PRIVATE LINE STATION ARRANGEMENTS USING DATA AUXILIARY SETS 830A AND 830B WITH DATA SETS 108- AND 109-TYPE INSTALLATION AND CONNECTIONS

CONTENTS PAGE

1. GENERAL

1.01 The data transmitting equipment (Fig. 1) consists of data auxiliary set (DAS) 830A and a data set. When these components are received from the service center, they are assembled and correct options are installed. When they are used in a teletypewriter (TTY), the DAS, data set, and associated apparatus can be installed in the TTY prior to delivery.

1.02 Whenever this section is reissued, the reason for reissue will be listed in this paragraph.

1.03 DAS 830A and data set 108A, 108C, 108D, 108E, 109A, or 109E should be installed in conformance with the section entitled Data Sets—General Installation and Connection Information (590-010-200). A 193A backboard is used when it is necessary to wall mount the data station and when used in TTY equipment.

1.04 Data set adjustments will generally require gaining access to the data station after installation. ***Information on gaining access to the data station when used in a TTY is covered in Section 591-816-300.***

2. TOOLS AND APPARATUS

2.01 A TTS-28 portable station test set, or equivalent, is required for making data set 108-type level adjustments. A KS-20538-L1 volt-ohm-milliammeter (VOM), or equivalent, is required for making data set 109-type measurements. A 748A extracting tool is used to remove the data set.

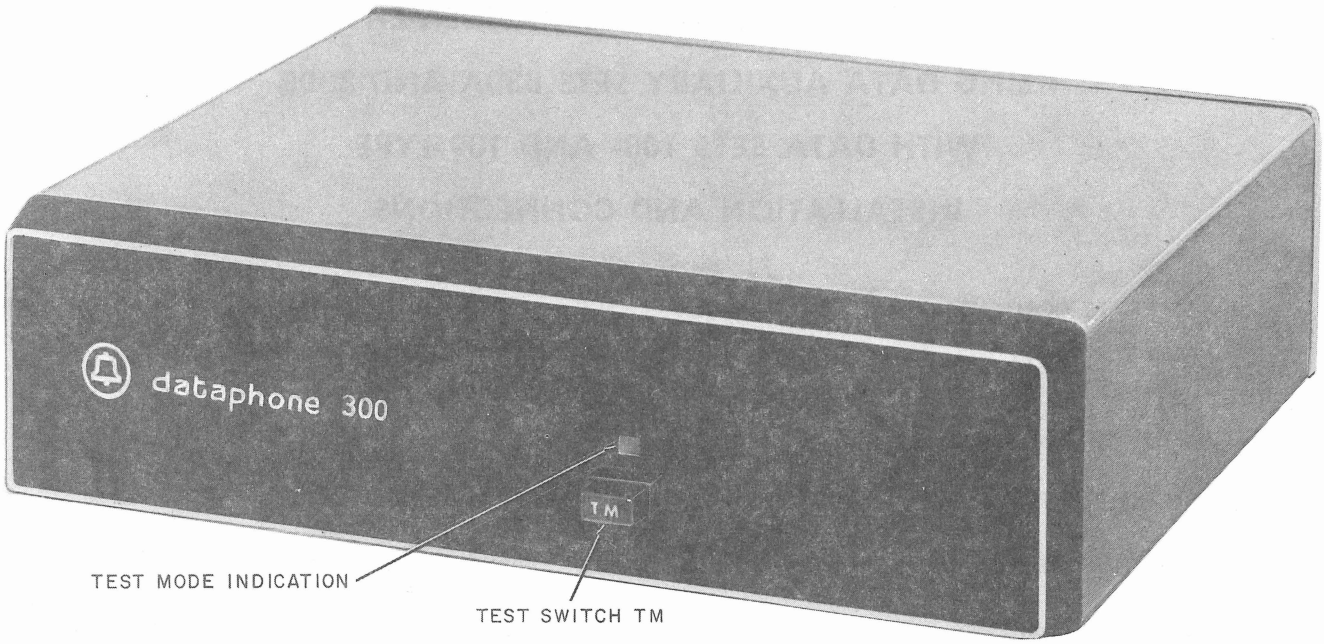


Fig. 1—DAS 830A Data Station

3. OPTION CONNECTIONS

3.01 Options are specified on the service order and must be installed ***prior*** to placing the data set in service. Tabular option information is provided as follows:

Table A—DAS 830A OPTIONS

Table B—DATA SET 108D AND 108E OPTIONS

Table C—DATA SET 109E OPTIONS

Table D—DAS 830B OPTIONS.

4. DATA STATION ACCESS INFORMATION

A. DAS 830A Front Cover Removal and Replacement

4.01 To gain access to the data set, it will be necessary to remove the DAS front cover. The plastic front can be removed by gently squeezing it at the top and bottom and pulling forward. To replace the cover, position it properly, gently squeeze it at the top and bottom, and push it into place.

B. DAS 830A Rear Cover Removal and Replacement

4.02 To gain access to the option switches on DAS 830A, it will be necessary to remove DAS 830A rear cover. The Electronic Industries Association (EIA) connector, power cord, and line facility must be disconnected before removing the rear cover. The plastic back can be removed by gently squeezing it at the top and bottom and pulling forward. To replace the cover, position it properly, gently squeeze it at the top and bottom, and push it into place.

5. INSTALLATION, PREOPERATIVE ADJUSTMENTS, AND TESTS

DATA STATION

5.01 ***DAS 830A and data set.*** Installation procedures for the data station are dependent upon the type data set used. Before installing the data station, the installer must check the following:

- ***Desired options on DAS 830A and data set.*** See Section 591-816-100 for data set option restrictions.

TABLE A

DAS 830A INSTALLATION OPTIONS

FEATURE		OPTION	SWITCH SETTINGS *(Note 5)*	
			OPEN	CLOSED
Copy In Test Mode	Yes	Z		S1-1
	No	Y	S1-1	
CB Lead Connected To *(Note 1)*	CA Lead	X	S1-3, S1-4	S1-2
	RS Lead	W	S1-2, S1-3	S1-4
Carrier Squelch On Carrier Fail *(Note 2)*	Yes	T	S1-3	S1-5
	No	S	S1-3, S1-5	
−24 Volt Lead (-P, JZ-10) Condition *(Note 3)*	Resistor Bypass	R		S2A
	Resistor In Series	Q	S2A	
Remote Operation Of Test Relay Via J2-18	Yes *(Note 4)*	P		S1-6
	No	N	S1-6	
Frame Ground Connected To Signal Ground	Yes	M		S2B
	No	L	S2B	

Note

1. Option W is provided in standard private line arrangements. Local engineering is required when request-to-send (CA) lead is connected to the carrier squelch (CSQ) lead for squelching outgoing carrier. The CSQ and CA leads can be connected by opening S1-2, S1-5, and closing S1-3. This changes normal testing and makes it necessary to disconnect the EIA connector when the DAS 830A is placed in the test mode.
2. Option T can be used only with data sets 108D and 108E.
3. Option R is used when DAS 830B is provided.
4. Option P is provided when external operation of the test relay is provided via EIA interface lead 18.
5. Rocker switches are considered closed when the marked (bar) end is completely depressed.

