DATA SET 103A3

DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section covers the general description, operating principles, and equipment features of data set 103A3.

1.02 This section is reissued to:

(a) Add instructions that the MANUAL ANS key must be operated when testing with a data test center to prevent the data set from aborting the test call.

(b) To introduce data set 103A3, series 2, which uses data set 103E6 instead of 103E5 used in data set 103A3, series 1.

1.03 Data set 103A3 is a general purpose duplex, frequency-shift-keyed serial set designed for low-speed (up to 300 baud) data transmission over the direct distance dialing (DDD) network. The customer interface conforms to Electronic Industries Association (EIA) Standard RS-232-B ▶(data set 103A3, series 1) and RS-232-C (data set 103A3, series 2).◀ Table A lists the interface leads by designation, name, and purpose.

1.04 ▶Data set 103A3, series 1, is assembled at a service center using a new 38A1 data mounting and a C stock data set 103E5. Data set 103A3, series 2, uses a data set 103E6 instead of the 103E5 and may be ordered from Western Electric Company (WE). Data sets 103E2 and 103E4 may be used on a special assembly basis to fulfill specific requirements (as shown in Table B) that are not provided by data set 103E5 or 103E6. Data set 103A3 uses standard key telephone sets and is ***not*** compatible with data auxiliary set (DAS) 804-type.◀

1.05 ▶Data set 103A3, series 1, may be equipped with data set 103E5 using either CJ15 or CJ11 circuit pack (CP). When equipped with CJ15 CP, the sensitivity range of data set 103A3, series 1, is 0 to −50 dBm.◀ When equipped with CJ11 CP, the range is −10 to −50 dBm. When data set 103A3 is installed on a private branch exchange (PBX) line, the received signal from another data set served by the same PBX can exceed −10 dBm and impair the operation of the data set if it is equipped with CJ11 CP. For such installations, the CJ11 CP should be replaced by CJ15 CP or data set 103E5 replaced by data set 103E2, 103E4, or 103E6. Conversion by WE of CJ11 to CJ15 CP is possible. ▶The sensitivity range of the data set 103A3, series 2, is 0 to −50 dBm.◀

1.06 When a data set other than data set 103E5 ▶or 103E6◀ (data modem) is used, data set 103A3 should be appropriately marked to indicate the deviation from the standard arrangement.

1.07 Figure 1 is a block diagram showing the components that are associated with a data set 103A3.

1.08 Data set 103A3 may be used in single station applications where the shortcomings of data set 103A2/DAS 804B1 combinations present special problems.

TABLE A

DATA SET 103A3 INTERFACE LEADS

PIN NO.	LEAD AND FUNCTION		DESIG
1	Protective Ground	— To connect ac power service ground to equipment chassis	AA
7	Signal Ground	— To provide ground for all electronic circuits (May be connected to AA by installer screw switch option)	AB
2	Transmitted Data	— To present customer data to data set	BA
3	Received Data	— To present data output from data set to customer data terminal	BB
5	Clear to Send	— To inform customer that data set is ready to transmit any data presented on lead BA	CB
6	Data Set Ready	— To inform customer that the data set is connected to the transmission facility	CC
20	Data Terminal Ready	— To inform the data set that the data terminal is ready to originate or answer data calls	CD
22	Ring Indicator	— To indicate to the customer that ringing current is being received	CE
8	Data Carrier Detector	— To indicate to the customer that carrier is being received	CF

TABLE B

DATA SETS THAT MAY BE INSTALLED IN DATA SET 103A3 IN LIEU OF DATA SET 103E5 OR 103E6*

REPLACING DATA SET	REQUIREMENT
103E2 103E4	To replace data set 103A1

* When a data set other than data set 103E5 or 103E6 is used, data set 103A3 should be marked to indicate the deviation from the standard.

1.09 Data set 103A3 can provide all the functions and features of data set 103A2, plus additional features and service improvements as follows:

(a) A choice between rotary and Touch-Tone® dials, with or without card dialers. (Data set 103A2/DAS 804B1 is available with rotary dial only.)

