

**DATA SYSTEMS ON DIRECT DISTANCE DIALING (DDD) NETWORK
DATA-PHONE SYSTEMS USING 130-TYPE SUBSCRIBER SETS
DESCRIPTION — TEST CENTER TESTING ARRANGEMENT**

CONTENTS	PAGE
1. GENERAL	1
2. DESCRIPTION OF TESTING ARRANGEMENT	2
3. ADJUSTMENTS OF TEST CENTER 130C1 SUBSET	3
PURPOSE	3
APPARATUS REQUIRED	3
DETAILED PROCEDURES	3
REFERENCE CHART	3
4. MAINTENANCE OF TEST CENTER 130C1 SUBSET	3

1. GENERAL

1.01 This section describes the arrangement and adjustments of the equipment for testing subscriber DATA-PHONE stations that use:

- A — A 130-type subscriber set as the DATA-PHONE subset, and,
- B — TTY station apparatus for data communication purposes.

The testing arrangement would normally be provided at the test center serving the stations involved.

1.02 Methods of using the equipment for testing purposes are covered in Section 314-200-500.

1.03 At the subscriber's station, the 130-type DATA-PHONE subscriber set accepts serialized digital data from the data equipment (TTY transmitter-distributor or keyboard). It

then converts these data into suitable voice-frequency (VF) tones for transmission over a regularly established telephone connection. At the other end of the connection, the receiving portion of a like subset performs the reverse functions, i.e., it converts the incoming VF tones back to serialized digital data. These data are then printed out by the receiving TTY equipment. In both cases, the signal conversion is accomplished by means of a plug-in 43A1 channel terminal contained within the 130-type subset. The channel terminal is provided with frequency-determining networks for operating at VF carrier frequencies of 1310 cps for marking signals and 1240 cps for spacing signals.

1.04 These subscriber station arrangements permit TTY communication between the DATA-PHONE stations at speeds up to 100 words per minute.

1.05 An initial application of the test arrangements covered herein will be in testing stations provided for airlines Teleticketing service. This service is described in Section 314-200-100. Briefly, however, this service is a one-way DATA-PHONE service that permits an airlines ticket office to "send" passenger tickets over regular switched telephone connections to customers who are provided with complementary DATA-PHONE receiving equipment. Operating speeds of 75 or 100 words per minute can be used. For local compatibility, only one speed is used in a particular metropolitan area.

1.06 The testing arrangement covered herein will permit testing either a sending or a receiving DATA-PHONE station provided for Teleticketing or any similar one-way service. It will also permit testing a 130-type DATA-

PHONE subset station arranged for alternate 2-way TTY communication. The principal requirement is that the same signaling frequencies be used. As stated before, these are 1310 cps for marking signals (sending or receiving) and 1240 cps for spacing signals (sending or receiving).

2. DESCRIPTION OF TESTING ARRANGEMENT

2.01 Foldout Fig. 1 shows a block diagram of the testing arrangement which consists of items described below. Circuit schematics for Items 1 and 2 are shown in foldout Fig. 2.

Item 1. A relay-rack-mounted 130C1 subset with an included, plug-in, 43A1 carrier channel terminal. These are powered by a similarly installed companion rectifier per KS-5663, List 8. The VF input and output of the 43A1 terminal are connected to an included, plug-in, hybrid-line-transformer. The dc send and receive loops of the subset are brought out on a FDX basis and each is terminated in a 3-jack TLT at the test position. These TLT's are for convenience in setting up various test arrangements.

Note 1: As previously noted, the 43A1 terminal uses the same carrier frequencies for both sending and receiving. For the receiving condition, it is, of course, necessary that the sending oscillator be turned off. This is accomplished by wiring the plate supply of the oscillator thru contacts of the SEND LPG jacks. A plug must be inserted in one of the LPG jacks to turn on the oscillator.

Note 2: In the sending condition, a portion of the outgoing VF signal is reflected back into the receive side of the 43A1. If this reflected signal is of too high a level, it may distort the sending signals due to coupling within the 43A1 terminal. The hybrid-line-transformer is provided to control this effect by adjustment of its balancing network.

