

DATA SETS 108D- AND 108E-TYPE DESCRIPTION USED IN STATION APPLICATIONS

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- 28A-type data mounting equipped with 27B1 data unit
- 28D1 data mounting
- Data auxiliary set 830A
- Data auxiliary set 820-type.

1. GENERAL

1.01 This section covers the physical and functional description of data sets (DSs) 108D- and 108E-types used in private line station applications.

1.02 This section is reissued to incorporate information on the newly introduced DSs 108D-L1A and 108E-L1A.

1.03 Data sets 108D-L1 and 108E-L1 (Fig. 1 and 2) have been redesigned. The new sets are coded DS 108D-L1A and DS 108E-L1A (Fig. 3 and 4). These sets offer the same features and fit into the same mountings as the MD sets they replace. However, there are small differences between the sets. When necessary to describe these differences the sets will be referred to by full designation (DSs 108D-L1, 108E-L1, 108D-L1A and 108E-L1A).

1.04 The following is a list of data mountings in which DSs 108D- and 108E-type can be mounted for station application.

1.05 Data sets 108D and 108E are full-duplex (FDX), frequency-shift-keyed (FSK), serial-transmission data sets which provide low-speed (up to 300 baud) data transmission over 2-wire or 4-wire private line (PL) voiceband facilities.

1.06 Data sets 108D and 108E are very similar; they differ in send and receive frequencies and data set restore characteristics. Data set 108E send and receive frequencies complement those of DS 108D.



Data sets 108D and 108E are not designed to handle supervisory line current.

1.07 Data set 108E restores upon detection of either **marking or spacing** carrier, whereas all other DS 108-type restore only upon detection of incoming marking carrier.

1.08 Data Set 108D-L1A may be used as a direct replacement for DS 108D-L1 (MD) and DS 108C (MD). Data Set 108D-L1A is also compatible with DS 108B, 108F, 108G, 108J, 108H, and 103F (in originate mode). Comparison of these data sets are contained in Table A.

1.09 Data Set 108E-L1A may be used as a direct replacement for DS 108E-L1 (MD) and DS 108A (MD). Data Set 108E is also compatible with

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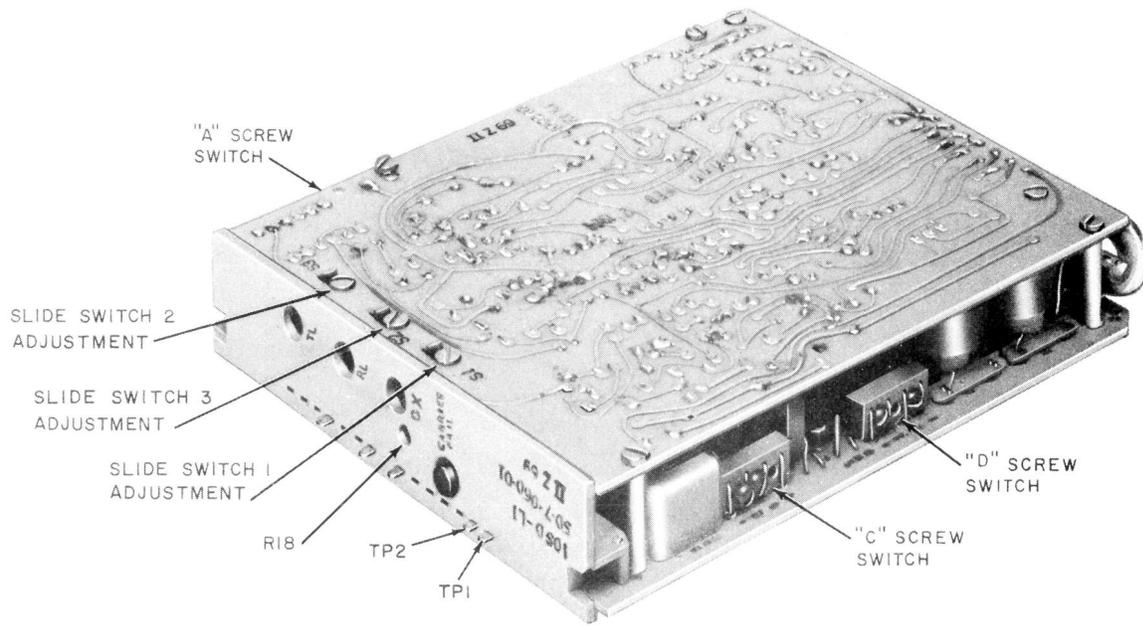


