

**DATA SET 103J-L1/2
TRANSMITTER-RECEIVER
SINGLE SET
DESCRIPTION AND OPERATION**

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NOTICE

Not for use or disclosure outside the
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1. GENERAL

1.01 This section describes the physical and functional characteristics of data set (DS) 103J-L1/2 (Fig. 1). General operating information is included for single set installations. The 590-010-ZZZ layer provides examples and guidelines to be followed for station arrangements that include multi-set arrangements in 40A-type data mounting(s) and cabinet.

1.02 When this section is reissued, this paragraph will contain the reason for reissue.

1.03 DS 103J-L1/2 is intended for use on 2-wire switched network circuits at speeds up to 300 baud.

1.04 The following is a specification summary for DS 103J.

Operation: Nonsynchronous, binary, serial, full-duplex on 2-wire switched network.

Modulation: Frequency shift keying.

Rate: Up to 300 baud.

Modes: Originate, answer.

Customer Interface Connection: EIA Standard RS-232-C. Customer-provided equipment (CPE)

must connect via a 25-pin Cinch or Cannon DB-19604-432 (male) connector plug with Cinch DB-51226-1 hood (or equivalents). Interface cable should be less than 50 feet long per EIA Standard RS-232-C recommendations.

Power: 105 to 129 Vac at 57 to 63 Hz, approximately 10 watts.

Environment: Ambient temperature = 40 to 120°F, relative humidity = 20 to 95 percent.

Note: These environmental operational limits are valid only under the condition that no condensation occurs.

Dimensions and Weights: DS 103J-L1 overall dimensions are 5.6 inches wide, 10.4 inches long, and 1.5 inches high. The assembly weighs approximately 2 pounds. DS 103J-L1/2 dimensions are 5.8 inches wide, 10.9 inches long, and 2.2 inches high. The weight is approximately 5 pounds.

Compatibility: Line signal compatible with all DS 103-type on switched network. In the appropriate mode, DS 103J is compatible with all DS 113-type.

Installation Configurations: Single set or multiple, manual and/or automatic calling or manual and/or automatic answer.

Testing: Local self test, analog loop-back, digital loopback and end-to-end self test.

2. PHYSICAL DESCRIPTION

2.01 List code designations have been assigned to DS 103J as follows:

- **DS 103J-L1:** Printed circuit pack assembly shown in Fig. 2.
- **DS 103J-L1/2:** Printed circuit pack assembly DS 103J-L1; housing assembly, power cord and transformer, and M13F cord (Fig. 3).

A. DS 103J-L1

2.02 This list code specifies the basic data set.

DS 103J-L1 consists of two printed circuit boards interconnected by three flexible cables. The overall dimensions are 1.5 inches high, 5.6 inches wide, 10.4 inches long, and the weight is 2 pounds. A faceplate is provided which contains the status