Item 2. A 3 db, impedance-improving pad and an impedance-matching and isolating-holding transformer (94F coil). These are connected externally between the 130C1 subset and its access VF LN jack.

Note: A single 43A1 channel terminal presents an impedance of 600 ohms only over

the narrow band of carrier frequencies at which it operates. At other frequencies it presents a relatively high impedance. Under the DATA-PHONE condition, therefore, a 130C1 subset presents a poor termination, outside of its pass-band, to the telephone line to which it is connected. Where gain is employed on a particular telephone connection, this poor termination may cause a singing condition to develop. To minimize this possibility, a 3 db impedance-improving pad is connected ahead of the subset. A 1-1/2:1 ratio coil (94F) ahead of the pad provides a match at the carrier frequencies with the nominal 900-ohm impedance subscriber line. This coil also serves to hold up the telephone connection under the DATA-PHONE condition.

Item 3. A jack-terminated subscriber line from the serving local central office.

Note: The jack circuit is so arranged as to permit regular telephone use or DATA-PHONE use of the line by appropriate patches. For telephone communication, the testboard attendant's regular telephone cord and set are used. Under the DATA-PHONE condition, the telephone connection is held up by the hold feature mentioned in Item 2.

Item 4. Standard testboard or serviceboard telegraph transmission measuring and testing equipment including:

- a. Monitor TTY equipment.
- b. Transmitter-distributor.
- c. Source of undistorted and distorted test signals arranged for "open and close" operation.
- d. Telegraph transmission measuring equipment such as the 164C- or 118C- types.

Note: The equipment included in Item 4 may be provided in a variety of ways depending on local conditions. Specific items may be either jack terminated or cord terminated. The jack terminations shown in Fig. 1 are, therefore, purely arbitrary. The jack designations shown are functional ones and may not agree with the standard designations employed for the equipment.

3. ADJUSTMENTS OF TEST CENTER SUBSET**PURPOSE**

3.01 This part covers the method of adjusting the test center 130C1 subset. As this set will be the reference standard for adjusting the subscriber's DATA-PHONE subset, it is essential that the adjustments made in the test subset be "on the nose." The adjustment procedures relate to:

- a. Preliminary equipment checks
- b. Power supply adjustments
- c. Send-loop current adjustment
- d. Oscillator frequency adjustment
- e. VF send level adjustment
- f. Hybrid transformer network balance adjustment
- g. Receive loop current adjustment
- h. Receive bias adjustment

The procedures are to be used for initial adjustment. For "readjust" procedures, steps that do not apply may be disregarded.

APPARATUS REQUIRED

3.02 The items of test apparatus required to make the necessary adjustments in the test subset are itemized on the inner fold of Sheet 1 of foldout Fig. 3.

DETAILED PROCEDURES

3.03 Detailed step-by-step procedures covering the adjustment of the 130C1 subset are included in foldout Fig. 3.

REFERENCE CHART

3.04 Foldout Fig. 4 provides a chart summarizing the various adjustments and requirements. It may be used as a sample for a form to be kept with the subset and to be used for recording the results of initial and subsequent tests.

4. MAINTENANCE OF TEST CENTER 130C1 SUBSET

4.01 After initial installation and testing, no routine maintenance will be necessary except for regular 12-months check of the SA-G and LP-C reference voltages.

4.02 If trouble develops or improper operation is suspected, the following procedure should be employed:

- (1) Verify that all tube filaments are lit.
- (2) Check the reference voltages, loop currents and sending levels, etc, and compare with the last entry on the REFERENCE CHART. Wide variations in these readings will usually indicate the probable source of trouble.
- (3) If any controls, adjustments, tubes or other component parts of the 130C1 subset or 43A1 channel terminal unit are changed, a new set of reference readings should be determined and entered on the REFERENCE CHART.