Fig. 1—Data Set 108D-L1

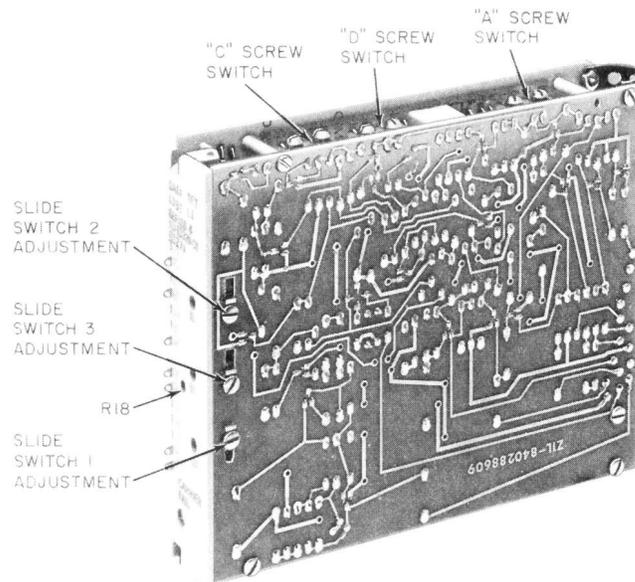


Fig. 2—Data Set 108E-L1

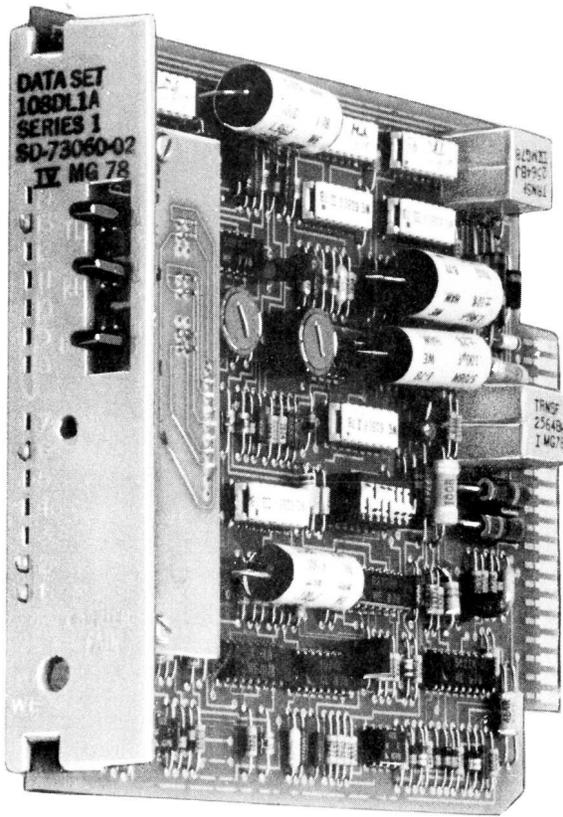


Fig. 3—Data Set 108D-L1A

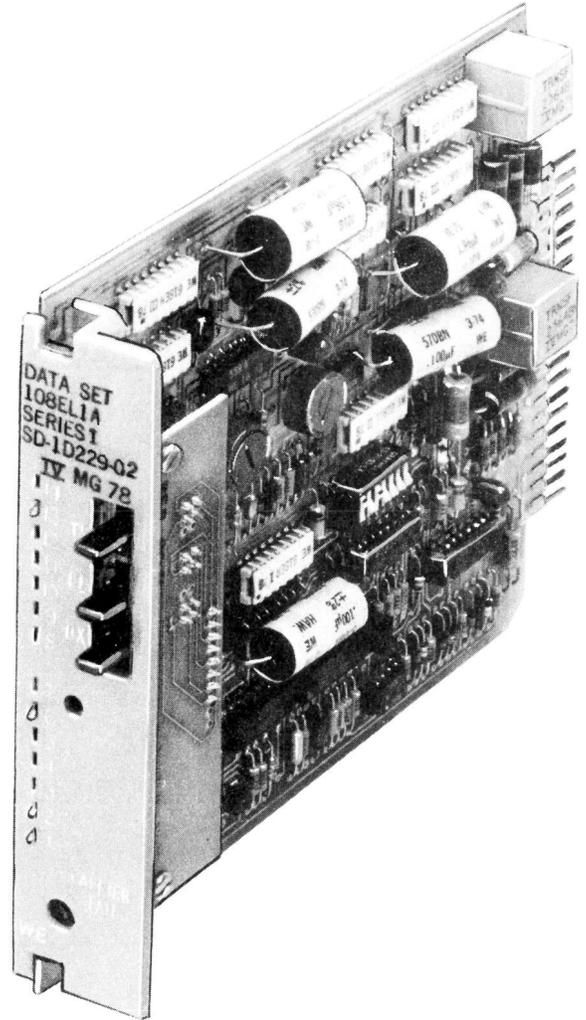


Fig. 4—Data Set 108E-L1A

TABLE A
DATA SET 108-TYPE — A COMPARISON

FEATURES		DATA SET 108D-L1A	DATA SET 108E-L1A	DATA SET 108D-L1	DATA SET 108E-L1	DATA SET 108C	DATA SET 108A
Transmit Level (dBm)		-1 to -26	-1 to -26	Continuous -6 to -26	Continuous 0 to -26	Continuous 0 to -14	Continuous 0 to -14
Loop Termination		600-ohm 2-wire or 600-ohm 4-wire	600-ohm 2-wire or 600-ohm 4-wire	900-ohm 2-wire or 600-ohm 4-wire	900-ohm 2-wire or 600-ohm 4-wire	900-ohm 2-wire	900-ohm 2-wire
Lamp		CF Lamp	CF Lamp	CF Lamp	CF Lamp	None	None
Carrier Squelch		EIA Voltage or Contact Con- trolled	EIA Voltage or Contact Con- trolled	EIA Voltage or Contact Con- trolled	EIA Voltage or Contact Con- trolled	Contact Controlled	Contact Controlled
BB Lead Condition When Loss of Received Carrier Is Detected		Mark or Space	Mark or Space	Mark or Space	Mark or Space	Mark	Mark
Transmit Frequency	Mark	1270 Hz	2225 Hz	1270 Hz	2225 Hz	1270 Hz	2225 Hz
	Space	1070 Hz	2025 Hz	1070 Hz	2025 Hz	1070 Hz	2025 Hz
Receive Frequency	Mark	2225 Hz	1270 Hz	2225 Hz	1270 Hz	2225 Hz	1270 Hz
	Space	2025 Hz	1070 Hz	2025 Hz	1070 Hz	2025 Hz	1070 Hz
Signal Required to Restore BB Lead Condition Upon Detection of Carrier		Marking	Marking or Spacing	Marking	Marking or Spacing	Marking	Marking
Primary Uses		Station-to- Station Hub Applica- tion	Station-to- Station Station-to-Hub	Station-to- Station Hub Application	Station-to- Station Station-to-Hub	Station-to- Station	Station-to- Station Station-to-Hub

DSs 108F, 108G, 108H, 108J, and 103F (in answer mode).