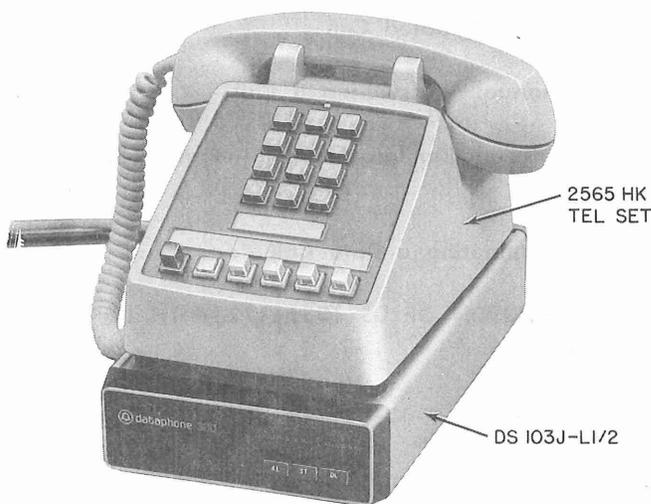


Fig. 1—Data Set 103J-L1/2 With 2565HK Telephone Set

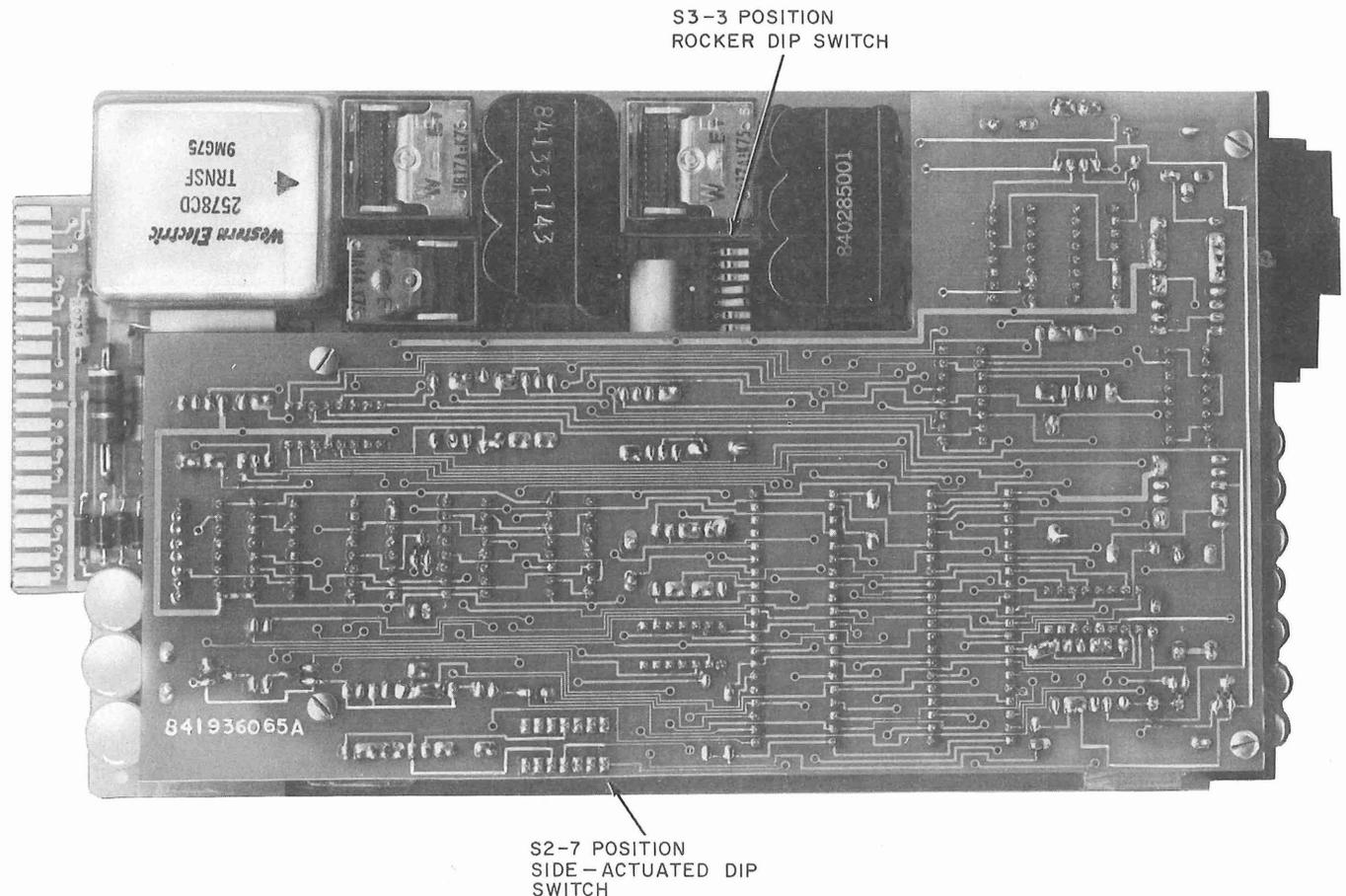


Fig. 2—Data Set 103J-L1

indicators and the three test switches. All interconnections to the circuit packs are made via a plug at the rear of the board.

2.03 The two miniature rocker switch assemblies S2 and S3 and one flexible strapping allow the telco craftsman to select options. All options are listed in Part 3.

B. DS 103J-L1/2

2.04 This list code specifies the "stand alone" configuration. It consists of the data set previously described, enclosed in a 47C1 data mounting.

2.05 The data mounting is an extruded aluminum shell measuring 2.2 inches high, 5.8 inches wide, 10.9 inches long, and weighing 2.3 pounds (3.2 with KS-21239 transformer). The data mounting

and data set plus transformer weigh approximately 5 pounds. The front cover is molded black plastic with seven translucent designations and a cutout for the test switches. The rear cover is also molded black plastic with a cutout for the two interface connectors and the power cord.

2.06 A KS-21239-L4 transformer, which is attached to the mounting by a power cord, a transformer mounting screw, and an M13F set cord, is included with the mounting. The transformer plugs into a standard nonswitched 117-volt 60-Hz outlet, 3-wire grounded outlet. It is equipped with a tab which should be secured to the outlet (where allowed by local electrical codes) to prevent inadvertent removal of power from the data set.

2.07 The status indicators are light emitting diodes (LEDs). When DS 103J-L1/2 is placed in the mounting with the covers installed, the LEDs

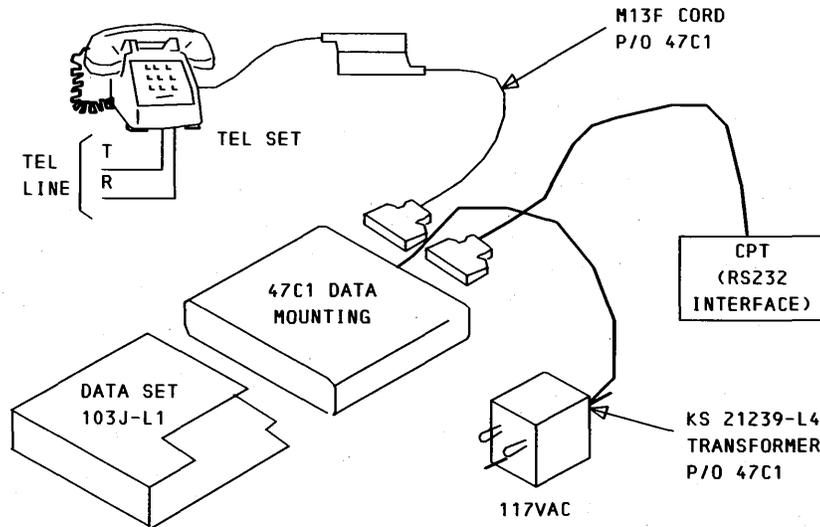


Fig. 3—Single Data Set Installation Without ACU

illuminate “dropout” graphics on the front cover. “Dropout” graphics provide for the appearance of the 2-letter abbreviation when the indicator is lighted and a continuous black opaque surface when the indicator is off.

2.08 The indicators are described as follows:

- MB (Made Busy): Lighted when any of the following occurs:
 - (1) When the CN lead is turned **on** by the CPE, if the ST and DL buttons are released.
 - (2) When option K (fail-safe state of CN circuit) is installed and there is zero volt or an open circuit on CN lead, provided the ST and DL button are released.
 - (3) When the AL test button is operated.
- TR (Terminal Ready): Lighted when the data terminal ready (CD) lead is **on**.
- MR (Modem Ready): Lighted when the data set ready (CC) lead is **on**.

- SD (Send Data): Lighted when the transmitted data (BA) lead is spacing.
- RD (Receive Data): Lighted when the received data (BB) lead is spacing.
- MC (Modem Check): Lighted in any of the following situations:
 - (1) In idle mode if power is present
 - (2) In data mode if carrier has not been detected
 - (3) In self test if test fails.