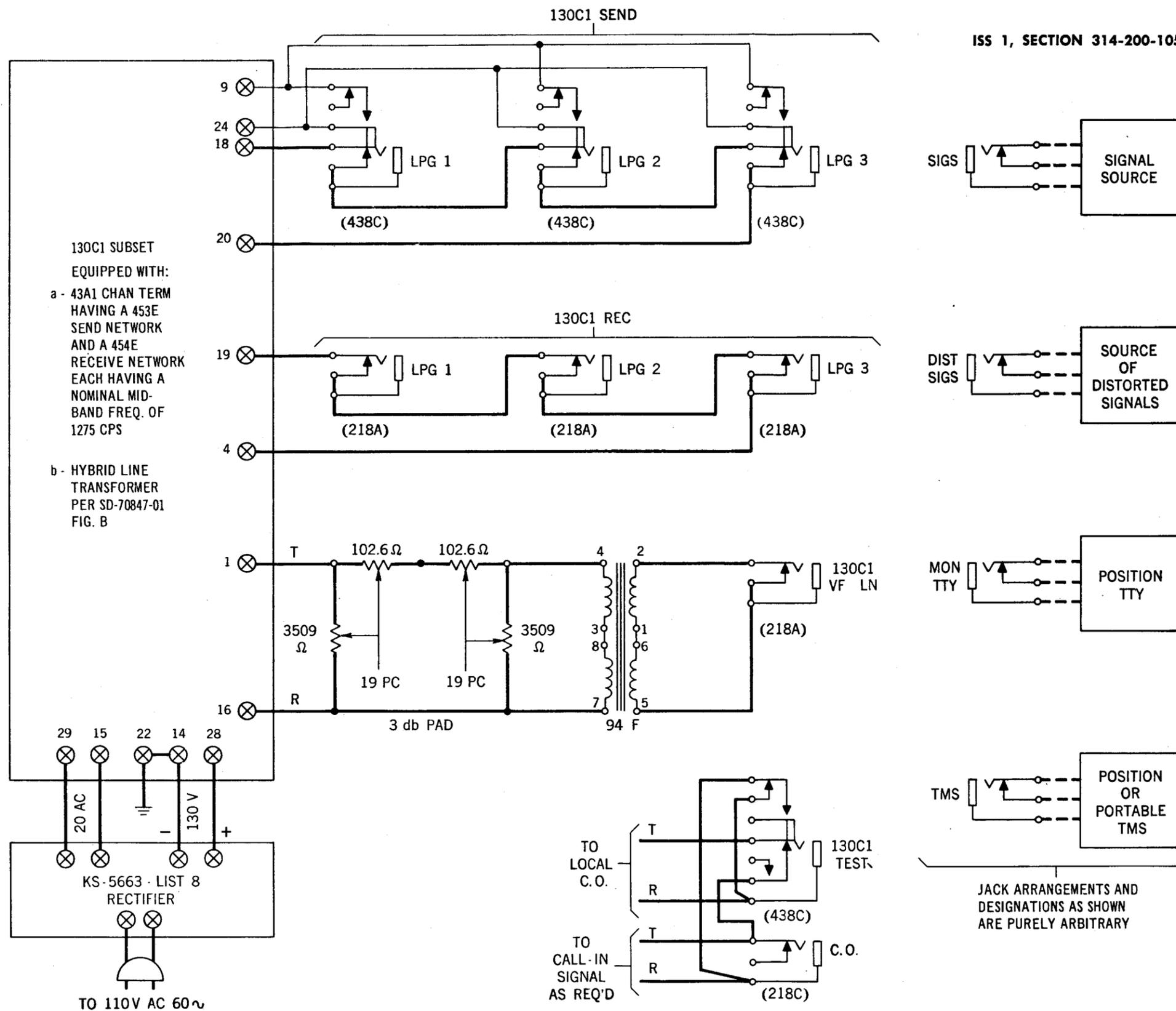
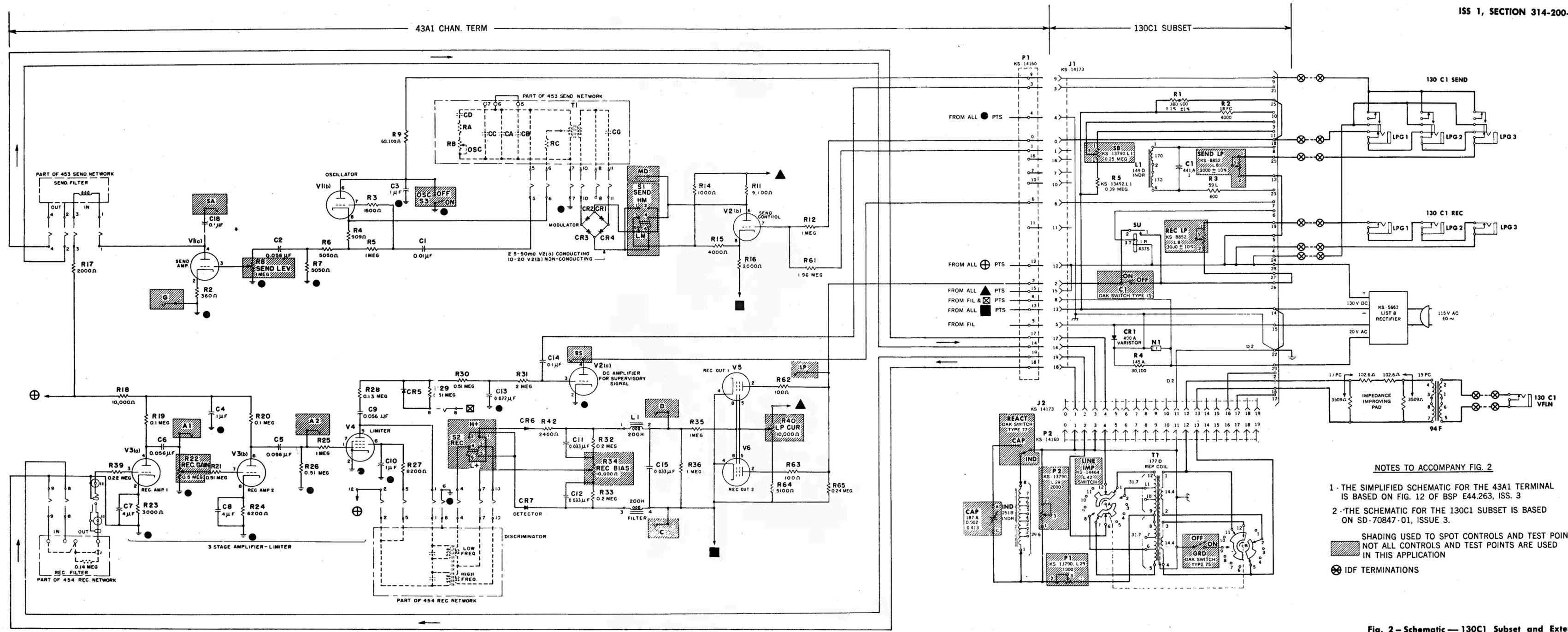


