

DATA SET 101C

IDENTIFICATION AND OPERATION

1. INTRODUCTION

1.01 This section is reissued to provide additional descriptive information for the data set 101C, change Tables A and B, and add block diagram, Fig. 1. It will also include operation of the data set as well as key and lamp functions of the associated attendant set. Due to extensive changes marginal arrows have been omitted.

1.02 Data set 101C is used with WADS C and 4-row, 100-speed TWX service.

1.03 The appropriate sections covering teletypewriters (TTY) should be consulted for information concerning the 33- and 35-type TTYS referred to in this section.

1.04 Tables A and B contain features and component parts of data sets 101A, 101B, and 101C. A general description of data sets 101A and 101B is covered in Section 591-012-100.

TABLE A

COMPARISON OF DATA SETS 101A, 101B, and 101C

Electronic Plug-in Units (Cards)		
101A	101B	101C
MODULATOR	MODULATOR	MODULATOR
HYBRID	HYBRID	HYBRID
LIMITER	LIMITER	LIMITER
DISCRIMINATOR	DISCRIMINATOR	DISCRIMINATOR
KEYER	KEYER	RESTRAINER
TIMER	TIMER	TIMER
ANSWER-BACK	ANSWER-BACK	SEND BREAK TIMER
Relays		
AN	AN	AN
CON	CON	CON
M	M	M
OR	OR	OR
S	S	S
RU	RU	RU
CY	CY	CY
-	RB (Equipped Not Used)	RB
-	-	RS (On Restrainer)
Terminal Strip D76 to D85 Wires and Cabling		
Not Equipped*	Equipped (Not Used)	Equipped

*Was equipped with K option on 101A.

TABLE B
FEATURES OF TELETYPEWRITER SERVICE USING DATA SETS
101A, 101B, AND 101C

Station Components	TWX					WADS		DLSTTS*
Teletypewriter	M15	M19	M28	M33	M35	M33	M35	M28
Keyboard	3 Row	3 Row	3 Row	4 Row	4 Row	4 Row	4 Row	3 Row
Speed	60	60	60	100	100	100	100	60/100
Code Levels	5	5	5	8	8	8	8	5
Service	TWX	TWX	TWX	TWX	TWX	WADS C	WADS C	WADS B
Data Set	101A or 101B	101A or 101B	101A or 101B	101C or 105A	101C or 105A	101C or 105A	101C or 105A	101A or 101B
Subscriber Set	691A	691A	689A	Part of Teletypewriter SD-3D009-01				689B

* Developmental line switching teletypewriter service.

2. GENERAL

2.01 Data set 101C is intended for WADS C and 4-row TWX service. The station associated with data set 101C will consist of an attendant set (built into TTY) and 100-speed, 4-row, 8-level, 33- or 35-type TTY equipment.

2.02 The data set 101A was developed primarily for use with TWX 60-speed, 3-row service. The station consists of the data set, a subscriber set (689- or 691-type), and 60-speed, 5-level TTY equipment such as 15-, 19-, or 28-type.

2.03 The data set 101B was developed to provide a set which would function in exactly the same manner and provide the same terminals as the data set 101A, but which could be readily converted into a data set 101C when required. For this purpose, relay RB is provided but not utilized in data set 101B. Terminal strip D76 to D85 is also provided, together with wires and cabling preparatory to its use after conversion to data set 101C.

2.04 Data set 101C contains seven cards. Five are identical to those in the data set 101B, namely, the DISCRIMINATOR, MODULATOR, HYBRID, LIMITER, and TIMER cards. Two of the 101B cards have no application in data set 101C: the ANSWER-BACK and the KEYSER cards. Two new cards are required and fit in the

equivalent slots of the last two mentioned cards: the SEND BREAK TIMER and RESTRAINER cards. Data sets 101B and 101C are also equipped with a receive-break relay RB and an additional terminal strip numbered D76 through D85.

2.05 Certain components, eg, capacitor C2 and receptacle T, which are no longer required may still be present in data set 101C if the set is derived by conversion from a data set 101B. Data sets manufactured as data set 101C will not have these components.

2.06 The 33- and 35-type TTY equipment required for WADS C and 4-row TWX service is listed below.

- (a) Keyboard Send and Receive (33KSR and 35KSR)
- (b) Automatic Send and Receive (33ASR and 35ASR)
- (c) Receive Only (33RO and 35RO)
- (d) Receiving Only Typing Reperforator (35ROTR)
- (e) Receiving Only Nontyping Reperforator (35RONTR)

2.07 All 4-row TWX and WADS stations operate at 100-wpm. As is the case

in 3-row TWX service, the alphabet characters are printed only in capital letters. Although an 8-bit code is used for transmitting the various characters and control codes, only seven of the bits contain the intelligence; the eighth bit is absorbed by the equipment. An 8-bit code was selected for this service in order to permit regular TTY equipment to send and receive any of the 8-hole punched paper tapes used by office machines and computers.

2.08 Start-stop operation is provided by the use of a single bit start element and a double bit stop element; thus, 11 bits are transmitted for each character. The equipment operates at 110 bits (ten characters) per second.