Note: May be lighted for first few seconds while handshaking.

- TM (Test Mode): Lighted when one or more of the AL, ST, or DL switches is depressed.

2.09 The data set is equipped with three locking pushbutton switches on the faceplate, which are used to test the data set. These switches are the depress-to-operate and depress-to-release type,

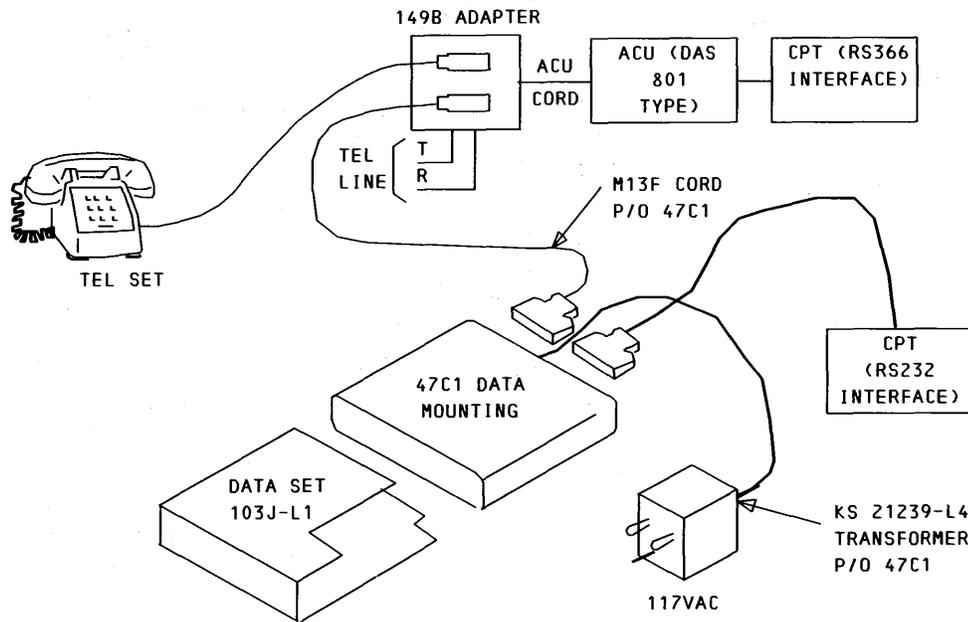


Fig. 4—Single Data Set Installation With ACU

and are designated AL (analog loop-back), ST (self test) and DL (digital loop-back). The functions of these switches are described in Part 4.

2.10 Installer options are accomplished by setting the position of individual switches on multiple section rocker assemblies, the jack-plug option, and screw switch S1 on the data mounting. Refer to Section 591-039-200 for installation of options.

3. FUNCTIONAL DESCRIPTION

3.01 DS 103J-L1/2 provides 300-baud originating and answer service in the following configurations:

- One data set enclosed in a 47C1 data mounting and a 565HK or 2565HK key telephone set (Fig. 3). An 801A- or C-type ACU may be installed as an option using a 149B adapter (Fig. 4). The telephone set is not required when automatic calling is used; and/or when the auto answer option is installed and manual operation and voice communications are not needed.

- A maximum of five data sets in an individual data mounting sharing a single telephone set via a KS-21253-L3 adapter (Fig. 5).

A. Customer Interface

3.02 The customer interface conforms to EIA Standard RS-232-C. The 25-pin female connector is not part of the data set card but is provided on the mounting (Fig. 6). The connector pin designations and functions are listed in Table A.

3.03 All other interface connector pins on the mounting are unused. As specified in EIA Standard RS-232, connector pins 9 and 10 are not to be used by the CPE. An additional interface circuit, CN on pin 25, is provided, as it is in DS 103E and 113-type (113B) data stations. Its function is to activate the make-busy and analog loop features via the interface.

B. Telephone Interface

3.04 A plug is provided on the mounting for all telephone company connections (Fig. 6). The plug pin designations and functions are itemized in Table B.

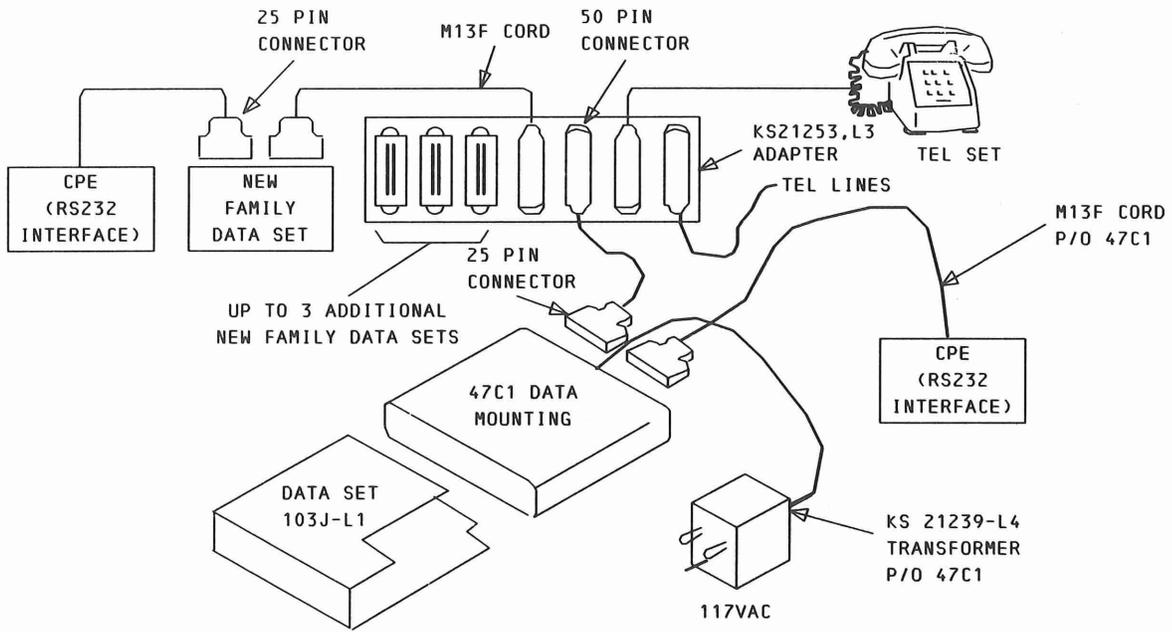


Fig. 5—Data Set 103J-L1 Sharing Telephone Set With Up to Four Other New Family Data Sets