1.10 Transmission from DS 108D is always in the f1 frequency band (1270 Hz for a mark and 1070 Hz for a space), and reception is always in the f2 band (2225 Hz for a mark and 2025 Hz for a space). Transmission from DS 108E is always in the f2 frequency band and reception is always in the f1 band.

1.11 Private line circuits using 108-type data sets may be divided into the following types:

- (a) Station-to-hub circuits
- (b) Station-to-station circuits.

Examples of typical private line station circuit arrangements are shown in Fig. 5.

1.12 For information on DSs 108D and 108E when used in a hub arrangement, refer to Section 312-805-100.

2. PHYSICAL DESCRIPTION

A. Data Sets 108D-L1 and 108E-L1

2.01 Data sets 108D-L1 and 108E-L1 each consist of two printed wiring circuit boards mounted together in piggyback fashion (Fig. 6 and 7). The piggyback arrangement provides a narrower faceplate than DS 108A or 108C, and occupies only two-thirds of the space necessary for DS 108A or 108C. Data sets 108D-L1 and 108E-L1 are each approximately 5-1/2 inches high, 7-1/5 inches deep, 1-1/8 inches wide, and weigh approximately 2 pounds.

2.02 Figures 1 and 2 show all items and designations visible on the faceplates of DS 108D (series 2) and DS 108E (series 1), respectively. Three slide switches (S1, S2, and S3) are visible from the front faceplate of the data set; however, the data set card must be removed from the data auxiliary set in order to change the slide switch settings. The screw holding the slide in place is loosened to slide the switch contact to the proper option as indicated by the tab. After positioning the contact, the screw is tightened (see Fig. 1 and 2).

2.03 Data set 108D-L1 (series 3) and DS 108E-L1 (series 2) use a 3-part rotary-screw switch

S1 in place of the three slide switches. Switch S1 facilitates a change in switch settings *without* removing the data set card from the data auxiliary set. Switch S1 is divided into three sections: A, B, and C (Fig. 8). To access the switch screws, the hinged protective cover must first be pried open from the end marked with a dot. Each switch section is individually adjusted to one of two positions using a small screwdriver (KS-20193, L1 or equivalent) to *gently* rotate the screw to either the upper or the lower position. The final position of the screw must be such that it butts up against the spacer and the screwdriver slot is parallel with the spacer.

2.04 The power required for the operation of either data set is 3.7 watts. The data sets require filtered +24 \pm 3 and -24 \pm 3 volts dc. The dc voltages required are supplied by the associated data auxiliary set or data mounting.

B. Data Sets 108D-L1A and 108E-L1A

2.05 Data sets 108D-L1A and 108E-L1A consist of a single card circuit pack rather than a double-decked circuit pack used on DSs 108D-L1 and 108E-L1. The overall dimensions of DSs 108D-L1A and 108E-L1A are: 7-1/4 inches long (with option jumper plugs inserted, 7-9/16 inches), 1-1/8 inches wide, 5-1/2 inches high, and weigh less than 1/2 pound.

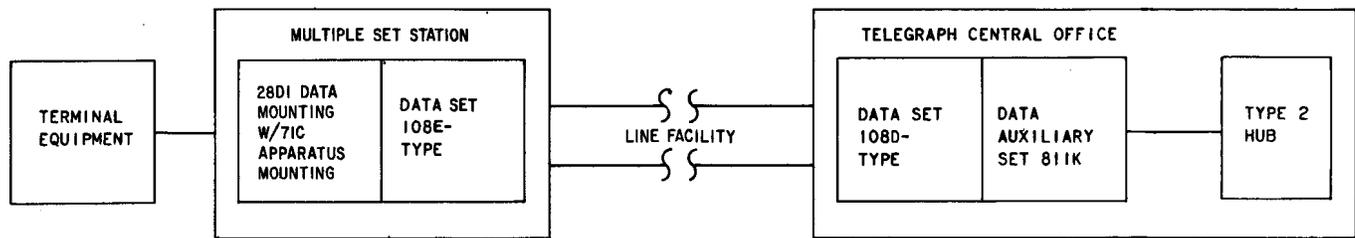
2.06 The circuit pack faceplate of DSs 108D-L1A and 108E-L1A contains a block for option jumper plugs, line facility test points, and a carrier fail indicator lamp.

2.07 Circuit connection is made via printed circuit fingers located on the rear of the circuit pack. This circuit pack is designed to plug into a suitable data mounting.

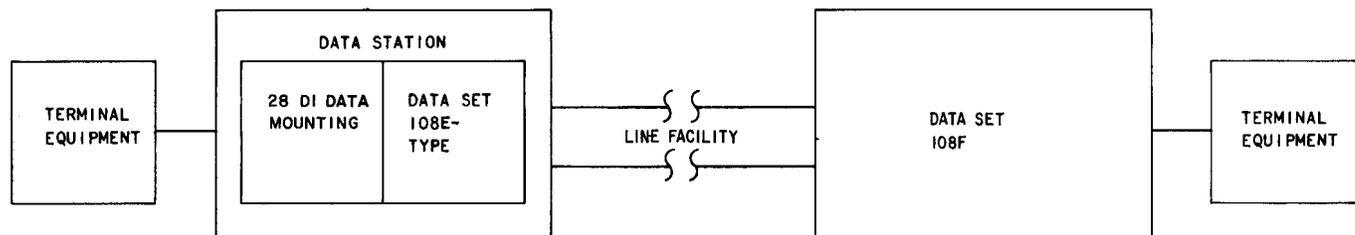
2.08 The power required for the operation of either data set is 4.7 watts. The data sets require filtered +24 \pm 3 and -24 \pm 3 volts dc. The dc voltages required are supplied by the data mounting.