2.09 The block diagram of a typical 4-row TWX or WADS C station is shown in Fig. 1. It consists of 33- or 35-type teletypewriter equipment, a built-in attendant set, and a data set 101C. The attendant set provides the keys, lamps, ringer, dial, speaker, and optional handset for operating the station. The data set converts the dc teletypewriter signals to voice-frequency signals for transmission over telephone facilities.

2.10 The features available with 4-row TWX station arrangements and WADS C station arrangements are for all practical purposes the same. The main difference is that all WADS stations use pushbutton calling whereas 4-row TWX

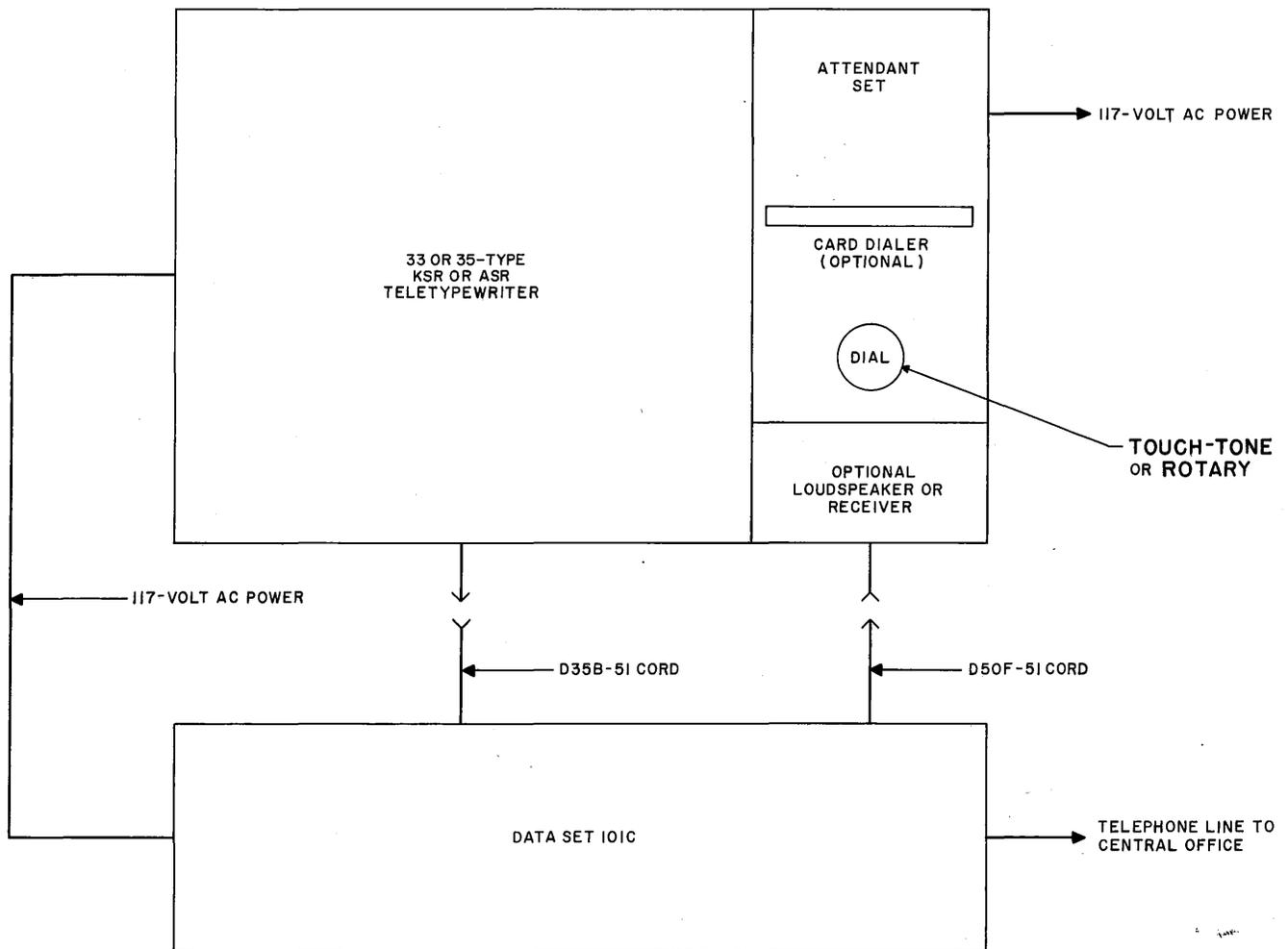


Fig. 1 - Block Diagram of Typical 4-Row TWX or WADS C Station

stations normally use a regular rotary dial. Pushbutton calling, ie, TOUCH-TONE operation, is available on 4-row TWX stations on an optional basis. Only originate-terminate station arrangements are offered. Although 4-row TWX stations are capable of receiving calls automatically, an attendant must be present when the station is sending traffic.