Fig. 1 - Block Diagram Testing Arrangement



NOTES TO ACCOMPANY FIG. 2

1. THE SIMPLIFIED SCHEMATIC FOR THE 43A1 TERMINAL IS BASED ON FIG. 12 OF BSP E44.263, ISS. 3
2. THE SCHEMATIC FOR THE 130C1 SUBSET IS BASED ON SD-70847-01, ISSUE 3.

SHADING USED TO SPOT CONTROLS AND TEST POINTS
 NOT ALL CONTROLS AND TEST POINTS ARE USED IN THIS APPLICATION

⊗ IDF TERMINATIONS

Fig. 2 - Schematic - 130C1 Subset and External Connecting Circuits

NOTES TO ACCOMPANY FIGURE 3

- | Note | Description |
|------|---|
| 1. | The following test apparatus is required to perform the tests called for in the adjoining figure: <ul style="list-style-type: none"> 1 — A KS-14510 volt-ohm-milliammeter (VOM). 2 — A Hewlett-Packard 400C vacuum tube voltmeter or equivalent (VTVM). This meter is to be used in lieu of the KS-14510 meter when measuring ac voltages of less than 3 volts. 3 — A 13A transmission measuring set or equivalent (TMS). 4 — A 164C- or 118C-type telegraph transmission measuring set (TGTMS). 5 — A dc milliammeter capable of measuring 60 ma. (maM). (VOM) indicate manner in which the equipment is referred to in Fig. 3. |
| 2. | CAUTION: Make sure that the ac power to the rectifier is removed before plugging or unplugging the 43A1 channel unit or when making wiring connections to the set. Where the ac is wired direct to the set without a cord and plug, this will require removal of the ac fuse in the set. |