3. FUNCTIONAL DESCRIPTION

3.01 This functional description will refer to data sets 108D- and 108E-type as "the data set" since most functions are the same. When an exception occurs, the data set will be referred to



A. STATION-TO-HUB OPERATION



B. STATION-TO-STATION OPERATION

Fig. 5—Data Set 108D- and 108E-Type Typical Station

by full designation. Figure 9 shows a block diagram of the data sets.

3.02 Data sets 108D-L1A and 108E-L1A have a fixed, compromise hybrid balance network, which is equivalent to the network obtained with the H option in DSs 108D-L1 and 108E-L1. The network settings of DSs 108D-L1 and 108E-L1 obtained by options A, B, E, F, or G are not available. The network now provided is always adequate.

Interface Leads

3.03 In addition to power and ground leads, the data set provides six interface leads. The interface between the data set and the associated station equipment conforms to the Electronic Industries Association (EIA) Standard RS-232-C for

signal characteristics except where noted. The interface leads and their functions are as follows:

- (a) BA on card terminal 3 connects to the EIA interface BA lead (transmitted data lead). A signal on this lead of less than -3 volts represents a mark, and a signal greater than +3 volts represents a space. The BA lead accepts data from the customer data terminal.
- (b) TL on card terminal 10 connects to the EIA interface BB lead (received data lead). This lead has a voltage output of less than -5 volts for a mark and greater than +5 volts for a space. The BB lead presents data output from the data station to the customer data terminal.
- (c) ON from card terminal 19 connects to the EIA interface CC lead (data set ready lead). This lead is connected to a positive potential in