(b) Equipped with an abort timer which will always disconnect the data set when the AUTO ANS key is operated and if fıM tone has not been received within about 25 seconds. (Data set 103A2 will not disconnect automatically after a caller hangs up unless it is served on a direct loop from a central office which provides a momentary dc interrupt on that loop.)

(c) Loss-of-carrier disconnect or a disconnect whenever the level of the incoming carrier drops below about −55 dBm. (Data set 103A2 will not disconnect automatically upon loss of carrier or low signal level.)

(d) All output interface circuits to the data terminal equipment are filtered to suppress undesired transients. (Data set 103A2—only lead CC [data set ready] is filtered.)

(e) Data set 103A3 is less sensitive to carrier level, −57 dBm at the most. (Data set 103A2 may be overly sensitive causing false indication of carrier presence.)

(f) Improved answer timer reduces the minimum waiting interval between an unanswered ring and origination of a call to 8 seconds. (Up to 30 seconds after an unanswered ring, the data set 103A2 may erroneously enter the answer

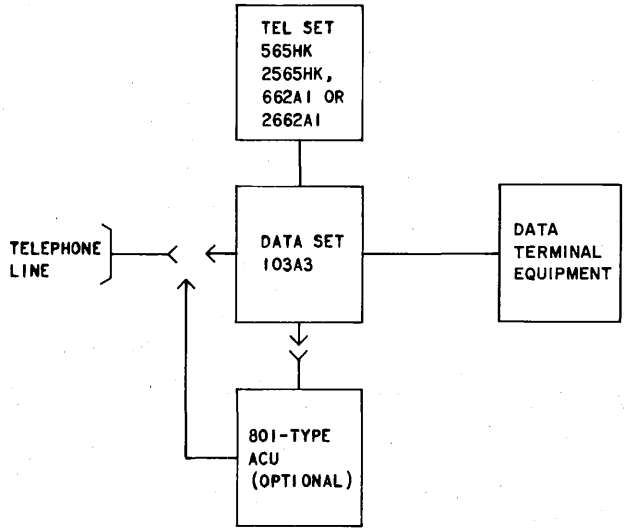


Fig. 1—Block Diagram of Data Station Arrangement

mode when the TALK key is operated and the handset is lifted to originate a call.)

(g) Data set 103A3 ring detector does not cause pretrip of ringing on some circuits (eg, PBX 756A 2-way trunk circuit). (Data set 103A2 can cause the above to occur.)

(h) Data set 103A3 automatically sends a long space disconnect signal when manually cleared. (Data set 103A2 does not.)

(i) Data set 103A3 has the option to disconnect in response to a long space (1.5 seconds) or to a short space (0.4 second). (Data set 103A2 has only the long timing.)

(j) ▶Data set 103A3 has a ring detector which is sensitive to low level signals that can occur on long unigauge loops. (Feature not available in a 103A3, series 1, unless CJ14 CP is used.)

(k) Data set 103A3, series 2, has a CC interface circuit which can be optioned by the installer to meet EIA RS-232-C Standard.◀

2. PHYSICAL DESCRIPTION

2.01 Data set 103A3 consists of a data set 103E5 ▶or 103E6◀ (data modem) mounted in a 38A1 data mounting. Other data set 103E-type data modems may be used for different requirements

as listed in Table B. ▶The mounting uses a two-tone gray plastic housing identical to the one used by data set 103A2.

2.02 Data set 103A3 is approximately 11 inches wide, 10-1/4 inches deep, 5-1/2 inches high, and weighs approximately 13 pounds.◀

3. FUNCTIONAL DESCRIPTION

3.01 The data set 103A3 accepts EIA voltage signals on the BA lead from the terminal and converts them to voice frequency tones for transmission over the DDD network. Received data in the form of voice frequency tones is converted to EIA voltage signals by data set 103A3 and delivered on the BB lead to the terminal equipment.

3.02 Data set 103A3 is designed to operate in two bands, designated f_1 and f_2, within the voice frequency band. When the data set originates a call, the transmit frequency band is f_1 and the receive frequency band is f_2. When the data set answers an incoming call, the f_2 band is the transmit frequency band and the f_1 band is the receive frequency band. Data set 103A3 transmit and receive frequencies are shown, by mode of operation, in Table C.