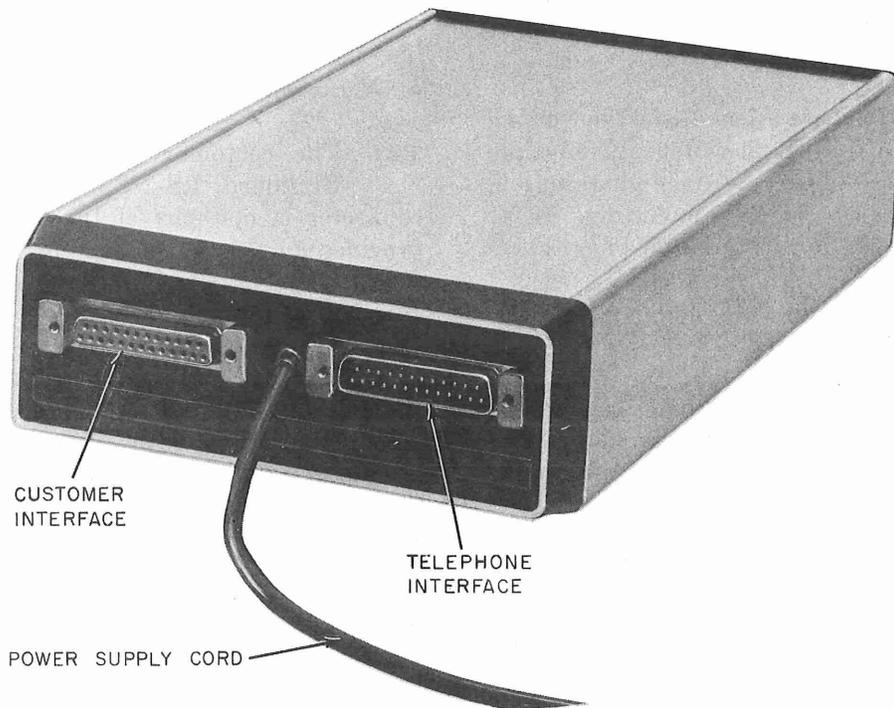


Fig. 6—Data Set 103J-L1/2—Rear View

TABLE A
CUSTOMER INTERFACE

EIA DESIGNATION	CIRCUIT	CP CONNECTOR PIN ASSIGNMENT	CUSTOMER INTERFACE CONNECTOR PIN ASSIGNMENT
AA	Protective Ground	—	Note 1
BA	Transmitted Data	2	2
BB	Received Data	3	3
CB	Clear to Send	5	5
CC	Data Set Ready	6	6
AB	Signal Ground	7	7
CF	Data Carrier Detector	8	8
+P	Data Set Test (+12V)	27	9
-P	Data Set Test (-12V)	26	10
—	Not Used	—	11 } 19 } Note 2
—	Not Used	—	
CD	Data Terminal Ready	22	20
CE	Ring Indicator	23	22
CN	Terminal Busy	25	25

Note 1: Not wired in connector but available in data mounting.

Note 2: Pin 19 is connected to pin 11 in the housing. This circuit is not used in low-speed data sets.

Note 3: All other interface connector pins on the mounting are unused. As specified in EIA Standard RS-232, connector pins 9 and 10 are not to be used by the CPE.

TABLE B
TELEPHONE INTERFACE

PI PLUG PIN ASSIGNMENT	DESIGNATION	DESCRIPTION
1	L	Tel set line lamp control from data set
4	LG	Tel set line lamp ground from data set
5	TD	Talk/data control from tel set
7	T	Telephone line tip lead
8	R	Telephone line ring lead
12	RD	Common ringer control contact to ground
14	C	Data mode contact closure to ground from set to ACU
16	D1	Data mode contact closure to ground from ACU to data set
21	T1	Tel set tip lead
22	R1	Tel set ring lead
23 & 24	A & A1	A lead control: used to provide an indication to ACU or KTU when the line is in use
25	TDG	Talk/data control ground lead

C. Options

3.05 Table C provides a listing of DS 103J-L1/2 options.

D. General Operation

3.06 DS 103J-L1/2 is a dual mode data set, suitable for originating and answering calls. The frequencies used depend on the mode and are as follows:

ORIGINATE MODE		ANSWER MODE
Transmit	f ₁ mark—1270 Hz f ₁ space—1070 Hz	f ₂ mark—2225 Hz f ₂ space—2025 Hz
Receive	f ₂ mark—2225 Hz f ₂ space—2025 Hz	f ₁ mark—1270 Hz f ₁ space—1070 Hz

E. Originate Mode

3.07 Either of the following methods may be used to originate a data call:

(a) The associated telephone set is used in the normal way to establish a telephone connection to any switched network DS 100-type except 113A or 113C. If the call is answered in the telephone mode, the caller requests a transfer to the data mode; if the called station is arranged for automatic answer, it answers in the data mode. In either case, an f₂ mark tone is heard by the caller, who then depresses the data key on the telephone.

(b) An alternate way to originate a call is via an optional automatic calling unit (ACU). In this case, the dialing of the call and the subsequent monitoring for f₂ mark tone is accomplished by the ACU, which then puts DS 103J-L1/2 in the data mode. For either method, the originating data set when going into the data mode does the following:

- (1) Turns **on** the CC lead when going off-hook, provided option ZD (CC indication early) is installed, and monitors the line for an f₂ mark tone.