PRELIMINARY EQUIPMENT CHECKS — TO BE MADE WITH POWER DISCONNECTED FROM RECTIFIER (2)				
ON PLUG-IN HYBRID TRANSFORMER OF 130C1 SUBSET		ON 130C1 SUBSET	ON 43A1 CHANNEL TERMINAL	
a. Set LINE IMP switch to C. (This switch setting provides a match against 600 ohms. This is effectively what the subscriber line looks like when viewed thru the 3 db pad and 94F coil.) b. Set GND switch to OFF. (Due to the isolating effect of the 94F coil ahead of the transformer, the position of this switch is not important.) c. Set REACT switch to C for cable circuits or to L for open wire circuits. (Final setting.) d. Set P1 and P2 controls to the centers of their mechanical range. (Final adjustment to be made later.)		a. Set C1 switch to OFF. (This is final setting.) b. Set SB control to its extreme clockwise position. (With the station wiring used with this 130C1 subset, the SB control is not in the circuit.) c. Set SEND LP control to the center of its mechanical range. (Final setting will be made later.) d. Set REG LP control to its extreme counterclockwise position. e. At the test position, patch the REC TTY to the REC LEG jack. (This inserts the receiving magnets in series with the REC LP control resistor.) f. Connect VOM — ohms x 100 scale — between terminals 26 and 4 of 130C1 subset terminal strip. Adjust REC LP control to give meter reading of 8.0. (This sets the receiving loop resistance at 800 ohms. When the loop current is set — later — to 63.0 ma by means of the LP to C, some tickling-up of the REC LP control may be required if the rectifier voltage cannot be set exactly to +130V.)	a. Check that the correct networks — A 453E send and a 454E receive network — and the 43A1 channel term. unit are secured in their respective sockets. b. Check that all electron tubes — V1 thru V6 — are correctly in place. c. Set REC switch to H+. d. Set SEND switch to HM. e. Set REC GAIN control to its maximum clockwise position. f. Set OSC switch to ON. g. Set REC BIAS, LP CUR, and SEND LEV controls to the center of their mechanical range. (Final positions will be set later.)	
DETAILED ADJUSTMENT PROCEDURES				
TEST		INITIAL PREPARATION AND PATCHES	TEST	
NO.	DESCRIPTION AND PURPOSE		STEP	PROCEDURE AND VERIFICATION
A	RECTIFIER VOLTAGE ADJUSTMENTS <i>Purpose:</i> To set the KS-5663 — List 8 rectifier controls so as to produce the correct operating voltages under full-load conditions.	a. Connect AC supply to rectifier. b. Observe that all tube filaments are lit on the 43A1 channel terminal. c. Allow 10-15 minutes for warmup of the 130C1 subset. d. Insert shorting plug into 130C1 SEND LPG 1 jk. (This shorting plug maintains continuity of the send loop circuit and turns on oscillator.)	1 2 3 4	Connect VOM (ac, 60V scale) to terminals 15 and 29 on the 130C1 subset. Record reading on REFERENCE CHART. If it is not within $20 \pm 1.0V$, determine source of trouble. Patch VOM (dc, 120 ma scale) into 130C1 SEND LPG 2 jack and adjust SEND LP control of 43A1 to give a VOM reading of 63.0 ma. Patch VOM (dc, 120 ma scale) into 130C1 REC LPG 1 jk. and adjust LP CUR control of 43A1 to give a VOM reading of 62.5 ma. Connect VOM (dc, 300V scale) across terminals 14 (-) and 28 (+) of the 130C1 subset. Select tap on rectifier to give VOM reading of $130 \pm 2V$. Record rdg. on REFERENCE CHART.
B	SEND LOOP CURRENT ADJUSTMENT AND MEASUREMENT OF MD-C REFERENCE VOLTAGE <i>Purpose:</i> To set SEND LP control so that the send loop current is 63.0 ma when sending from bare contacts. When sending thru series magnets this current will drop to about 62 ma for an average of 62.5 ma for the two sending conditions.	a. Retain shorting plug in SEND LPG 1 jk. per A-d above. (This simulates the condition of sending with no magnets in series with the sending contacts.)	1 2	Patch VOM (dc, 120 ma scale) into 130C1 SEND LPG 2 jack and adjust SEND LP control of 43A1 to give a VOM reading of 63.0 ma. Connect VOM (dc, 300V scale) between pin jack MD (+) and C (-) on the 43A1 channel terminal. Record VOM reading (expectancy = 95-100V) on the REFERENCE CHART.