- ***Correct data set used in far-end station.***

- ***Correct line facilities.*** Data sets 108-type require 3002 or 2000 series voiceband facilities. Data sets 109-type require a metallic loop which will conduct dc signals.

- ***The type of data set to be installed.*** The installation procedure in this section is based

TABLE B

DATA SETS 108D AND 108E OPTIONS

FEATURE *(Note 1)*	OPTION *(Note 2)*	SWITCH SETTING *(Note 3)*
Mark Hold ON TL (BB)	U	Slide switch S2 open. Rotary switch S1A up.
Space Hold ON TL (BB)	V	Slide switch S2 closed. Rotary switch S1A down.
FDX Operation	X *(Note 4)*	Slide switch S1 closed. Rotary switch S1C down.
2-Wire Operation	Y	Screw switch A 2-3 closed and 1-2, 3-4 open.
4-Wire Operation	Z	Screw switch A 1-2, 3-4 closed and 2-3 open.

Notes:

1. The function of the option is explained in Table D of Section 591-816-100.
2. Options S, T, and W are not used in station applications. Slide switch S3 or rotary switch S1B determines options S and T. Slide switch S1 is open or rotary switch S1C up for option W.
3. Data sets 108D (series 2) and 108E (series 1) use slide switches. Data sets 108D (series 2) use rotary switches. On the rotary switch, *down* refers to the position closest to the end of the switch marked with a dot.
4. Option X must be provided.

upon the type of data set to be installed. See table of contents.

- The power cord (KS-14532-L16 or M3AY) to be used with the DAS 830A must be ordered separately.

  (a) Power cord KS-14532-L16 has a 3-prong plug for connection to an outlet.

  (b) Power cord M3AY has three spade leads which are connected to the T terminal block of the TTY electrical service unit as follows:

  (1) White wire to terminal 1

  (2) Green wire to terminal 1

  (3) Black wire to terminal 2.

DAS 830B

5.02 Installation of the DAS 830B, ET1 circuit pack, and EC 833 break detection circuit is made at the service center. The wiring for ET1 circuit pack arrangements with DAS 830B (Fig. 2) includes a send space timing circuit and a message-waiting lamp circuit.

5.03 ***Power test.*** A 3-conductor cord is used to connect the TTY to the customer-supplied 117-volt, 60-Hz ac power. DAS 830B is powered from the UCC-29 call control unit of the TTY with approximately 3 watts of +20 to +28 Vdc and

TABLE C

DATA SET 109E OPTIONS

FEATURE		OPTION	SCREW SWITCH SETTING	
			CLOSE	OPEN
BB Lead	Space Hold	V	S1A *(Note 1)*	S1B *(Note 1)*
	Mark Hold	U	S1B *(Note 1)*	S1A *(Note 1)*
Crossover Shift	Space	R	S3-2	S3-1
	Mark	Q		S3-1 and S3-2
	None	P *(Note 2)*	S3-1	S3-2
Current Squelch		Z	S2	
No Current Squelch *(Note 3)*		Y		S2

Notes:

1. Screw should not be inserted in the center position of screw switch S1.
2. P option must be implemented for PL arrangements for minimum distortion.
3. Y option must be implemented for PL arrangements.