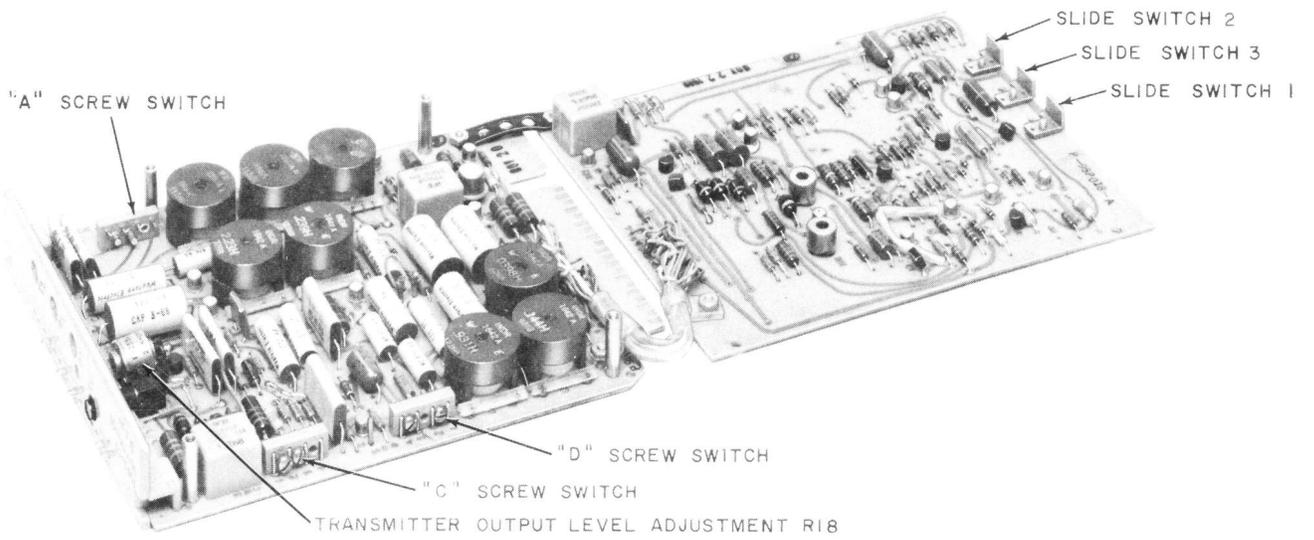


Fig. 6—Data Set 108D-L1 Showing Location of Switches

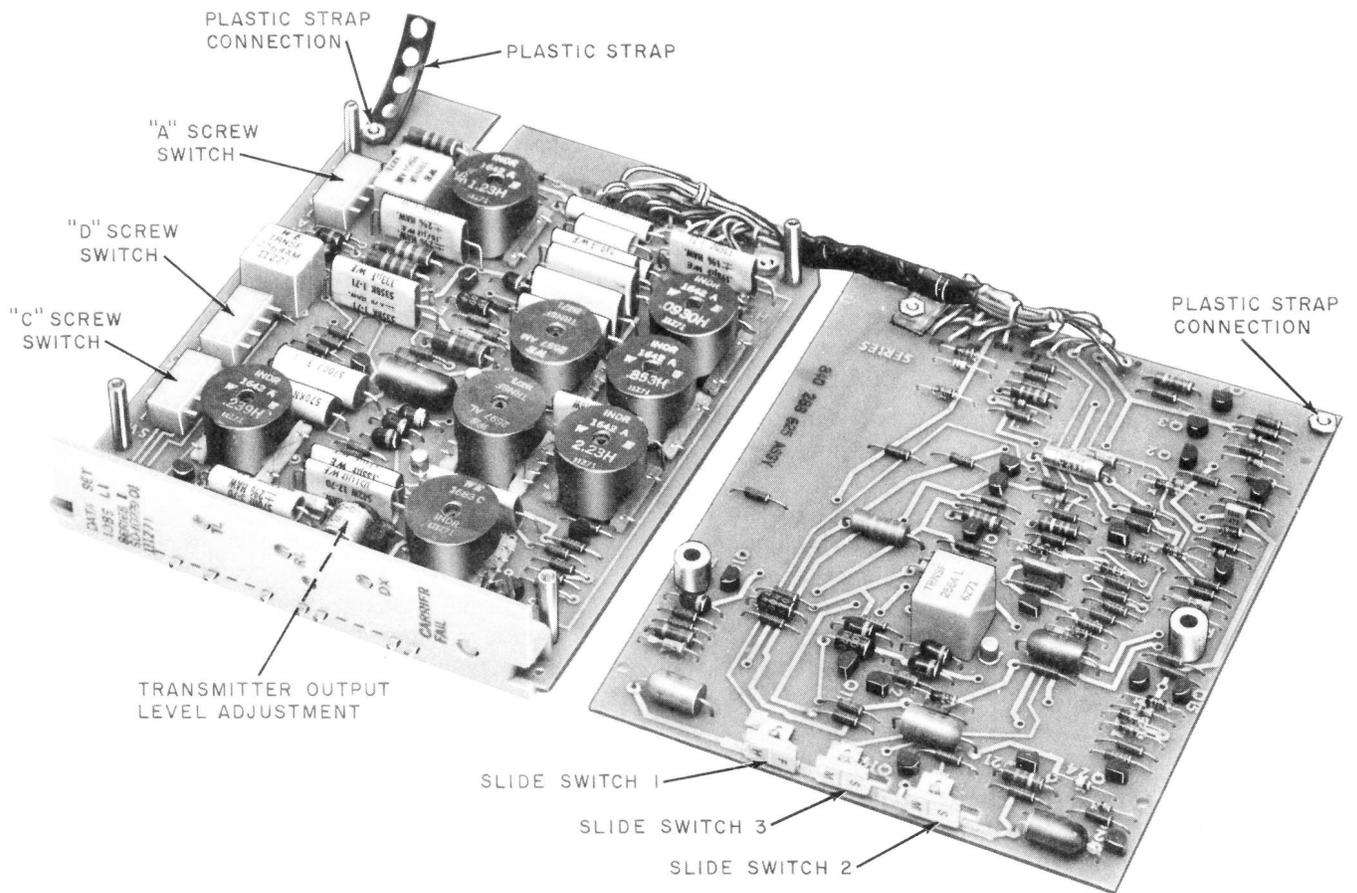


Fig. 7—Data Set 108E-L1 Showing Location of Switches

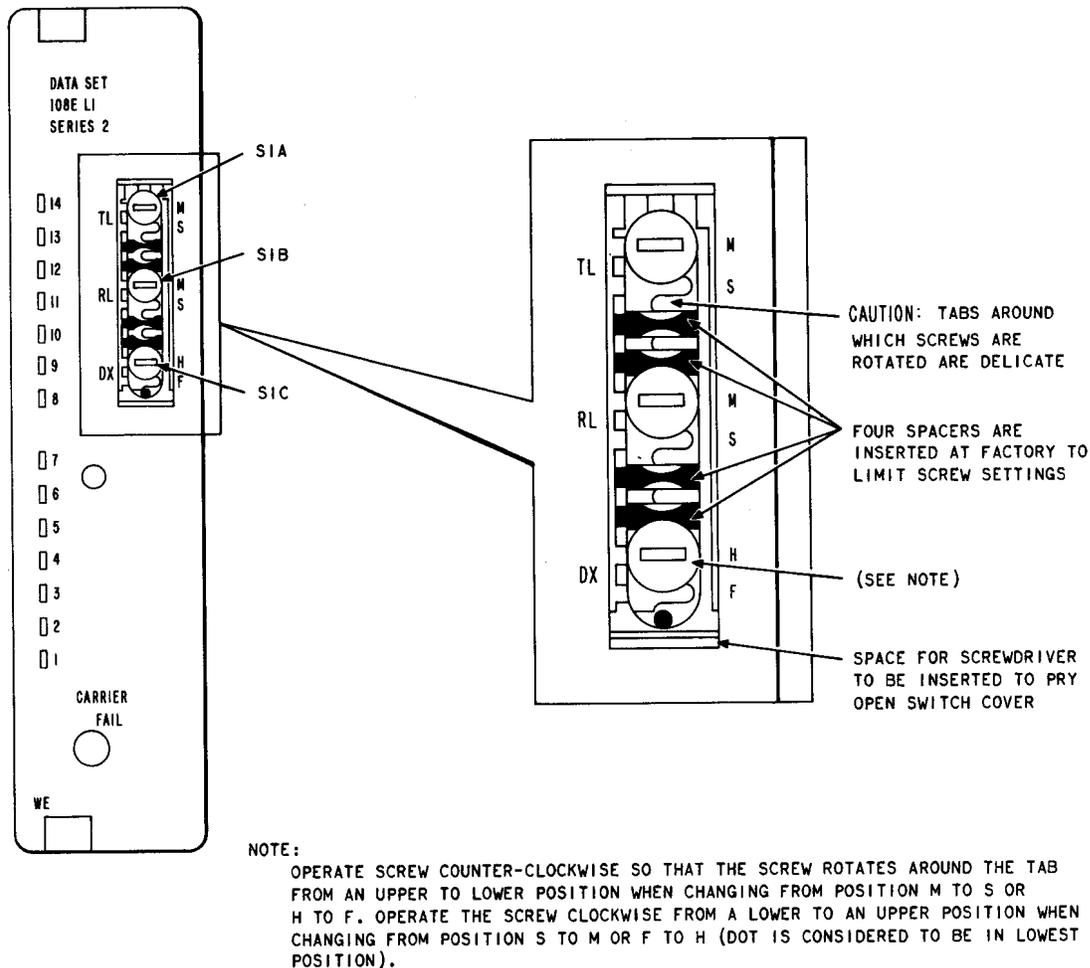


Fig. 8—Data Set 108D-L1 (Series 3 or Higher) or 108E-L1 (Series 2 or Higher) Rotary Screw Switch S1

the data set. The positive potential is an indication that the data set has power.