TABLE C

DS 103J OPTIONS

FEATURE		OPTION
Receive Space Disconnect	YES NO	V* Y
Send Space Disconnect	YES NO	T* U
Loss of Carrier Disconnect	YES NO	S* R
CC Indication	EARLY DELAYED	ZD* ZC
CB and CF Indications	COMMON SEPARATE	A* B
CC Indication for Analog Loop	ON OFF	ZF* ZE
Fail-Safe State of CN Circuit	ON OFF	K J*
Automatic Answer	YES NO	ZH* ZG
Common Ringer	YES NO	ZB ZA*
Tip-Ring Make Busy	YES NO	F E*
Contact to Ground Make Busy Floating Contact Make Busy	For use with 40A-type data mounting only	
Common Grounds	YES NO	Q* P

* Factory-Furnished Option

(2) When a continuous f_2 mark is detected, the data set does the following within a short time interval:

- Turns **on** the CF lead.
- Turns **on** the CC lead, provided option ZC (CC indication delayed) is installed.

- Removes the marking clamp on the BB lead.

- Applies an f_1 mark to the line.

- Turns **on** the CB lead. As soon as the CB lead is **on**, the CPE can send data.

(3) If f_2 mark is not received within 14 ± 4 seconds, an abort timer automatically disconnects the set.

F. Answer Mode

3.08 In response to a ringing voltage, the CE lead is turned **on** by the data set while ringing voltage is present.

3.09 If option ZG (automatic answer NO) was selected at installation, incoming calls are not answered automatically. Manual answer is accomplished by depressing the associated locking line key located on the telephone set and lifting the telephone receiver. Connection of the data set to the line is effected by momentarily depressing the data key.

3.10 If option ZH (automatic answer YES) was selected, the data set is connected to the line after the end of a ringing interval, provided the CD lead is **on**.

3.11 When the data set is connected by either method, the CC lead is turned **on** and the transmitter is kept disabled for a period of 2 seconds, after which time the f_2 mark frequency is transmitted. After receipt of this tone for some time, the originating station transmits the f_1 mark tone. If no such signal is received for 14 ± 4 seconds after connecting, an abort timer automatically disconnects the set. If a continuous f_1 mark is detected, the CB and CF leads are turned **on**, a mark hold is removed from the BB lead, and the CPE can send and receive data.

G. Mode Selection

3.12 The mode of all DSs 103-type is automatically selected, depending on whether the call was originated or answered. Whenever ringing voltage has been received, the data set is readied to go off-hook in the answer mode, using the answer mode frequencies listed in 3.06. Ring memory persists for a little over 4 seconds if the call is not answered, and for the duration of the call if answered either by the telephone or by an off-hook condition of the data set. It also persists on transfers between the data and talk modes. If no ringing voltage has been received, the call is assumed to be an originating call, and the originating frequencies are used. In this way, compatibility between all DSs 103-type is assured. In addition, originate-only data sets can originate calls to 103-type sets, and 103-type sets can call answer-only sets.

3.13 Three hazards exist which can cause the data set to be in the wrong mode (glare).

(1) If a call is originated from a DS 103-type just after a switching office has connected an incoming call, but during a silent interval before the ringing voltage was applied, the incoming call will be inadvertently answered, but in the originating mode. This silent interval may be as long as 4 seconds.

(2) If a call is answered manually after a very short ring, the DS 103-type may remain in the originate mode.

(3) If a call is originated within a few seconds after ringing voltage has been applied, but after the caller has abandoned his calling attempt, dial tone is received and a call can be originated, but the data set assumes the answer mode.

3.14 There are provisions for switching the mode at a 103J station for test purposes. This is explained in Part 4.

H. Carrier in Data Mode

3.15 In the data mode, any frequency in the appropriate band (f_2 for originate mode, f_1 for answer mode) will keep the carrier detector **on**. A loss for approximately 10 ms results in CF being turned **off** and BB clamped to mark. CB either goes **off** or stays **on** during periods of carrier fail, depending on the option selected. Any in-band signal of sufficient amplitude and duration is capable of restoring the carrier detector.

I. Disconnecting the Data Set

3.16 There are four ways by which DS 103J can be disconnected.

(1) The data set can be disconnected by turning the CD lead **off** for at least 50 ms. Provided option T is installed, the data set then transmits 3 ± 1 seconds of spacing signal prior to disconnecting.

(2) Provided option V is installed, the data set disconnects upon receipt of a continuous space disconnect signal of at least 2.2 seconds.

- (3) If option S is installed, the data set disconnects when incoming carrier is lost for approximately 250 ms.
- (4) The data set may also be manually disconnected by using the associated telephone.

J. Telephone Sets

3.17 As indicated in Fig. 3, 4, and 5, the 565HK or 2565HK telephone sets can be used with either the 47C1 or 40A-type data mounting. The 830C or 2830C telephone set may be used with one 40A data mounting, and the 831C or 2831C with two mountings.

3.18 The operation of all telephone sets is similar. One locking line key is associated with a particular data set and its telephone line. Depressing the line key and lifting the handset makes the telephone set available for dialing or answering calls and for talking. The lamp under the key does not light in the talk mode.

3.19 To transfer a call from the talk mode to the data mode, momentarily depress the red, nonlocking data key. This key is used for all data sets sharing the telephone set. The lamp under the line key lights whenever the associated data set is off-hook. The handset may be replaced during the data call.

3.20 To transfer a call from the data mode to the talk mode, depress the associated line key and pick up the handset.

3.21 A method for manually disconnecting a data call consists of entering the talk mode and then replacing the handset.

3.22 During ringing on any line, the lamp under the associated line key flashes at the ringing rate.

3.23 For installations where only ACU dialing and/or automatic answering is used and the talk mode is not required, the telephone set can be omitted. Nevertheless, its use is recommended for ease of maintenance.