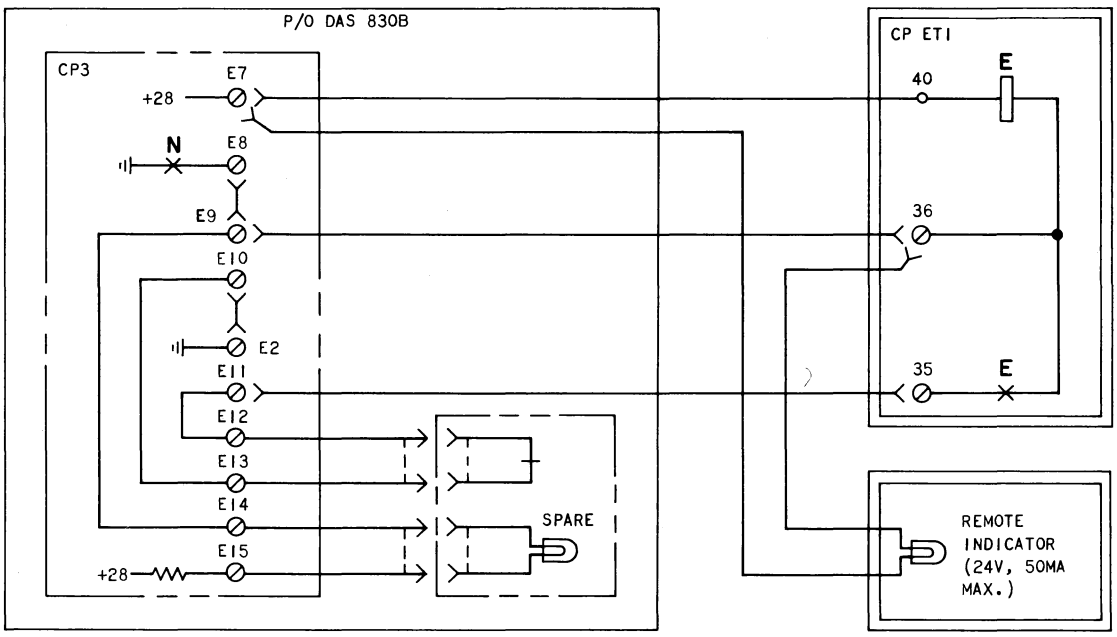
TABLE D

DAS 830B INSTALLER OPTIONS

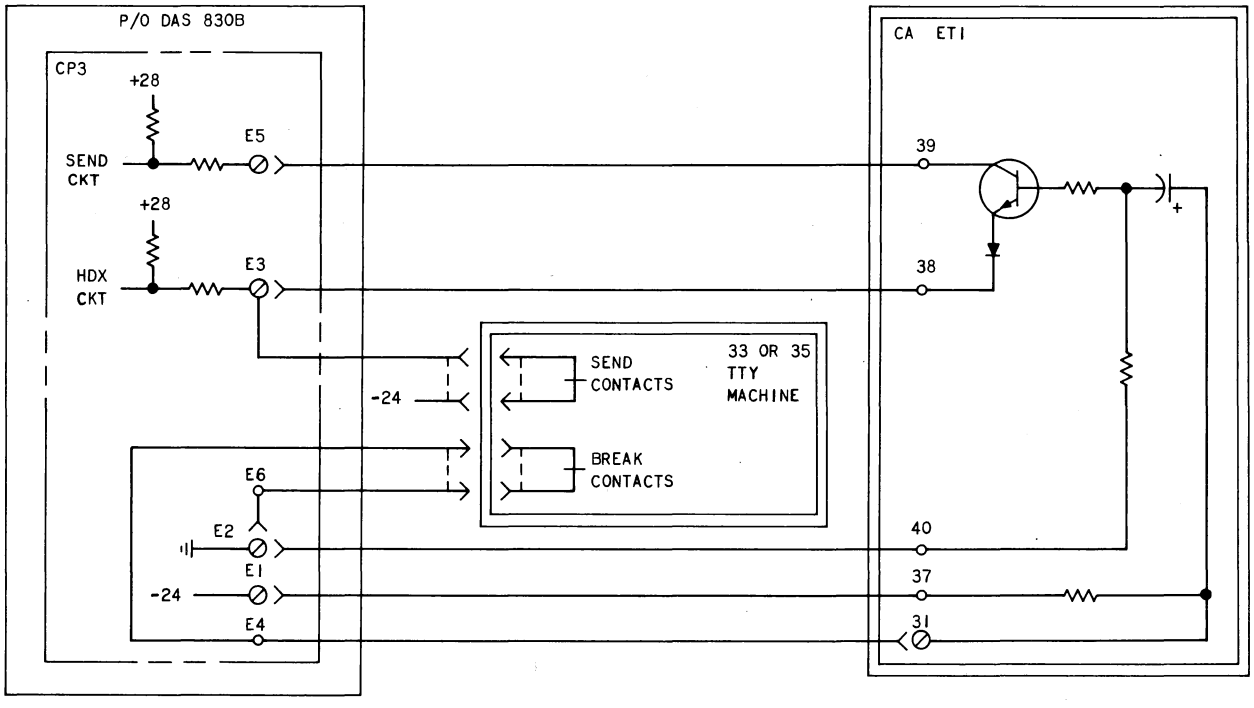
FEATURE	OPTION	SWITCH SETTING	
		OPEN	CLOSED
Half-duplex	Z		S1A
Full-duplex	Y	S1A	
Paper alarm — motor stop *(Note 1)*	X	S2B	
Paper alarm — no motor stop	W		S2B
EOT disconnect *(Note 2)*	V		S2A
No EOT disconnect	U	S2A	
Space clamp *(Note 3)*	T		S1B
Mark clamp *(Note 3)*	S	S1B	

Notes:

1. Paper alarm (low paper or out of paper) stops TTY motor.
2. If an end-of-transmission (EOT) character is received by the TTY, the TTY will turn off (placing a mark on select magnet driver to guard against spurious characters).
3. Mark or space clamp on the BA lead when TTY is in OFF condition.



WIRING OF CP ETI AND DAS 830B WITH TSPS NO. 1 HOTEL/MOTEL SERVICE FOR MESSAGE WAITING INDICATION ("SPARE" BUTTON MAY BE RELABLED FOR PROPER IDENTIFICATION, AND LOCKING SCREW MAY BE REMOVED TO CONVERT THE BUTTON TO NONLOCKING, NONRELEASING.) THE ARRANGEMENT FOR MESSAGE WAITING INDICATION CANNOT BE USED WITH EITHER THE ARRANGEMENT FOR SEND SPACE TIMING OR WITH THE TELETYPEWRITER BREAK DETECTION OPTION. THE LOCAL BUTTON MUST RETAIN THE BLOCKING RING (P-23F594).



WIRING OF CP ETI AND DAS 830B FOR SEND SPACE TIMING

Fig. 2—ET1 Circuit Pack Arrangement

from the associated DAS 830A or 820D with approximately 1/2-watt of −22 to −26 Vdc. To check for power, proceed as follows:

(1) With a KS-20538-L1 VOM set at the 300 ACV range, measure across the customer receptacle for 117 Vac power.

(2) With a KS-20538-L1 VOM set at the 30 DCV range, measure across terminals E7 (positive) and E2 on DAS 830B for +20 to +28 Vdc and across terminals E1 (negative) and E2 for −22 to −26 Vdc.

Correct power at all checkpoints indicates that the TTY and DAS 830B are receiving power.

5.04 ***Local copy test.*** This test provides a means of checking the operation of both the TTY and DAS 830B. To perform this test, proceed as follows:

(1) Depress LOCAL button. Motor starts and TTY should run closed.

(2) Operate TTY keyboard. Type "quick brown fox ..." and number sequence. If local copy is printed correctly, the TTY and DAS 830B are assumed to be operating properly.

5.05 Verify that the loop has been tested and meets requirements for the data set being used. If necessary, refer to the section entitled Private Line Data Circuits—Voice Bandwidth Circuits or Miscellaneous Data—Overall Tests and Requirements (314-410-500).

DATA SETS 108A- AND 108C-TYPE (Fig. 3)

A. Hybrid Network Strapping

5.06 The hybrid network is strapped to reduce interference between transmit and receive frequencies. Stapping is determined by the loop impedance of the facility. Table E shows typical loop impedance when the cable makeup is known. The hybrid network strapping arrangement should be on the service order or circuit layout record card (CLRC). If not, strap the hybrid network as indicated in Table F under Loop Impedance 900 Ohms. If the receive signal level at the station is more negative than −30 dBm with the 900-ohm strapping installed, change the strappings and screw switch settings to optimized receive signal level and hybrid loss.

B. Data Set Receive Level Adjustment

5.07 Screw switch D on data set 108A- or 108C-type was closed to provide maximum sensitivity (maximum gain of receive-amplifier stage) during manufacturing tests. The gain of the stage may be reduced in 4-dB steps and should be adjusted to meet the requirements of the individual installation. Table G shows the condition of the screw switches for each gain setting. ***The screw switches are normally set according to the service order or CLRC. Upon completion of hybrid network strapping and receive level adjustment, plug data set 108A- or 108C-type into DAS 830A.***

C. Data Set Transmit Level Adjustment

Tip and ring connections must be disconnected for data set transmit level adjustment.

5.08 Connect terminal + and − of TTS-28 portable station test set to TP1 and TP2 of the data set (Fig. 3). Set FUNCTION switch of TTS-28 to DBM 900-ohm TERM 0 position. Connect power to DAS. Adjust potentiometer R11 on the data set for output level specified on service order or CLRC.

> ***Note:*** If TTS-28 indicates no output level and option carrier squelch on carrier fail is installed on DAS 830A, remove the option to obtain measurement. Adjust output level and then replace the option in DAS 830A.

5.09 At the rear of DAS 830A, connect tip and ring to terminals T and R. Replace cover on DAS 830A, connect interface and power cords and operate the station to check if it is ready for service.