(d) RS on card terminal 7 connects to the EIA interface CF lead (received line signal detector lead). This lead will be at a positive potential when a carrier is being received from the line. When a loss of carrier is detected by the data set, the CF lead will have a negative potential and the CF lamp will light.

(e) CSQ (carrier squelch) on terminal 15 can be used for carrier control. This is a non-EIA lead to the station. A negative voltage on this lead squelches the outgoing carrier.

(f) Card terminal 13 can be used for carrier control. This is a non-EIA (contact control)

lead to the station. The outgoing carrier can be turned off by connecting a ground to the carrier control leads.

3.04 The data set converts ac signals received from the line into dc voltages and delivers them to the station circuit on the TL (BB) lead. Conversely, the data set converts dc voltages received from the station on the BA lead into voice frequency ac signals and transmits them onto the line. Since the ac signals occupy different frequency bands, the line functions as if it were two separate one-way channels (full-duplex mode).

3.05 Data sets 108D-L1A and 108E-L1A have line impedances of 600 ohms for both 2- and 4-wire line facilities. Data sets 108D-L1 and

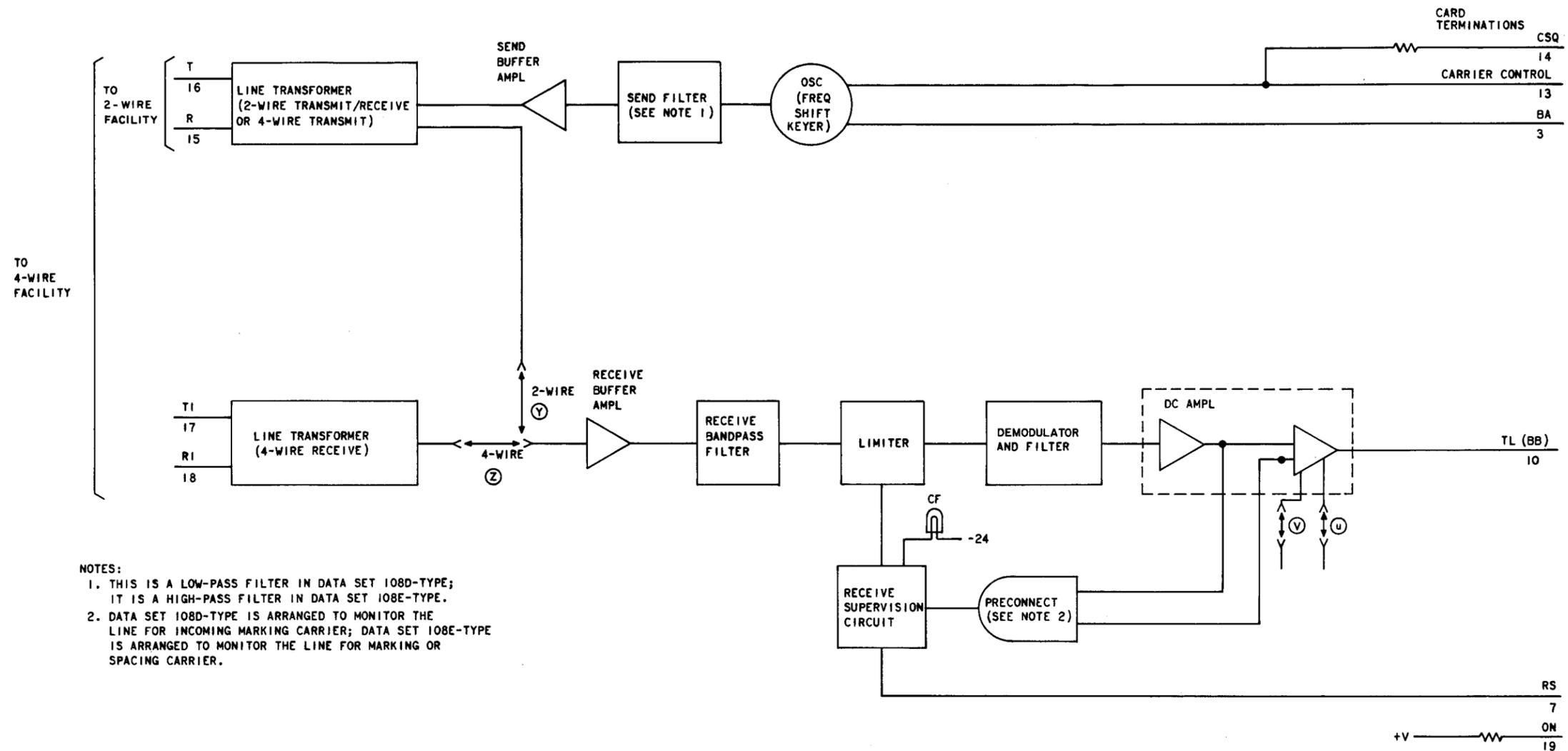


Fig. 9—Block Diagram of Data Sets 108D- and 108E-Type—Station Configuration

108E-L1 have line impedances of 900 ohms for 2-wire and 600 ohms for 4-wire line facilities.