NOTE
 (1) etc., in this figure indicates an important note which should be consulted. Notes 1 & 2 are on inner fold.

Fig. 3 — (Sheet 1 of 2) — Preliminary Equipment Checks and Detailed Testing Procedures

DETAILED ADJUSTMENT PROCEDURES

TEST		INITIAL PREPARATION AND PATCHES	TEST	
NO.	DESCRIPTION AND PURPOSE		STEP	PROCEDURE AND VERIFICATION
C	SENDING CARRIER FREQUENCY ADJUSTMENT <i>Purpose:</i> To set oscillator frequencies "on the nose."	a. REFER TO BSP "43A1 CARRIER TELEGRAPH TERMINAL TROUBLE TESTS — MEASUREMENT AND ADJUSTMENT OF SENDING CHANNEL OSCILLATOR FREQUENCIES." — E34.264.02	1 ETC	Refer to cited BSP.
D	VF SEND LEVEL ADJUSTMENT AND MEASUREMENT OF SA-G VOLTAGE <i>Purpose:</i> To adjust SEND LEV control of 43A1 so that the VF input to the exchange line is -8.5 dbm (3) for the signaling condition (mark or space) producing the higher oscillator output.	a. Verify that the SEND switch of the 43A1 is on HM and that a shorting plug is in the 130C1 SEND LPG 1 jk. to retain loop current and keep osc. on. b. Connect VOM (ac, 60V scale) between pin jacks A1 and G on the 43A1. c. Patch TMS to 130C1 VF LN jack. d. Connect VTVM (10V scale) between pin jacks SA and G on the 43A1.	1 2 3 4 5	Adjust SEND LEV control to give TMS rdg. of -8.5 dbm. Insert open plug in 130C1 SEND LPG 2 jack to cause spacing signal. Note TMS rdg. which should be same as Step 1 ± 2 db. If output level is higher than in Step 1, retain plug; if lower, remove plug. Adjust P1 and P2 controls and capacitor strapping to give VOM rdg. of 8-12V (4). Readjust SEND LEV control to give 13A rdg. of -8.5 dbm. Note and record on the REFERENCE CHART the TMS and VTVM rdgs. for the two signaling conditions (open plug in SEND LPG 2 jk. = space; plug out = mark).
E	HYBRID TRANSFORMER NETWORK BALANCE ADJUSTMENT AND MEASUREMENT OF A1-G AND A2-G REFERENCE VOLTAGES <i>Purpose:</i> To balance the hybrid transformer network against the DATA-PHONE exchange line. With adequate balance, the energy reflected back from the line into the receive side of the 43A1 will be sufficiently low so as not to distort the sent signals. It will, however, be sufficient to give local received copy thru the receive side of the subset.	a. Same as D-a. b. Same as D-b. c. Establish telephone connection to local office 900-ohm balance test termination. When termination is obtained, patch between 130C1 VF LN and 130C1 TEST jacks. Retain this connection for Tests F and G.	1 2 3 ✓	Put circuit in condition causing higher oscillator output — refer to Test D, Step 5. Readjust P1 and P2 controls and capacitor strapping to give a VOM rdg. of 8-12 volts. Record reading on REFERENCE CHART. Put circuit in other signaling condition. The VOM rdg. should drop an amount in volts numerically about equal to the difference in the TMS rdgs. of Test D, Step 5. Record reading on REFERENCE CHART. Patch VOM (ac, 60V scale) between A2 and G pin jks. of the 43A1. Note and record on the REFERENCE CHART the VOM rdgs. for the two signaling conditions.
F	RECEIVE LOOP CURRENT ADJUSTMENT AND MEASUREMENT OF LP-C VOLTAGE <i>Purpose:</i> To adjust LP CUR control on 43A1 and REC LP control on 130C1 so that the correct loop current of 62.5 ma and correct LP-C voltage of 80V are obtained. (5)	a. Same as D-a. b. Patch REC TTY to 130C1 REC LEG jack. c. Same as E-c = 900 ohm test termination. d. Patch maM (dc, 100ma scale) to 130C1 REC LPG 1 jack. e. Connect VOM (dc, 300V scale) between pin jacks LP and C of 43A1.	1	Alternately adjust LP CUR control and REC LP control so that a VOM rdg. of 80V and a maM rdg. of 62.5 ma are obtained simultaneously (5). Record VOM and maM readings on the REFERENCE CHART.
G	RECEIVE BIAS ADJUSTMENT <i>Purpose:</i> To adjust the REC BIAS control so that the signals received by reflection from the send side have minimum bias. (6)	a. Patch source of undistorted miscellaneous signals to the 130C1 SEND LPG 1 jack. (7) b. Patch receiving TTY to 130C1 REC LPG 1 jack. (8) c. Same as E-c = 900 ohm test termination. d. Patch TGTMS to 130C1 REC LPG 2 jack.	1	Adjust REC BIAS control so as to meet the distortion limits in E34.263.09. Observe that the REC BIAS control is not at or close to its extreme setting. Note and record on the REFERENCE CHART the TGTMS bias reading for all signaling speeds at which the test arrangement is required to operate. (6)