K. Make-Busy Feature

3.24 A make-busy feature is available for DS 103J. This feature is important in line-hunting

arrangements. It should not be used for nonline-hunting installations, for which the "don't answer" condition is proper to indicate that a port is out of service.

L. Other Features

3.25 The telephone set used with DS 103J is not provided with keys to select automatic or manual answer. An installer option determines whether the automatic answer feature is functional. To override the automatic answer feature, if installed, CD lead should be turned *off* in the CPE. An alternate method consists of operating the AL button, if the make-busy option is not installed. Before manually transferring to the data mode, this button must be released.

3.26 A common ringer option (ZB) is available when one telephone set is shared by five "new family" data sets. When any of the five sets receives a ringing signal, a buzzer sounds, while the flashing light under one of the line keys identifies the line which is rung. A similar option exists for the 40A-type data mounting, but can only be used if the sleeve-lead or second pair make-busy feature is not installed.

3.27 For installations in key telephone systems, the data set provides "A" lead control when required.

M. Performance

3.28 The performance of DS 103J over the switched telephone network is as good as or better than the performance of the older 103-type sets. The transmit level is fixed at -9 dBm into a 600-ohm line. It can receive at any level between 0 and -50 dBm, and detects loss of carrier when the signal falls below this level, typically at -53 dBm.

N. Status Lamps

3.29 DS 103J-L1 is equipped with seven status lamps. These are useful for checking the status of the data set, for observation of the progress of a call and of the exchange of data, and for checking the results of tests. The lamps are designated as follows:

MB—Made Busy

TR—Terminal Ready

MR—Modem Ready

SD—Send Data

RD—Receive Data

MC—Modem Check

TM—Test Mode.

3.30 These lamps and the associated line keys light as follows.

Data Set in Idle Mode (On Hook, All Test Buttons Released), or Talk Mode

- MC is lighted.
- TR is lighted while CD lead (data terminal ready) is **on**.
- SD is lighted while BA lead (send data) is spacing.

Note: The MC lamp in idle mode serves as a “power on” indication. No ON lamp is provided.

Ringling

- The line key lamp flashes on and off at the ringing rate.
- MC is lighted.
- TR is lighted while CD lead is **on**.
- SD is lighted while BA lead is spacing.

Entering the Data Mode

- MC is lighted.
- SD is lighted while BA lead is spacing.
- TR is lighted (CD lead must be **on**, otherwise the set cannot enter the data mode).
- The line key lamp lights and MR lights when the data set goes off-hook.
- MC goes off when the CF lead is turned **on**.

Data Mode

- TR and MR are lighted.
- SD lights whenever the CPE applies a space on the BA (send data) leads.
- RD lights whenever the data set receives a space and the BB (receive data) lead is spacing.

Note: A steady mark on BA or BB can be recognized by a nonlighted SD or RD lamp. Data transmission can be detected by a flickering lamp. Reversals at rates above 60 baud may look like a steadily lighted lamp.

Test Modes

- TM lights if any of the test keys of the data set are depressed and serves as an indication to the attendant that a manual operation is required to restore the set to normal. On a test initiated by turning **on** of the CN lead (terminal busy) by the CPE, TM does not light.

Made Busy

- MB lights if any of the three following events occur:
 - (1) CPE turns on the CN lead, provided the ST and DL buttons are released.
 - (2) If option K is installed and there is zero volt or an open circuit on the CN lead, provided the ST and DL buttons are released.
 - (3) Operation of the AL test button.

Note: The MB light does not light if the line is made busy by the data mounting circuits.

O. Installation and Maintenance

3.30 No special tools are required at installation.

3.31 DS 103J does not require routine maintenance or adjustments. Troubles isolated to the set should be cleared by data set replacement.

4. TEST FEATURES

A. Test Buttons

4.01 The data set is equipped with three push-to-operate, push-to-release buttons which are accessible at the front panel. The buttons are designated as follows:

AL—Analog Loop-Back

ST—Self Test

DL—Digital Loop-Back.

B. Analog Loop-Back Test

4.02 This test can be initiated by any of three methods:

- The AL button is operated.
- CPE applies an **on** condition to the CN lead.
- If option K (fail-safe state of CN circuit **on**) is installed, a zero-volt condition on the CN lead causes the data set to go into the analog loop-back test mode.

4.03 In the analog loop-back test mode, the data set is isolated from the telephone line, with the exception of the ring detector circuit. During this test, the data set circuits are modified to keep both the transmitter and the receiver in the f_1 mode. The output of the transmitter is looped via an attenuating circuit to the receiver.

4.04 If a make-busy option is installed, the telephone line is made busy. If not, the data set ring detector turns **on** the CE lead and lights the associated line key lamp in the normal way. Automatic answer is inhibited during this test; the telephone set and telephone ringer remain functional.

4.05 The test is performed in the following manner.

- (a) The AL button is depressed or the CN lead is turned **on** by the CPE. If at this time the CD lead is **off**, the MC and MB lamps are lighted, indicating that an idle data set is in the AL test mode. The TM lamp is also lighted

if AL is depressed, and SD is off only if the BA lead is marking.

- (b) If the CD lead is **on**, the data set goes through the "handshaking" sequence. TR and MR are lighted and after a slight delay, MC goes off and the CB and CF leads are turned **on**.

Note: If option ZE is installed, the CC lead remains **off** per RS-232-C for the duration of the test. If option ZF is installed, the CC lead is turned **on** for the duration of the test. Some terminals require the CC **on** indication to be able to proceed with this test.

- (c) The CPE can now send data signals which will be modulated by the transmitter, looped back to the receiver, demodulated, and presented to the CPE via the BB lead. In this way the CPE, in a duplex mode, can test the complete operation of the data set, and its own capability to generate and read data signals. The data signals may be observed at the SD and RD lamps.

- (d) Release of the AL button and/or turning **off** of the CN lead restores the station and lamps to normal.