TABLE C

DATA SET 103A3 FREQUENCIES

MODE	FREQ BAND	FREQ IN HZ	
		MARK	SPACE
Originate	TRMT f_1	1270	1070
	RCV f_2	2225	2025
Answer	TRMT f_2	2225	2025
	RCV f_1	1270	1070

3.03 Data set 103A3 operates with any one of the four telephone sets listed in Table D. The telephone set must be ordered separately.

3.04 When an automatic calling unit (ACU) is required, an 801-type may be used. The designations, names, and functions of the ACU leads are given in Table E.

TABLE D

TELEPHONE SETS FOR USE WITH DATA SET 103A3

TEL SET CODE (BSP)	TYPE OF DIAL	EQUIPPED WITH CARD DIALER
565HK (502-541-415)	Rotary	No
2565HK (502-543-405)	Touch-Tone®	No
662A1* (502-617-402)	Rotary	Yes
2662A1 (502-619-402)	Touch-Tone	Yes

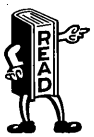
* When 662A1 telephone set is used, a 2012B transformer is required (not part of telephone set — must be ordered as a separate item).

4. OPERATION

A. Telephone Set Key Functions

4.01 The telephone set is used for call origination and voice communication. Six keys on the telephone set are provided to enable the attendant to control the data set. The six keys are MANUAL ANS, AUTO ANS, TEST, CLEAR-TALK, DATA, and a spare. The spare key is to be used when a ground-start ACU is connected to the data set. The key will then be labeled DIAL TONE.

4.02 The MANUAL ANS key is a locking, releasing key (without lamp) used to inhibit the abort timer in the data set and to release the AUTO ANS key. ▶The MANUAL ANS key must be operated prior to placing the data set in the test mode.



If the MANUAL ANS key is not operated, the data set will release the line connection before a complete test can be made.◀

TABLE E

ACU INTERFACE LEADS

LEAD AND FUNCTION		DESIG
Data Tip	— To extend the tip side of the transmission facility through the ACU to the data set	DT
Data Ring	— To extend the ring side of the transmission facility through the ACU to the data set	DR
—	— To provide an alternate path for extension of the ring side of the telephone (Used only during automatic call origination)	"3"
Data Mode	— Signal flow from the data set to ACU informs ACU that the data set is in the data mode (Automatic call origination inhibited)	C
Talk Mode	— Signal flow from data set to ACU informs ACU, if C is OFF, that the attendant wishes to originate a call. If C is ON, the ACU is informed that a data-to-talk mode transfer has occurred and automatic call origination is inhibited	TK
Circuit Ground	— To provide a common ground reference for the data set and the ACU	G
—	— Signal flow from ACU to data set places the data set off-hook when a call is originated automatically	D1
—	— Signal flow from ACU to data set to clear data set from data mode when ACU terminates data call	SH2

4.03 The AUTO ANS key is a locking, releasing key. Operation of the key conditions the data set for automatic answering of incoming calls and lights the AUTO ANS lamp.

4.04 The TEST key is a nonlocking, nonreleasing key used to place the data set in the test mode to allow remote testing. The TEST lamp indicates to the attendant that the data set is in the test mode. The data set will automatically disconnect from the test mode upon completion of the test call. However, if the test mode is entered inadvertently, it may be cleared by operation of the CLEAR-TALK key.

4.05 The CLEAR-TALK key is a nonlocking, nonreleasing key. Operation of the CLEAR-TALK key when the handset is off-hook will transfer the data set from the data mode to the talk mode. Operation of the CLEAR-TALK key when the handset is on-hook will disconnect (clear) the data set from the transmission facility and return it to idle. The CLEAR-TALK lamp will be lighted by the data set whenever the data set is going through the 3-second disconnect sequence.

4.06 The DATA key is a nonlocking, nonreleasing key. Operation of the DATA key will connect data set 103A3 across the transmission facility (data set off-hook) and light the DATA lamp to indicate to the attendant that the data set is off-hook.

Either the AUTO ANS or MANUAL ANS key must be operated at all times. It is not acceptable to have both keys released.