Transmitter Circuit

3.06 The data set transmitter circuit consists of an oscillator (frequency-shift keyer), sending low-pass filter in DS 108D or sending high-pass filter in DS 108E, a sending buffer amplifier, and the transmit and receive line transformer.

3.07 When a mark signal is applied to the BA lead, the oscillator (frequency-shift keyer) has an output of 1270 Hz (mark) for DS 108D or 2225 Hz (mark) for DS 108E. The application of a space to the BA lead causes the oscillator to shift to 1070 Hz (space) for DS 108D or 2025 Hz (space) for DS 108E.

3.08 The output of the oscillator is fed to the sending filter. The filter attenuates the unwanted frequencies in the receiving band, thereby reducing the balance requirements of the hybrid transformer for 2-wire operation of the data set.

3.09 The sending buffer amplifier isolates the line and provides a suitable termination for the sending high-pass filter (DS 108E) or low-pass filter (DS 108D). Level adjustment controls deliver the proper power to the line.

3.10 In a 4-wire line arrangement line connections are made to the send transformer and to the receive transformer at the data set. In a 2-wire line arrangement the line is connected to the send transformer which is arranged as a hybrid transformer.



The data sets are designed for a direct 4-wire loop connection in order to minimize equipment need for those transmission links consisting of 4-wire facilities.

Receiver Circuit

3.11 The receiver circuit consists of the transmit and receive line transformer (4-wire operation) or transmit and receive line transformer (2-wire operation), receiving buffer amplifier, receiving bandpass filter, limiter, demodulator, low-pass detector filter, and dc amplifier.

3.12 Depending on the type of connection (2-wire or 4-wire), the line transformer will be connected to the receiving buffer amplifier. This amplifier isolates the line from variations in impedance of the receive bandpass filter which follows this amplifier.

3.13 The receiving filter has a bandpass of 1170 \pm 150 Hz (DS 108E) or 2125 \pm 150 Hz (DS 108D). This serves to reduce interference by attenuating out-of-band line noise. This filter also reduces the balance requirements of the hybrid transformer by providing attenuation of the locally transmitted signals in the f1 band (DS 108D) or in the f2 band (DS 108E).

3.14 The output of the receiving bandpass filter is connected to the limiter. The limiter amplifies the incoming frequencies and limits the output to provide a constant amplitude signal to the demodulator. The limiter also provides an output signal for the receive supervision. The demodulator converts the carrier frequency variations into dc voltage variations and delivers them to the low-pass detector filter and to the dc amplifier.

3.15 In DSs 108D and 108E-L1 the dc voltage presented to the receive supervision circuit is proportional to the limiter output signal. It can be used to determine when the input signal level drops below the minimum operating level of -43 dBm for 4-wire operation (for 2- and 4-wire operation in DSs 108D and 108E-L1A) or -40 dBm for 2-wire operation. When the receive carrier level drops 7 dBm below these values for a period of 75 to 150 ms, the receive supervision circuit is turned off. This places a negative voltage on the RS lead, lights the CF lamp, and causes the TL (BB) lead to send marking or spacing to the terminal devices, depending upon which option is installed in the data set. In addition, the data set will enter the preconnect mode.

3.16 The output dc amplifier amplifies the output from detector low-pass filter. An incoming **marking** frequency causes a negative marking signal to be applied to the TL lead. An incoming **space** frequency causes a **positive spacing** signal to be applied to the TL lead.

Preconnect Mode

3.17 In the preconnect mode, DS 108D is arranged to monitor the line for incoming marking

carrier, while DS 108E is arranged to monitor the line for incoming marking or spacing carrier. When the marking carrier, or marking or spacing carrier, is received for a sufficient period of time (200 to 600 ms to ensure that the data set does not enable on a momentary noise burst), the receive supervision circuit will turn on. This places a positive voltage on the RS lead, extinguishes the CF lamp, and unclamps the TL (BB) lead. In the preconnect mode, the slicer levels are shifted toward the marking and/or spacing frequency. Thus, during the 200 to 600 ms that the carrier is being received for reinitialization of the data set, the signal power must be in either the upper marking or lower spacing band with DS 108E or in the upper marking band with DS 108D.

3.18 Carrier detection in DSs 108D-L1A and 108E-L1A can be reduced to about 100 ms by a simple modification: a wire strap soldered to two land areas of the printed board marked with the letter R. No option letter has been assigned to this local engineering modification.

Fail Safe State

3.19 In DSs 108D-L1A, 108E-L1A, 108D-L1, and 108E-L1, the fail-safe state of the request-to-send (CA) circuit is the *on* state. This is the correct state for the commonly used application in which the terminal or mounting does not provide a CA driving circuit. For stations on polling systems, the desirable fail-safe state is *off*. This can be obtained in DSs 108D-L1A and 108E-L1A by a simple modification: a wire strap soldered to two land areas on the printed board marked with the letter Q. No option letter has been assigned to this local engineering modification.