DATA SETS 108D- AND 108E-TYPE (Fig. 4)

A. Hybrid Network Switching

5.10 If the line facility is a 2-wire loop, the data set interface with the line is a hybrid network which must be adjusted to provide the correct loss. The hybrid network is strapped to reduce interference between transmit and receive frequencies. If the line facility is a 4-wire loop,

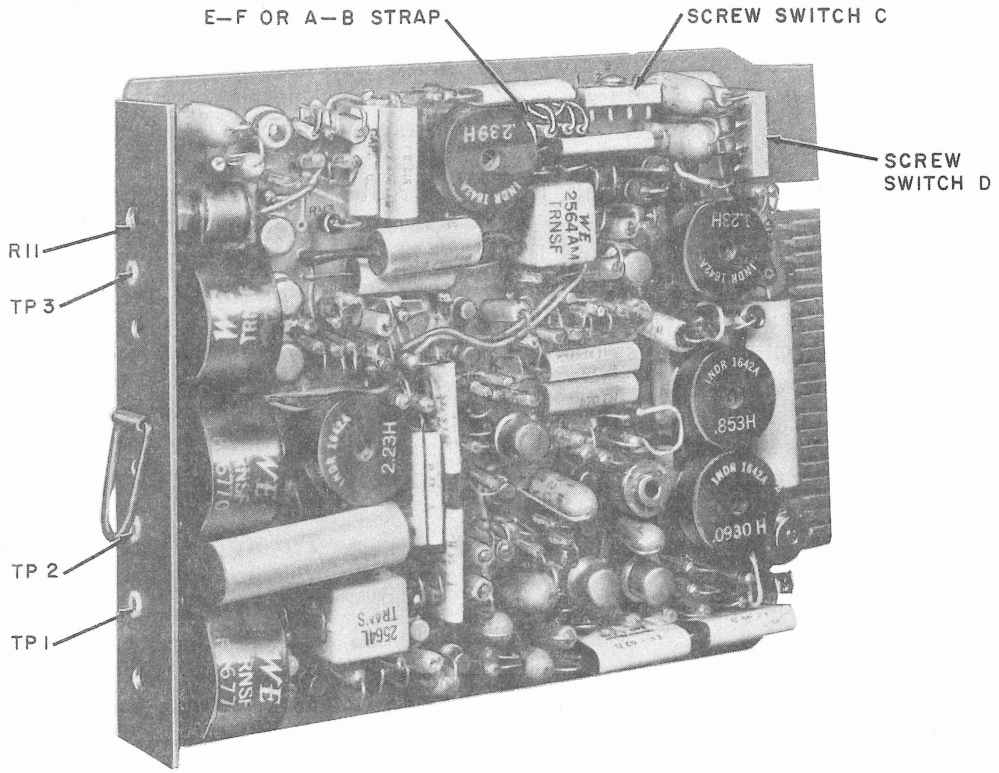


Fig. 3—Data Set 108A- or C-Type

TABLE E

TYPICAL LOOP IMPEDANCE WITH DATA SETS 108A AND 108C

TYPICAL LOOP FACILITY	TYPICAL LOOP IMPEDANCE	
	DATA SET 108A-TYPE (2125 Hz)	DATA SET 108C-TYPE (1170 Hz)
26 NL (HC)	650	900
24 NL (HC)	500	700
22 NL (HC)	400	550
19 NL (HC)	280	400
16 NL (HC)	200	280
26 H88 (HC)	1300	1180
24 H88 (HC)	1260	1080
22 H88 (HC)	1250	1060
19 H88 (HC)	1240	1030
16 H88 (HC)	1340	1130

NL — Nonloaded (HC) — High Capacity

no loss adjustments are necessary to interface the data set with the line. The correct hybrid network impedance is determined by the loop impedance of the facility. Tables H and I show typical loop impedance for data sets 108D and E, respectively, when the cable makeup is known. The hybrid network switching arrangement for 2-wire application should be provided on the service order or CLRC. If not, set the hybrid network impedance for the compromise switch setting as indicated in Tables H and I.

B. Data Set Receive Level Adjustment

5.11 Screw switch D on data set 108D or E was opened to provide minimum sensitivity (minimum gain of receive-amplifier stage) during manufacturing tests. If the receive level is more negative than −30 dBm (−31, −32, etc), the 6-dB reduction of gain should be removed by closing the 1-2 section of screw switch D. Table J shows

TABLE F

DATA SETS 108A AND 108C
HYBRID NETWORK STRAPPING

LOOP IMPEDANCE	DATA SET 108A- AND 108C-TYPE SCREW SWITCH C CLOSED	DATA SET 108A-TYPE E-F CONNECTION	DATA SET 108C-TYPE A-B CONNECTION
1255	2-3	Cut	Cut
900	2-3	Strapped	Strapped
850	1-2	Cut	Cut
750	3-4	Cut	Cut
575	1-2, 3-4	Cut	Cut
500	1-2	Strapped	Strapped
410	3-4	Strapped	Strapped
220	1-2, 3-4	Strapped	Strapped

TABLE G

SCREW SWITCH D SETTINGS ON DATA SETS 108A AND 108C
FOR REDUCTION IN GAIN

LOOP FACILITY LOSSES (DB)		DESENSITIZING PAD (DB) TO BE USED	SCREW SWITCH D	
DATA SET 108A (1000 Hz)	DATA SET 108C (2300 Hz)		CLOSED	OPEN
0-3		8		1-2, 3-4
3.1-7		4	1-2	3-4
7.1 and greater		0	3-4	1-2

the condition of the screw switches for each gain setting. ***The screw switch is normally set according to the service order or CLRC. Upon completion of hybrid network switching and receive level adjustment, plug data set 108D- or 108E-type into DAS 830A.***

C. Data Set Transmit Level Adjustment

Tip and ring connections must be disconnected for data set transmit level adjustment.

5.12 Connect the ac power cord to the ac connector of DAS 830A and to the customer-provided wall receptacle. Connect terminals + and – of TTS-28 portable station test set to TP1 and TP2 of the data set. Test points are identified by raised numbers on the faceplate of the data set. Set FUNCTION switch of TTS-28 to DBM 900-OHM TERM 0 position. Connect power to DAS. Adjust potentiometer R18 on the data set for output level specified on service order or CLRC. If the line is a 4-wire 600-ohm termination, adjust R18 to indicate 1-1/2 dBm more than the output level specified to allow for use of the TTS-28 with a 900-ohm termination.

Note: If TTS-28 indicates no output level and the option (carrier squelch on carrier fail) is installed on DAS 830A, this option must be removed. Adjust output level and then replace the option in DAS 830A.