4.07 The spare key is a nonlocking, releasing key which is blocked to prevent accidental release of the AUTO ANS key. If the data set is connected to a telephone line arranged for ground-start operation, the blocking ring is to be removed and the key labeled DIAL TONE. In this case, operation of the key will place a ground on the ring side of

the telephone line which is the required signal for obtaining dial tone on ground-start lines. If an ACU is used with the data set, dial tone will be obtained automatically and the key need not be used unless the ACU becomes inoperative.

4.08 When the data set is in the idle mode or without ac power, the telephone set can be used as a standard telephone, with the following exceptions:

- When the telephone set is a 662A1 set, loss of ac power will inhibit the card dialer.
- When an ACU uses a ground-start transmission facility, the loss of ac power to the ACU will prevent the ACU from obtaining dial tone.

4.09 When the data set is in the data mode, the data set disables both the handset and the dial. This prevents interference with data transmission if an attempt is made to use either the dial or handset. Operation of the CLEAR-TALK key will signal the data set to relinquish control of the transmission facility.

4.10 Various features, controls, and operations are optional and are listed in Table F.

B. Manual Origination of Calls

4.11 Manual origination of calls is performed in the same manner as for any normal telephone call. If the distant end answers automatically, operation of the DATA key at the originating end will switch the data set to the data mode. However, if the distant end answers manually, operation of the DATA key at both ends is necessary to switch the data sets to the data mode. In either case the handshaking sequence will now be performed and the data connection established for data transmission.

C. Automatic Answering

4.12 In order for a station to answer a call automatically, the following conditions must exist:

- The AUTO ANS key on the telephone set must be operated.
- The CD lead must be on.

When these conditions exist, the answering station will detect ringing, go off-hook, and will be in the answer mode of operation.

D. Disconnecting

4.13 Reception of a timed spacing signal, loss of carrier, turning off the CD interface lead, or operation of the CLEAR-TALK key will return the data set to the on-hook (idle) condition.

4.14 Three options (Table F) are available for the timed space disconnect feature:

- No space disconnect
- Short space disconnect
- Long space disconnect.

With no space disconnect option provided, the data set will not disconnect when receiving a spacing signal of any duration. The short space disconnect option will cause the data set to disconnect after 400 milliseconds of spacing signal. The long space disconnect option will cause the data set to disconnect after 1.5 seconds of spacing signal.

4.15 The loss of carrier option will cause the data set to disconnect whenever carrier is removed for a period of time, which is determined by a timer. This period is nominally 200 milliseconds. However, due to timer tolerances, the length of time the carrier is lost before disconnect occurs can be as short as 100 milliseconds. In those marginal cases where carrier is going on and off randomly, disconnect will occur on an individual loss of carrier less than 100 milliseconds in duration. When a loss of carrier disconnect occurs, the data set always sends 3 seconds of spacing signal, thereby causing the other stations, if equipped with the short or long space disconnect option, to space disconnect.

4.16 Transfer from the data mode to the talk mode at data stations equipped with the loss of carrier or space disconnect feature can result in an unwanted loss of the telephone line connection. When the distant station transfers to the talk mode, it may send 3 seconds of space signal before removal of carrier from the line. If the data set 103A3 is equipped with either space disconnect or loss of carrier disconnect option, the data set will return to the idle mode when the distant station

TABLE F

DATA SET 103A3 CONTROL OPTIONS

OPTION	NAME	FEATURE PROVIDED
X	CE ON	CE lead of answering station will remain on after ringing is removed. (Informs data terminal that station is answering, not originating a call)
W	CE OFF	CE lead is turned on only while ringing is present
V	Long Space Disconnect	Receipt of 1.5 seconds of continuous spacing signal will disconnect data set
H	Short Space Disconnect	Same as option V except timing interval is 400 milliseconds
T	Send Disconnect	Data set transmits 3 seconds of spacing signal during disconnect sequence initiated by turning off CD control lead
S	Loss of Carrier Disconnect	Data set disconnects upon loss of carrier
G	Originate - Only Test	Allows entrance to test mode from talk mode (originate - only stations)
Q	Common Grounds	Connects signal and frame grounds together
N	Without Answer/ Originate Transfer	Always provide option N
M	Answer Control Combined	Always provide option M
Y*	Normal Frequencies	Data set uses frequencies specified in Table C
Z*	Inverted Frequencies	Mark and space frequencies are interchanged
B	Separate Carrier — Detected, Clear-to-Send Indication	CB and CF interface leads are independent
A	Common Carrier Detected, Clear-to-Send Indications	CB and CF interface leads are dependent (turn off and on together)
ZD†	CC Indication Early	CC interface lead conforms to EIA RS-232-B when this option is provided. When the option is not provided, the interface lead conforms to EIA RS-232-C