C. End-to-End Self Test

4.06 Operation of the ST button turns **off** the CC, CB, and CF leads, opens the BB lead, and arranges the data set circuits to ignore the BA, CN, and CD leads from the CPE. It simulates internally the **on** condition of the CD circuit, and connects a square wave (reversals) signal generator of about 300 baud to the transmitting circuits and a bias detector to the output of the receiver.

4.07 To perform an end-to-end self test, a call is set up to another DS 100-type equipped with a self test button. The ST buttons are operated at both ends, and the data mode is entered in the normal way. The test can be performed with or without a terminal connected to the data set. The TR lamp continues to monitor the terminal and can be ignored. TM, SD, and MC are lighted. When entering the data mode, MR and RD light, and MC goes off only if the signal from the far end is received with less than 35 percent distortion. Similarly, the MC lamp at the far end indicates the proper reception of the

square wave generated at the near-end data set. On noisy connections, MC may go off but flash on occasionally, indicating a "hit" or error.

4.08 A similar test may be conducted when the set is connected to a testboard, with the testboard using a square wave (reversals) generator and a bias indicator. It should be noted that some TMS bias indicators will give excessive readings if the speed setting of the indicator differs from the actual speed of the generator. At DS 103J, the speed is held to 300 ±15 baud. The built-in bias detector of DS 103J is speed-insensitive.

4.09 If the far-end data set does not have a self test button but is provided with a digital loop-back feature, it is still possible to make an end-to-end test, but the results may be ambiguous. Have the far-end data set placed in the digital loop-back mode and depress the ST button on the near-end DS 103J. The square wave signal makes one complete round trip, and the signal detector of DS 103J checks if the round-trip distortion exceeds 35 percent. If the MC lamp goes off now, there is a very strong indication that both data sets and the line facilities are satisfactory.

Note: There is a slight possibility that the bias may be excessive in at least one direction, but that this bias is compensated for by bias of the opposite polarity in the other direction.

A successful test indicates that all circuits of both data sets seem to be working. If the MC lamp does not go off, the only conclusion that can be drawn is that the round-trip distortion exceeds 35 percent. As the bias distortion in the two directions of transmission may be additive, no conclusion about the proper operability of the sets and the line facilities can be drawn.

D. Local Self Test

4.10 By operating the ST and then the AL button, a local self test can be performed. The effect on the telephone line, the telephone set, and make-busy circuits is outlined in 4.03 and 4.04, and the effect on the CPE is outlined in 4.06.

4.11 In the local self test, an internal CD *on* condition is applied; the data set goes through the "hand-shaking" sequence; and a data signal is applied to the transmitter, looped back to the receiver (both in the fi mode), and the demodulated

signal is checked by the bias detector. In this way, most of the circuits of the data set are checked. The MC lamp goes out after a short delay if the bias of the received signal is under 20 percent, indicating proper operation of the set.

E. Digital Loop-Back Test

4.12 A digital loop-back test is normally set up at the request of the test center. Operation of the DL button turns *off* the CC, CB, and CF leads, clamps the BB lead marking, and arranges the data set circuits to ignore the BA and CD leads from the CPE. It simulates internally the *on* condition of the CD circuit, and internally loops BB to BA. When a data call is established between the test center and the data set, the test center can measure the round trip data distortion.

4.13 The digital loop-back test can also be set up between two data sets, as described in 4.09. During the test, TR monitors the CD lead and SD monitors the BA lead; MB, RD, and MC are off; and MR and TM are lighted.

4.14 No mode switching takes place, and the set must be manually restored to normal by releasing the DL button.

F. Mode Switching

4.15 At times it may be advantageous to switch the mode of the data set manually for test purposes. For instance, after a test center has called a data set for testing in the answer mode, switching manually to the originate mode permits further testing without having to call from the station.

4.16 To switch from the answer to the originate mode, enter the talk mode by depressing the associated line key and lifting the telephone receiver. Momentarily depressing the switchhook now changes the mode memory to the originate mode. Reenter the data mode by depressing the data key.

4.17 To switch from the originate mode to the answer mode while a call is in progress, depress and then release both the DL and ST buttons.

4.18 For an answered call, it is safe to switch back and forth between the two modes

without losing the central office connection. For an originated call which was manually switched to the answer mode, take care to flash the switchhook only very briefly (to return to the originate mode) and thus avoid a release of the central office connection. On some PBX or Centrex arrangements, conditions are set up for call transfer when the switchhook is flashed; for instance, the operator may be recalled. Appropriate action such as telling the operator to ignore the signal will normalize the call.

5. OPERATION

A. Manually Originating A Call

5.01 To originate a call manually, perform the following:

- Depress the appropriate line button and lift handset.
- Listen for dial tone.
- Dial the call in the usual way.
- If the call is answered in the telephone mode, request a transfer to the data mode. If the called station is arranged for automatic answer, it will answer in the data mode. In either case, an f_2 (2225 Hz) mark tone should be heard by the caller.
- If the TR lamp is lighted, depress the red data key on the telephone set. The line key lights and remains lighted.

Note: If the data key is depressed when TR is not lighted, the call will be lost.

- On the data set, the MR lamp lights and the MC lamp goes off.
- Data transmission can begin.
- The handset may be placed in the on-hook position.

B. ACU-Originated Call

5.02 The ACU accomplishes the dialing of the call and the subsequent monitoring for F2 mark tone. When the F2 mark tone is detected,

the ACU automatically places the data set in the data mode.

C. Manually Answering a Call

5.03 To answer call manually, perform the following procedure:

- Depress the flashing line key on the telephone set and lift handset.
- When requested, momentarily depress data key. The line key releases and lights. Data transmission can begin.

Note: If the data key is depressed when TR is not lighted, the call will be lost.

- On the data set, the MR lamp lights and the MC lamp goes off.
- The handset may be placed in the on-hook position.

D. Answering an Incoming Call Automatically

5.04 Stations arranged for automatic answer require no intervention by the attendant provided the TR lamp is lighted (CPE ready).