5.13 At the rear of DAS 830A, connect tip and ring to terminals T and R (2-wire), or the transmit loop pair to terminals T and R, and the receive loop pair to terminals T1 and R1 (4-wire). Replace the cover on DAS 830A and connect the

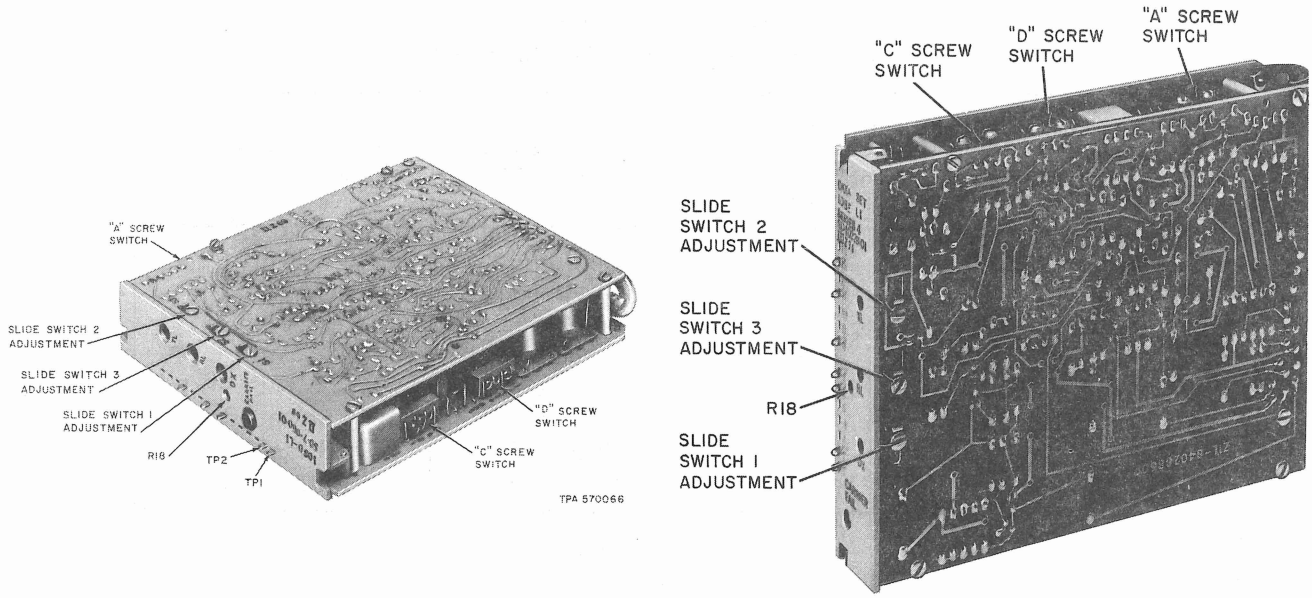


Fig. 4—Data Set 108D and 108E

TABLE H

DATA SET 108D
HYBRID NETWORK SWITCHING FOR 2-WIRE APPLICATION

OPTION	TYPICAL LOOP FACILITY	TYPICAL 2-WIRE LOOP IMPEDANCE MEASURED AT 1170 Hz)	SCREW SWITCH C		SCREW SWITCH D	
			OPEN	CLOSE	OPEN	CLOSE
H	26 NL (HC)	900*	1-2, 3-4	2-3		3-4
G	24 NL (HC)	700	1-2, 2-3	3-4	3-4	
F	22 NL (HC)	550	2-3	1-2, 3-4	3-4	
E	19 NL (HC)	400	1-2, 2-3	3-4		3-4
B	16 NL (HC)	280	2-3	1-2, 3-4		3-4
A	26 H88 (HC)	1180	1-2, 3-4	2-3	3-4	
A	24 H88 (HC)	1080	1-2, 3-4	2-3	3-4	
A	22 H88 (HC)	1060	1-2, 3-4	2-3	3-4	
A	19 H88 (HC)	1030	1-2, 3-4	2-3	3-4	
A	16 H88 (HC)	1130	1-2, 3-4	2-3	3-4	

NL — Nonloaded (HC) — High Capacity
* Compromise hybrid network switching.

TABLE I

DATA SET 108E
HYBRID NETWORK SWITCHING FOR 2-WIRE APPLICATION

OPTION	TYPICAL LOOP FACILITY	TYPICAL 2-WIRE LOOP IMPEDANCE MEASURED AT 2125 Hz	SCREW SWITCH C		SCREW SWITCH D	
			OPEN	CLOSE	OPEN	CLOSE
H	—	900*	1-2, 3-4	2-3		3-4
G	26 NL (HC)	650	2-3	1-2, 3-4	3-4	
F	24 NL (HC)	500	2-3, 3-4	1-2		3-4
E	22 NL (HC)	400	1-2, 2-3	3-4		3-4
B	19 NL (HC)	280	2-3	1-2, 3-4		3-4
A	16 NL (HC)	200	2-3	1-2, 3-4		3-4
ZA	26 H88 (HC)	1300	1-2, 3-4	2-3	3-4	
ZA	24 H88 (HC)	1260	1-2, 3-4	2-3	3-4	
ZA	22 H88 (HC)	1250	1-2, 3-4	2-3	3-4	
ZA	19 H88 (HC)	1240	1-2, 3-4	2-3	3-4	
ZA	16 H88 (HC)	1340	1-2, 3-4	2-3	3-4	

NL — Nonloaded (HC) — High Capacity
* Compromise hybrid network switching.

TABLE J

SCREW SWITCH D SETTINGS ON THE
DATA SETS 108D AND 108E
FOR REDUCTION IN GAIN

DB REDUCTION IN GAIN	"D" SCREW SWITCH		DATA SET OPTION
	CLOSED	OPEN	
6	—	1-2	K
0	1-2	—	J

interface and power cords. Operate the station to check if it is ready for service.

DATA SET 109A-TYPE (Fig. 5)

5.14 Insert the data set 109A-type into the mounting position of DAS 830A.

5.15 Connect the ac power cord to the ac connector of DAS 830A and to the customer-provided wall receptacle.

5.16 Determine whether voltage is present across the leads of the incoming transmission loop by performing the following steps.

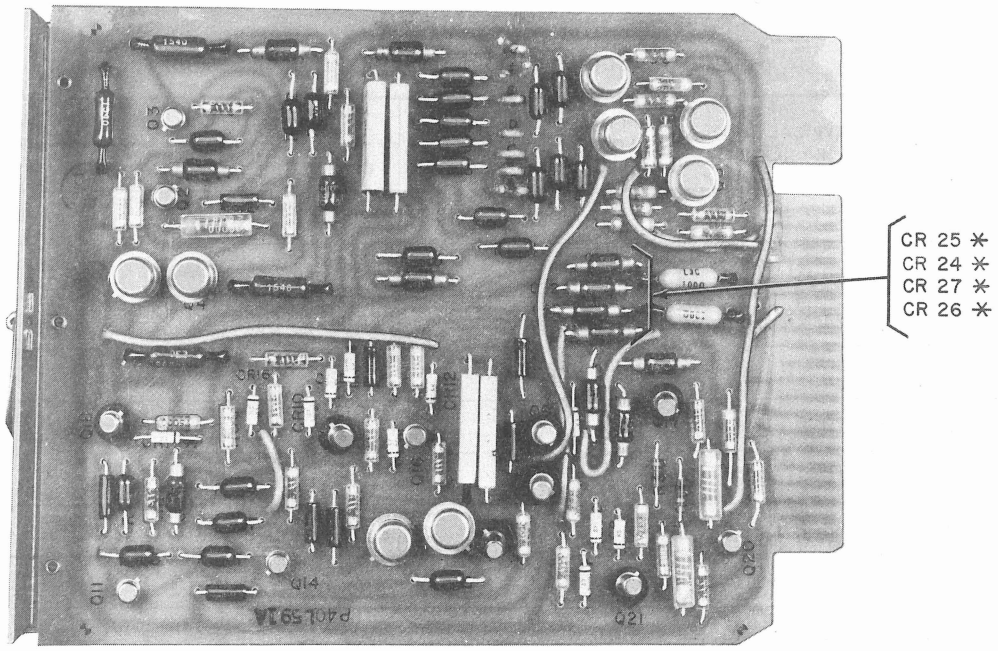
Note: Voltage present across the loop leads indicates that the distant station is connected to the loop. Voltage not present across the loop leads indicates that either the distant station is not connected or the path of the transmission loop is open.