* Not optional in data set 103A3 — NORMAL FREQUENCIES are always provided. Data set 103A3 must be modified by replacing data set 103E5 or 103E6 with either data set 103E2 or data set 103E4 in order to obtain the optional feature, INVERTED FREQUENCIES.

† Not optional in data set 103A3 series 1 — CC Indication Early is always provided.

transfers to the talk mode. Therefore, the telephone set at the data set 103A3 should be preconditioned to hold the line before the distant station makes the transfer between modes. The preconditioning is accomplished without interference to the transmission of data by lifting the handset of the telephone connected to data set 103A3.

4.17 When the data-terminal-ready interface lead (CD) is turned off, a data terminal disconnect will occur and, if the send disconnect option is provided, the CLEAR-TALK lamp will light. The CD lead must be turned off for at least 50 milliseconds in order to ensure proper disconnect. The data set disconnect will occur in either of two ways. If the send disconnect option is not provided, the data set will disconnect immediately. If the send disconnect option is provided, the data set will send 3 seconds of spacing signal before disconnecting. The send disconnect option is controlled by an installer screw switch.

4.18 Manual disconnect can be achieved by operation of the CLEAR-TALK key. If the data set is not in the data mode, it will go on-hook immediately. However, if the data set is in the data mode, operation of the CLEAR-TALK key will cause the CLEAR-TALK lamp to light and a spacing signal to be sent for 3 seconds before disconnect occurs.

E. Test Mode

4.19 When the data set is in the test mode, the transmitted data lead (BA) is looped around to the received data lead (BB) and all of the other terminal interface leads except for CE are turned off. In this condition, most of the data set circuitry can be tested from a 904-type data test center (DTC).

4.20 There are two methods of entering the test mode. One method is used for data sets serving outgoing-only lines (ie, WATS service) and the other for data sets which are used for both originating and answering data calls. The method to be used by a particular data set is selected on installation of the data set by means of a screw switch option (see Table F).

4.21 In order to place a data set serving outgoing-only lines in the test mode, a call must be placed to the DTC. At the request of the DTC, the attendant must ▶operate the MANUAL ANS key, then◀ operate the TEST key. This will place the data set in the test mode as an originating station. After the test is complete, the DTC will return the data set to the on-hook condition. Operation of the CLEAR-TALK key will also return the data set to the on-hook condition.

4.22 In order to place a data set used to originate and answer data calls into the test mode, the MANUAL ANS key must be operated. The DTC will call the data set to be tested. When ringing is received, the TEST key must be operated until the TEST lamp lights. The DTC can now perform the required tests. When the tests are complete, the data set is returned to the on-hook condition by loss of carrier or operation of the CLEAR-TALK key.

▶If the MANUAL ANS key is not operated when the data set is in the test mode, the set will release the line before the test center can complete its tests.◀

5. REFERENCES

5.01 The following schematic drawings, circuit descriptions, and BSPs provide additional information on data set 103A3, its component parts, and key telephone sets that may be used with data set 103A3.

NUMBER	TITLE
SD- & CD-1D147-01	Data Sets 103E5, 103E6 Transmitter—Receiver Circuit
SD- & CD-1D245-01	Data Set 103A3

SECTION	TITLE
502-541-415	Service—565HK Telephone Sets
502-543-405	Service—2565HK Telephone Sets
502-617-402	Service—662-Type Telephone Sets
502-619-402	Service—2662-Type Telephone Sets
591-025-100	Data Set 103E-Type—Identification