4. OPTIONS

2-Wire/4-Wire Option

4.01 Three screw switches (A, C, and D) are provided in DSs 108D-L1 and 108E-L1 to implement 2- or 4-wire service (see Table B). For 4-wire connection, option Z must be installed in DSs 108D-L1 and 108E-L1. The sending loop facility must be connected to the terminals mating with card terminals 15 and 16 (R and T); the receiving loop facility must be connected to the terminals mating with card terminals 17 and 18 (T1 and R1). The 4-wire option requires all of the C screw switches to be opened. For 2-wire connection,

option Y must be installed in DSs 108D-L1 and 108E-L1. The loop facility must be connected to the terminals mating with card terminals 15 and 16 (R and T) and the proper hybrid network option installed. Options Y and Z are under control of screw switch A (Fig. 6 and 7). The A screw switch setting for each option is listed in Table B.

4.02 In addition to the screw switch options, DSs 108D-L1 and 108E-L1 are provided with several slide switch or rotary-screw switch (refer to paragraph 2.03) options. The option designations, along with the function and switch setting for each, are given in Table B.

4.03 Data sets 108D-L1A and 108E-L1A are provided with a rocker switch inside the data set and jumper plugs on the faceplate by which options (Table B) are set.

4.04 In station applications the DX switch is always in the F position (option X of Table B).

Receiving Sensitivity Adjustment

4.05 The gain of the receiving buffer amplifier is adjustable to allow compensations to be made for differences in receive level. If the receive carrier level is greater than -30 dBm (-29, -28, etc), the 6-dB reduction of gain should be installed (see Table B).

Transmitting Sensitivity Adjustment

4.06 The transmission level of the DSs 108D-L1 and 108E-L1 are continuously adjustable over a range (see Table A) to allow compensations to be made for differences in local loop loss. Potentiometer R18 (Fig. 6 and 7) adjusts the output power level through a range of -6 to -26 dBm for DS 108D-L1 or 0 to -26 dBm for DS 108E by continuous adjustment into a 600-ohm loop 4-wire circuit or a 900-ohm loop 2-wire circuit.

4.07 Data sets 108D-L1A and 108E-L1A are provided with switches to adjust the transmitting level in 2 dB steps from -1 dBm to -15 dBm (Table C). In addition five send levels between -16.0 and -26.0 dBm (Table C) can be obtained for central office applications.

4.08 All options available with the data set are covered in Tables B, C, D, and E. The

implementation of the desired options is given in the applicable table or paragraph.

5. REFERENCES

5.01 For additional information on DS 108D- or 108E-type, refer to the following:

- | | |
|--|---|
| (1) SD-1D229-01 (DS 108E-L1 Schematic Diagram) | (4) CD-73060-01 (DS 108D-L1—Circuit Description) |
| (2) CD-1D229-01 (DS 108E-L1—Circuit Description) | (5) SD-1D229-02 (DS 108E-L1A—Schematic Diagram) |
| (3) SD-73060-01 (DS 108D-L1—Schematic Diagram) | (6) CD-1D229-02 (DS 108E-L1A—Circuit Description) |
| | (7) SD-73060-02 (DS 108D-L1A—Schematic Diagram) |
| | (8) CD-73060-02 (DS 108D-L1A—Circuit Description) |

TABLE B

DATA SETS 108D-L1A AND 108E-L1A OPTIONS
(OPTIONS FOR DATA SETS 108D-L1 AND 108E-L1 ARE SHOWN FOR COMPARISON.)

FEATURE		OPTION	108D-L1A OR 108E-L1A			108D-L1 OR 108E-L1	
			SWITCH SETTING			SWITCH SETTING	
			S1 SWITCH ON CP1			A SCREW SWITCH	
			OPEN	CLOSED		OPEN	CLOSED
FACILITY	4-WIRE	Z	3	2		2-3	1-2, 3-4
	2-WIRE	Y	2	3		1-2, 3-4	2-3
						SWITCH SETTING	
						D SCREW SWITCH	
						OPEN	CLOSED
RECEIVED GAIN REDUCTION	6 dB	K	1	—		1-2	—
	0 dB	J	—	1		—	1-2
			FACE PLATE DESIGNATION				
DIRECTIONAL CONTROL	C.O. HUB	X	DX	F		DX	F
	FDX HDX	W		H			H
		STATION	X	F			F
TL LEAD	MARK HOLD	U	TL	M		TL	M
	SPACE HOLD	V		S			S
RL LEAD	MARK HOLD	S	RL	M		RL	M
	SPACE HOLD	T		S			S

Note 1: A fixed hybrid balance is provided in data sets 108D-L1A and 108E-L1A, corresponding to options H of data sets 108D-L1 and 108E-L1, respectively.

Note 2: To obtain an OFF, fail-safe state of the request to send (CA), solder a wire strap to two land areas on the printed board marked with the letter Q (this is a modification not an option).

Note 3: Carrier detection time can be reduced to about 100ms, by soldering a wire strap to two land areas of the printed board marked with the letter R (this is a modification not an option).

TABLE C

**TRANSMIT LEVEL ADJUSTMENT OF
DATA SETS 108D-L1A AND 108E-L1A**

TRANSMIT LEVEL (dBm)	SWITCH SETTING S1 SWITCH ON CP1	
	OPEN	CLOSED
-1	4,5,6,7,8	—
-3	4,6,7,8	5
-5	4,5,7,8	6
-7	4,5,6,8	7
-9	5,6,7,8	4
-11	6,7,8	4,5
-13	5,7,8	4,6
-15	5,6,8	4,7
-16	6,8	4,5,7
-17.5	5,8	4,6,7,
-18.5	8	4,5,6,7
-23	5,6,7	4,8
-26	—	4,5,6,7,8

Note: In data sets 108D-L1 and 108E-L1, the transmit level is adjusted by means of potentiometer R18.

TABLE D

DATA SET 108D-L1

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 setting.

TABLE E
DATA SET 108E-L1
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 — Nonload (HC) — High Capacity
 *Compromise hybrid network setting.