(1) Set the KS-20538-L1 VOM, or equivalent, DC VOLTS scale on 60.

(2) Connect the leads of the meter across the leads of the incoming transmission loop for a voltage.

Note: It may be necessary to switch the leads of the meter to obtain the correct polarity and measure the voltage on the applicable scale.

- A reading within the range of 3.2 through 4.7 volts indicates that the distant station



* THESE COMPONENTS ARE USED FOR LIGHTNING PROTECTION AND ARE ONLY PROVIDED ON DATA SET 109A1.

Fig. 5—Data Set 109A-Type

is transmitting a mark. Tag the loop lead that is connected to the positive (+) lead of the meter, ring (+); and tag the loop lead that is connected to the negative (−) lead of the meter, tip (−).

- If the voltage reading is more than 4.7 volts or less than 3.2 volts, report the reading to the proper personnel of the local telephone company. The connection of the loop leads cannot be completed until the voltage reading across the loop leads is within the range of 3.2 through 4.7 volts.

Note: A reading within the range of 10.5 through 13.3 volts across the loop leads indicates that the distant station is transmitting a space.

(3) Determine whether the distant station is grounded or equipped with a floating ground.

Note: When the signal and chassis grounds are tied together, the station is grounded; but when the grounds are not tied together, the station has a floating ground.

(4) Determine whether the local data station is grounded or has a floating ground.

(5) Determine whether the local station is to be arranged for station-to-hub operation or station-to-station operation.

Note: Station-to-hub operation means the distant station is equipped with a data set 109B-type. Station-to-station operation means the distant station is equipped with a data set 109A-type. ***The type of operation must be known before proceeding with the connection of the transmission loop leads.***

(6) Measure the difference in potential (voltage) between the positive (ring) lead of the incoming transmission loop and the chassis ground of the local data station to ensure that the loop is acceptable. Measure the difference in potential as follows:

(a) Set the VOM DC VOLTS scale to 60.

(b) Connect the positive (+) lead of the meter to the positive (ring) lead of the loop

and the negative (−) lead of the meter to the chassis ground of the local data station.

Note: It may be necessary to switch the meter leads to make the required reading of potential difference.

(c) Record the reading of the meter.

- If the reading is 20 volts or less, the data set 109A-type system will function whether the local station is grounded or provides a floating ground.

- If the reading is more than 20 volts, the system will not function unless one of the stations is equipped with a floating ground.

Note: When both stations must be grounded and the difference in potential exceeds 20 volts, the data set 109A-type system cannot be used.

(7) Measure the magnitude between the positive lead of the loop and the chassis ground of the local data station as follows:

(a) Set the VOM on the AC VOLTS scale to 60.

(b) Connect the leads of the meter between the positive (ring) lead of the incoming transmission loop and the chassis ground of the local data station.

(c) Record the reading of the meter.

- If the reading on the AC VOLTS scale is 14 volts and below, the data set 109A-type system will function whether the local station is grounded or equipped with a floating ground.

- If the reading is more than 14 volts ac, the system will not function unless one of the stations is equipped with a floating ground.

(8) Measure the current in the incoming transmission loop as follows to determine if the dc resistance of the loop is acceptable.

(a) Set the VOM on the DC MA (milliampere) scale to 12.

(b) Connect the positive (+) lead of the meter to the positive (ring) lead of the loop and the negative (−) lead of the meter to the negative (tip) lead of the loop.

(c) Record the current reading.

- If station-to-station operation is to be used, refer to 5.20 and Table K to determine if the loop resistance is acceptable as indicated by the current reading.

- If station-to-hub operation is to be used, refer to 5.18 and Table L to determine if the loop resistance is acceptable as indicated by the current reading.

5.17 When voltage is present across the leads of the incoming transmission loop, the actual connection procedure of the loop leads depends on whether the local data station is to be arranged for station-to-hub operation or station-to-station operation.

Station-to-Hub Operation

5.18 If the dc resistance of the incoming transmission loop is between 1800 and 2500 ohms and the maximum capacitance of the loop does not exceed 1 μf, the loop is acceptable. Connect the loop leads (tip and ring) to T and R of DAS 830A and complete the following steps.

(a) Contact the hub location.

(b) Request the personnel at the hub location to verify the dc resistance of the transmission loop as outlined in the section entitled Data Set 109B-Type—Installation (312-802-200).

5.19 If the dc resistance of the incoming transmission loop is below 1800 ohms, connect the loop leads (tip and ring) to T and R of DAS 830A and perform the following procedures.

(a) Contact the hub location.

(b) Request that the personnel at the hub location build out the dc resistance of the loop to 2000 ohms as outlined in the section entitled Data Set 109B-Type—Installation (312-802-200).

TABLE K

STRAPPING FOR STATION-TO-STATION OPERATION WITH DATA SET 109A

METER READING RANGE	EQUIVALENT LOOP RESISTANCE RANGE	EQUIVALENT RESISTANCE REQUIRED	13A1 DATA UNIT				
			LEAD DESIGNATION				STRAP TERMINALS
			T	R	T1	R1	
			CONNECT TO TERM.				
1.40-2.15 mA	2500-1500Ω	Not Req'd	—	—	—	—	—
2.15-2.54 mA	1500-1200Ω	294Ω	T2	R2	T1	R1	—
2.54-3.08 mA	1200-900Ω	632Ω	T3	R3	T2	R2	—
3.08-3.92 mA	900-600Ω	928Ω	T4	R4	T3	R3	—
3.92-5.40 mA	600-300Ω	1222Ω	T4	R4	T1	R1	T2, T3, R2, R3
5.40-9.50 mA	300-0Ω	1560Ω	T4	R4	T2	R2	—

TABLE L

CURRENT ON TRANSMISSION LOOP FOR STATION-TO-HUB OPERATION WITH DATA SET 109A

METER READING RANGE	EQUIVALENT LOOP RESISTANCE RANGE	LOOP ACCEPTABLE
0.8-1.05 mA	2500-1800Ω	YES
1.05-2.0 mA	1800-0Ω	NO*

* The J70165D-1 line adjusting resistor unit for adjusting loop resistance is located at the hub location.