5.05 To override the automatic answer feature, depress the AL key. With the AL key depressed, the telephone can be used in the talk mode. Be sure to release the AL key before going into the data mode, or call will be lost.

Note: If make-busy option is installed, 5.05 does not apply.

E. Terminating A Data Call

5.06 A data call can be terminated in any of four ways.

(1) The call is terminated by going into the talk mode and hanging up.

- Depress the associated line key.
- Lift the handset. Line key goes off.
- Hang up the handset.

- (2) The CPE can terminate the call by momentarily turning off the CD lead (data terminal ready).
- (3) With option V (receive space disconnect) installed, the data set disconnects on reception of a long spacing signal.
- (4) With option S (loss of carrier disconnect) installed, the data set disconnects upon loss of carrier.

6. COMPARISON OF DS 103J-L1/2 WITH DS 103A3

6.01 Many obvious differences in appearance and test features exist between data sets 103J-L1/2 and 103A3. The following list contains further differences between the two data sets.

6.02 Options: Table D provides a comparison of the options available on the two data sets. Table E lists options available on DS 103A3 but not available on DS 103J-L1/2.

6.03 Operating Procedure: Many differences in operating procedures exist concerning controls and indicator lamps. The operating procedure for DS 103J-L1/2 is described in Part 5. There are no controls or indicators located on DS 103A3. In addition, the following differences exist in the operating procedure.

- Using DS 103J-L1/2, a call cannot be answered manually in the data mode. DS 103J-L1/2 must be put in the talk mode.
- DS 103J-L1/2 is not equipped with a clear key and is manually cleared by entering the talk mode.
- Automatic or manual answer modes are not selected by a key. Automatic or manual answer mode in DS 103J-L1/2 is selected by an installer option.

Note: The AL test key can be used to manually override the automatic answer mode, but must be released before entering the data mode.

- The abort timer in DS 103J-L1/2 is not only active while answering calls, but also when originating calls.

- In the automatic answer mode, DS 103J-L1/2 goes off-hook at the end of the ringing cycle. DS 103A3 goes off-hook at the beginning of the ringing cycle.

6.04 Send Space on Disconnecting: Both data sets 103J and 103A3 have an option which causes the set to send a 3-second space when the CD lead is turned *off*. In addition, DS 103A3 always sends a space when the clear key is depressed, or when the data set disconnects on carrier fail. DS 103J does not send a space under these conditions.

6.05 CPE Interface: DS 103A3 has the AA lead connected to pin 1 of the 25-pin interface connector. Pin 1 in DS 103J is not connected.

6.06 Timing: The timing of the various sequences in DS 103J-L1/2 differs from those of DS 103A3, but both sets comply with the requirements of EIA Standard RS-232, the needs of the telephone network, and are compatible with all Bell System switched network 100-type data sets.

6.07 Telephone Line Interface: The impedance of DS 103J is 600 ohms, while the DS 103A3 has an impedance of 900 ohms. In DS 103J, f_1 and f_2 are sent at the same level; in DS 103A3, f_2 is sent 4 dB higher than f_1 .

6.08 ACU Compatibility: DS 103A3 is compatible with DAS 801A5 and 801C3 (ACUs). DS 103J is not compatible with these ACUs. Both data sets are compatible with DASs 801A6, 801C4, and 801C-L1.

7. REFERENCES

SECTION	TITLE
590-001-110	Data Set 103J-L1/2—Reference Guide
591-039-150	Data Set 103J-L1/2 Transmitter-Receiver—Supplementary Information
591-039-180	Data Set 103J-L1/2 Transmitter-Receiver—Summarizing Specification
591-039-200	Data Set 103J-L1/2 Transmitter-Receiver—Installation and Connections

TABLE D

COMPARISON OF OPTIONS IN DATA SETS 103J AND 103A3

FEATURE		DS 103J OPTION	DS 103A3 OPTION
Receive Space Disconnect	YES	V*	V*†
	NO	Y	w/o V, H
Send Space Disconnect	YES	T*	T*
	NO	U	w/o T
Loss of Carrier Disconnect	YES	S*	S
	NO	R	w/o S*
CC Indication	EARLY	ZD*	ZD*
	DELAYED	ZC	w/o ZD
CB and CF Indications	COMMON	A*	A*
	SEPARATE	B	B
CC Indication for Analog Loop	ON	ZF*	NA
	OFF	ZE	NA
Fail-Safe State of CN Circuit	ON	K	NA
	OFF	J*	NA
Automatic Answer	YES	ZH*	Key Controlled
	NO	ZG	Key Controlled
Common Ringer	YES	ZB	NA
	NO	ZA*	Provided
Tip-Ring Make Busy	YES	F	NA
	NO	E*	Provided
Contact to Ground Make Busy	For use with 40A-type data mounting only		NA
Floating Contact Make Busy			NA
Common Grounds	YES	Q*‡	Q*
	NO	P‡	w/o Q
Transmit Level (Telco Selected Adjustment)	Fixed		Screwdriver adjustment of potentiometer

* Factory Furnished Option

† Long Space Disconnect

NA = Not Available

‡ Options P and Q are on the 47C1 data mounting.

TABLE E

OPTIONS PROVIDED IN DATA SET 103A3 BUT
NOT AVAILABLE IN DATA SET 103J

FEATURES IN DS 103A3		DS 103J OPTION	DS 103A3 OPTION
Short Space Disconnect		NA	H
Answer Mode Indication	CE ON CE OFF	NA Provided	X W*
Originate Only Test	YES NO	NA Provided	G w/o G*
w/o Answer Orig. Transfer	YES NO	Provided NA	N* w/o N
Answer Control	COMBINED SEPARATE	Provided NA	M* w/o M

* Factory Furnished Option
NA = Not Available

SECTION	TITLE	SECTION	TITLE
591-039-500	Data Set 103J-L1/2 Transmitter- Receiver—Test Procedures	591-817-500	Data Station Using Data Set 103J-L1—Tests