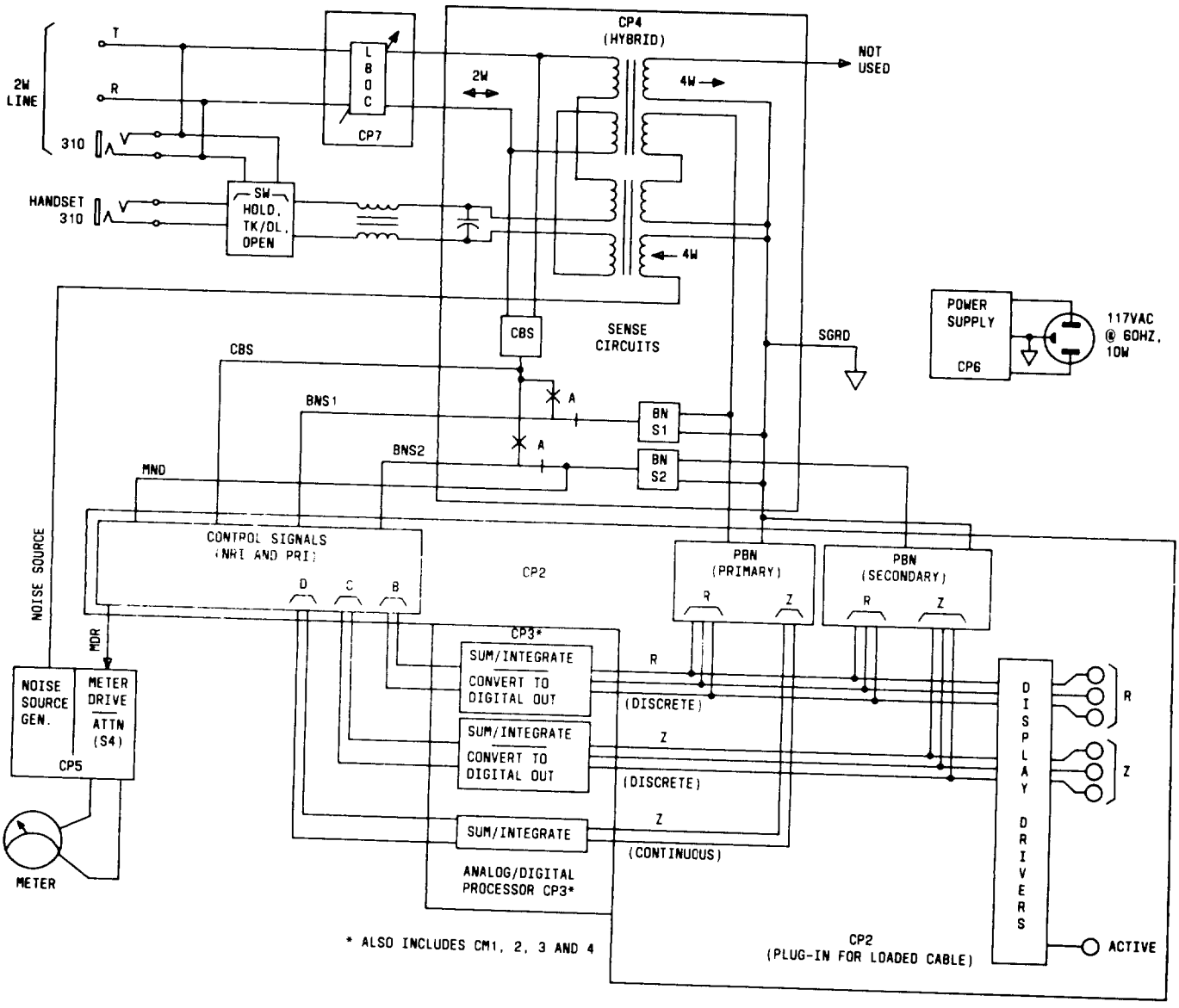

Fig. 3—Block Diagram of the Facility Matching Test Set Arranged for Loaded Cable

(1) Replace the transmission unit with the test extender.

(2) Connect the test set to the appropriate test extender LINE jack.

(3) Operate the test set panel switch to the TALK-DIAL position.

(4) Operate the test set MODULE SEL switch to the appropriate module.

(5) With a handset, dial the far office quiet termination. When seizure occurs, operate the panel switch to the HOLD position.

(6) If the loaded test module is selected, set the L and LBOC switches to the appropriate position.

(7) Operate the test set power switch to ON.

(8) Allow sufficient time for all coding displays to converge to a steady state condition. The final test set settings (both the PBN

readout and LBOC setting) are the actual circuit layout values to be used. These settings should be installed on the repeater that interfaces the 2-wire facility.◀

(9) Perform other required tests on the repeater unit.

(10) Remove the test extender and test set and place the transmission unit in service.

4.04 It is recommended that test set AC power be kept off until the test circuit is seized, terminated and ready for test. Power should then be applied for the test period. The time required to obtain a stable code display is generally on the order of 30 seconds or less.

5. REFERENCES

5.01 ▶The following documents are available on the facility matching test set:◀

CD-7C041-01

SD-7C041-01

801-406-160 (Equipment Description).