Note: The additional resistance is provided by adjusting a circuit of the J70165-D-1 line adjusting resistor unit at the hub.

Station-to-Station Operation

5.20 If the dc resistance of the incoming transmission loop is between 1500 and 2500 ohms and the maximum capacitance of the loop does not exceed 1 μF, the loop can be used without adding a line build-out unit. Connect the leads (tip and ring) of the incoming transmission loop to T and R as follows:

(a) Connect the ring (+) lead of the loop to terminal R of DAS 830A.

(b) Connect the tip (-) lead of the loop to terminal T of DAS 830A.

Note: The above connection procedure for the loop leads ***must be used*** to ensure proper

operation of the data set 109A-type system when voltage is present across the leads of the transmission loop and a line build-out unit is not required.

5.21 If the dc resistance of the incoming transmission loop is below 1500 ohms, the resistance of the loop must be built out to 1800 ohms by using a 13A1 data unit. When the 13A1 data unit is used, the location must be decided by the installer. Connect the data unit to the DAS 830A as indicated in Table K and Fig. 6.

5.22 To ensure that no opens exist in the 13A1 data unit, measure the voltage across the leads of the wire from the data unit as follows:

(1) Set the VOM on the DC VOLTS scale to 12.

(2) Connect the positive (+) lead of the meter to the ring (R) lead of the wire and the negative (–) lead of the meter to the tip (T) lead of the wire.

(3) A reading within the range of 3.2 through 4.7 volts indicates that no opens exist in the 13A1 data unit.

(4) Connect the tip and ring leads of the wire from the 13A1 data unit to TS A of DAS 830A as follows.

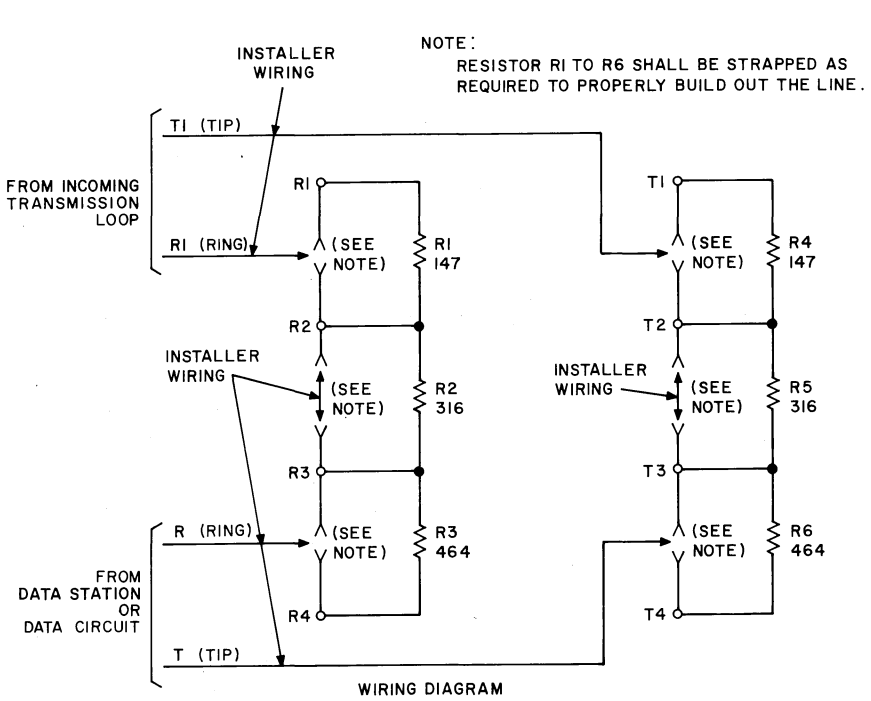
(a) Connect the tip (T) lead of the wire to terminal T of DAS 830A.

(b) Connect the ring (R) lead of the wire to terminal R of DAS 830A. The station is now ready for service.

DATA SET 109E-TYPE (Fig. 7)

5.23 Insert the proper data set 109E-type with correct options into the mounting position of DAS 830A.

In the HDX mode, data set 109E will operate with any data set 109-type. In the FDX mode it will operate with data sets 109E-type, 109F-type, 109G-type, and 109H-type. The mode of operation (HDX or FDX) is governed by the