NOTES TO ACCOMPANY FIGURE 3

- | Note | Description |
|------|---|
| 3. | This -8.5 dbm value includes an allowance for reflection loss arising from the use of the 600-ohm TMS. |
| 4. | This voltage at the A1 jack means that the trial balance of the network is sufficiently close to its final value (when adjusted against the line) to permit setting the SEND LEV control to its final value. |
| 5. | It will be recalled that the REC LP control was set to approximately the correct position by Step e of the 130C1 subset preliminary checks. Only minor tickling-up of this control should be all that is required at this time. |
| 6. | With the REC BIAS control adjusted in accordance with Test G, it will not be necessary to measure the voltage between pin jacks D and C under the two signaling conditions. |
| 7. | Separate signal sources should be used for each signaling speed to be used. |
| 8. | The receiving TTY should be arranged for the correct signaling speed. |

NOTE
(1) etc., in this figure indicates an important note which should be consulted. Notes 3-8 are on inner fold.

Fig. 3 — (Sheet 2 of 2) — Preliminary Equipment Checks and Detailed Testing Procedures

	TEST NO. TABLE 1	METER		TEST POINTS	REQUIREMENTS	READINGS		
		KS-14510 SCALE	OTHER TYPE AND SCALE			INITIAL	SUBSEQUENT	
						DATE =	DATE =	DATE =
130V, dc supply	A	300V, dc		14 (-) and 28 (+) on 130C1	130 ± 2V			
20V, ac supply	A	60V, ac		15 and 29 on 130C1	20 ± 1.0V			
Send Loop Current and MD-C Reference Voltage	B B	120 ma, dc 300V, dc		SEND LPG 1 jk — Testboard MD (+) and C (-) pin jks — 43A1	63.0 ma 95-100V			
Sending Carrier Level and SA-G Reference Voltage	D D		TMS, -5dbm VTVM, 10V	130C1 VF LN jk — Testboard SA and G pin jks — 43A1	-8.5 dbm — worst* condition (M or S) -8.5 to -10.5 dbm other condition (S or M) - V — worst* condition (M or S) - V — other " (S or M)			
Hybrid Network Balance and A1-G Reference Voltage A2-G Reference Voltage	E E	60V, ac 60V, ac		A1 and G pin jks — 43A1 A2 and G pin jks — 43A1	8-12V — worst* condition (M or S) 6-12V — other " (S or M) V — worst* " (M or S) V — other " (S or M)			
Receive Loop Current and LP-C Reference Voltage	F F	300V, dc	maM, 100ma	130C1 REC LPG 1 jk — Testboard LP and C pin jks — 43A1	62.5 ma) 80V) simultaneously			
Receive Bias	G		TGTMS	130C1 REC LPG 1 jk — Testboard	As specified in BSP E34.263.09.			

* Worst = Condition, marking (M), or spacing (S) that causes the higher output level or the higher voltmeter reading.

Fig. 4 — Reference Chart