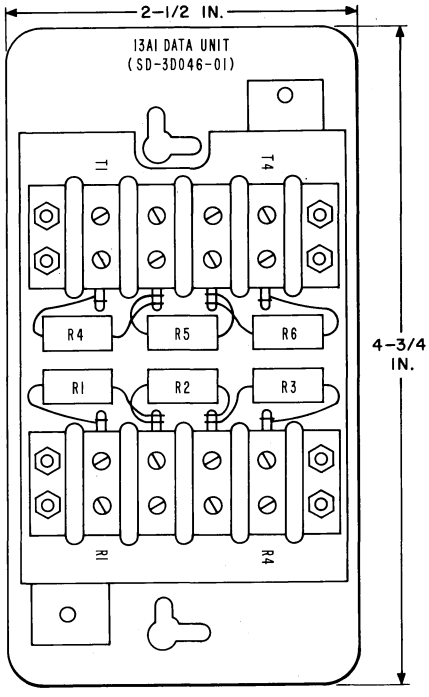


Fig. 6—13A1 Data Unit and Wiring Diagram

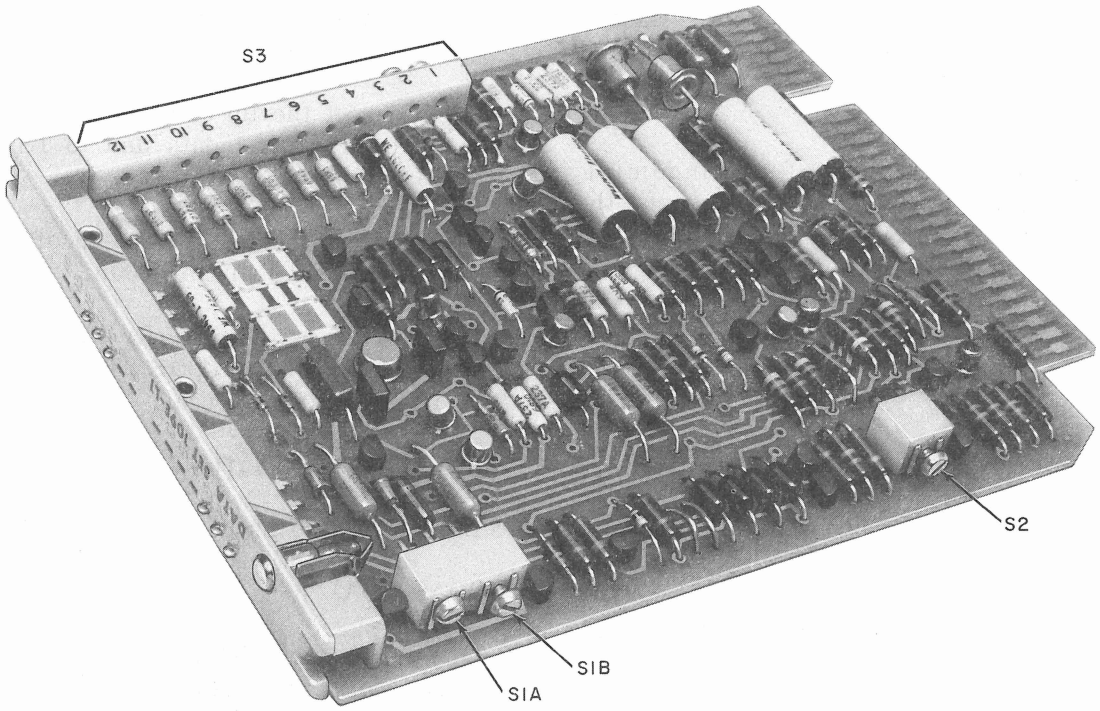


Fig. 7—Data Set 109E-Type

remote station (or hub) and the terminal equipment.

5.24 Before connecting the transmission line to the DAS, perform the following steps:

(1) Condition VOM to measure 12 volts dc.

(2) Connect the positive (+) lead of the VOM to terminal T of DAS 830A on the DAS and the negative (−) lead of the VOM to terminal R of DAS 830A.

(3) Connect the ac power cord to the ac connector of DAS 830A and to the customer-provided wall receptacle.

- A reading within the range of +3.9 through +4.7 volts indicates proper operation of the data station when the data set is transmitting a mark. If the reading is not within the range of +3.9 through +4.7 volts, verify that the data set is transmitting a mark, then test to determine the cause of the malfunction.

(4) Disconnect the power cord from the DAS.

(5) Disconnect the VOM from the DAS.

5.25 When the remote station is not installed, the transmission loop can be adjusted for the proper resistance by performing the following steps:

(1) Determine the loop resistance and remote station line pad resistance as indicated on the CLRC.

(2) Add the value of the remote station line pad resistance and the loop resistance and subtract this value from the optimum 2000-ohm transmission loop resistance. The remaining value is the pad resistance which is to be inserted in the loop.

(3) Verify the line pad resistance already installed in the local station data set by observing the screw switch settings and determining the resistance according to Table M. If this line pad resistance is different from the pad resistance determined in Step 2, readjust the line pads.

TABLE M

LINE PAD ADJUSTMENTS FOR DATA SET 109E

LINE PAD RESISTANCE (OHMS)	SCREW SWITCH S3-SETTINGS	
	CLOSE	OPEN
0	4, 5, 6, 7, 9, 10, 11, 12	
136.2	4, 5, 6, 10, 11, 12	7, 9
266.0	4, 5, 7, 9, 11, 12	6, 10
402.2	4, 5, 11, 12	6, 7, 9, 10
522.0	4, 6, 7, 9, 10, 12	5, 11
658.2	4, 6, 10, 12	5, 7, 9, 11
788.0	4, 7, 9, 12	5, 6, 10, 11
924.2	4, 12	5, 6, 7, 9, 10, 11
1022.0	5, 6, 7, 9, 10, 11	4, 12
1158.2	5, 6, 10, 11	4, 7, 9, 12
1288.0	5, 7, 9, 11	4, 6, 10, 12
1424.2	5, 11	4, 6, 7, 9, 10, 12
1544.0	6, 7, 9, 10	4, 5, 11, 12
1680.2	6, 10	4, 5, 7, 9, 11, 12
1810.0	7, 9	4, 5, 6, 10, 11, 12
1946.2		4, 5, 6, 7, 9, 10, 11, 12

(4) When inserting pad resistance, the difference in resistance between the local station and the remote station must not exceed 1000 ohms (eg, 1500 ohms in the local station, 500 ohms in the remote station).

Note: When the actual loop resistance is between 2000 and 2500 ohms, the pad resistance in the local and remote data sets must be set at zero.

Verify that the remote station is connected before performing the following procedures. If the remote station is not connected, the transmission leads can be connected to terminals T and R, indiscriminately.

5.26 When the remote station is installed, the line pad resistance can be accurately adjusted by performing the following procedure.

Note: The following procedure is performed assuming that the remote station is marking. If the remote station is not marking, request that it be placed in a marking state.

DAS 830A must not be grounded when performing this test and the signal ground cannot be connected to chassis ground. If installed, remove option M by opening screw-switch S2B on DAS 830A. After completion of this test, restore the DAS 830A to pretest condition.

(1) Condition the VOM to measure 12 Vdc.

(2) Connect the positive lead of the VOM to one of the transmission leads.

(3) Connect the negative lead of the VOM to the other transmission lead.

(4) If the meter deflects down scale, reverse the VOM leads.

(5) If the meter deflects up scale, the transmission lead connected to the positive VOM lead will be the positive transmission lead; the lead connected to the negative VOM lead will be the negative transmission lead. Tag these leads.

(6) Disconnect VOM leads.

(7) Connect the negative transmission lead to terminal T of DAS 830A.

(8) Condition the VOM to measure 12 mA dc.

(9) Connect the negative VOM lead to terminal R of DAS 830A.

(10) Connect the positive VOM lead to the disconnected positive transmission lead.

Requirement: Meter indicates +3.0 to +3.2 mA.

(11) When the measured current is greater than 3 mA, additional resistance will have to be added to the circuit by opening one or more of the screw switches in each side of the line. If the measured current is less than 3 mA, the screw switches will have to be closed to remove some of the pad resistance.

(12) The screw switches are designated by pairs, one pair serving both sides of the line. The following switches are treated as pairs:

(a) S3-9 and S3-7

(b) S3-10 and S3-6

(c) S3-11 and S3-5

(d) S3-12 and S3-4.

These switches are always opened and closed in pairs so that resistance will always be equal to both sides of the line. Table M gives the resistance provided by these switches.

Note: The S3-9 and S3-7 screw switches can be thought of as representing a basic unit of resistance and the opening of these screw switches, in each side of the line, will add resistance to the line. Therefore, opening the screw switches S3-10 and S3-6 adds twice as much resistance as S3-9 and S3-7, opening the S3-11 and S3-5 screw switches adds four times the resistance of S3-9 and S3-7. Closing the screw switches removes the resistance in the same increments.

(13) In order to adjust the line current from +3.0 to 3.2 mA, observe the line current, remove the data set, open or close the screw switch pairs, and replace the data set. By observing the change in the current, the amount of resistance that is required can be judged. This trial and error method can be repeated until a current level between +3.0 and 3.2 mA is obtained. This method provides a quick way of adjusting the loop current when a connection to a far-end data set can be made.

(14) Disconnect the VOM leads and connect the positive transmission lead to terminal R of the DAS 830A terminal board. The station is now ready for service.