2.11 The principal features provided by WADS C and 4-row TWX are listed below:

- Transmission from 4-row keyboards and 8-level transmitter-distributors (TDs).
- Drum answer-back is standard equipment.
- Connect and disconnect time reduced by data set timing.
- Fast disconnect without a "hit" character by the transmission of an "end of transmission" character.
- Electronic break detection and a break indicating lamp.
- Loudspeakers and TOUCH-TONE dialers are standard equipment. (TOUCH-TONE dialers are optional on 4-row TWX service.)
- Added control keys (in attendant circuit).
 - (a) Nonlocking lighted break release (BRK-RLS) key, whose lamp indicates the reception of a break signal.
 - (b) Locking lighted buzzer release (BUZ-RLS) key which silences an alarm buzzer in the TTY and whose lamp indicates the buzzer has been silenced.
- Station can be placed in a "don't answer" mode by external switches such as the "low paper" switch of the TTY.
- Station can be made or held busy by external switches such as the "out-of-service" switch.

- Data set provides proper outputs to activate the mode switching circuits of its associated TTY.

3. DESCRIPTION

3.01 The attendant sets used with 4-row TWX and WADS stations are built into the cabinet of the TTY equipment. Their purpose is to provide the attendant with a means to dial, to monitor the progress of a call, and to house control keys.

3.02 The following keys and lamps are provided with 4-row TWX and WADS C stations.

(a) Originate Key (ORIG): This key is used to originate a call. Depressing this key causes the lamp in the key to light, the data set to go off-hook, and the send and receive circuitry in the data set to go into the originate mode; that is, to receive signals in the f_2 band (2025 or 2225 cycles per second) and to send signals in the f_1 band (1070 or 1270 cycles per second.)

(b) Clear Key (CLR): This key is operated by the attendant to restore the station to normal from any other mode. The lamp in the CLR key enclosure lights during the disconnect cycle, whether the station is disconnected automatically or by depressing the CLR key.

(c) Answer Key (ANS): The answer key is used to answer an incoming call when the station is in the local mode. Depressing the ANS key lights the ANS lamp and puts the data set in the terminating mode; that is, it sends signals in f_2 band and receives signals in the f_1 band.

(d) Test Key (TST): This key is operated when it is desired to connect the dc output of the data set to the dc input of the data set for maintenance reasons. The lamp in the key housing lights when the key is depressed.

(e) Local Key (LCL): Depressing this key lights the lamp in the key enclosure and permits the typing unit to be driven from the keyboard without the

data set going off-hook. This mode is used by the attendant to practice or to punch tape with local copy. Incoming calls will not be answered automatically, but the ringing indication will be present.

(f) Buzzer Release (BUZ-RLS): This key is used to silence the audible alarm resulting from a low-paper or paper-out condition. The lamp in the buzzer release key remains lit as long as the key is depressed or the paper alarm condition exists.

(g) Out-of-Service Key (OUT-OF-SVC): The OUT-OF-SVC key is used whenever it is necessary to take a station out of service. When this key is operated to its locking position the OUT-OF-SVC lamp is lit, the station is put in a don't answer mode, and the ringer is disconnected, although the ANS lamp can flash when ringing is applied to the line. To restore a station to service, it is only necessary to return this key to its NORMAL position unless the station is in a terminal hunting group. In this case, the key should be operated to the RESTORE position long enough to hear dial tone; the key will automatically return to the NORMAL position when it is released. When the key is in RESTORE the ORIG lamp lights.

(h) Break Release Key (BRK-RLS): This key is used to unblind the data set signal input previously blinded by the receipt of a break signal from the distant station. The lamp in the BRK-RLS key lights when a break signal is detected and remains lit until the BRK-RLS key is depressed.

(i) Restrain Lamp (REST): A high intensity lamp (REST) lights when a restraining signal is received from a 4-row to 3-row converter used in transmission to 3-row TWX stations on the DDD switching plan. The lamp remains lit until the restraining signal is removed. The purpose of this feature is to limit the sending speed from 4-row machines transmitting at 100 wpm to 3-row machines receiving at 60 wpm.

3.03 The keys and lamps provided for WADS receive-only stations are the same as those provided for WADS C stations except that the BRK-RLS key and lamp and the REST lamp are omitted and the LCL key is disabled. The ORIG key is used for maintenance purposes only.

3.04 WADS RO stations do not have a keyboard, and therefore are not capable of transmitting a message.

3.05 In all other respects WADS RO stations have the same features as are available with WADS C station arrangements. A loudspeaker is not provided with RO stations. However, a handset is provided for use with OUT-OF-SVC key. The handset is required in this case because it is necessary to monitor for dial tone when the station is restored to service. See discussion under Out-of-Service Key in 3.02.

Restrainer

3.06 The restraint signal is generated and transmitted by the central office data converter. This signal is a frequency-shifted tone keyed at a 50-cycle per second rate between a steady marking tone and 50 cycles below the marking tone. Therefore, the restraint signal will be one of two frequencies depending upon whether the 100-wpm machine is the originating or terminating station. These frequencies are either the f_{1m} or f_{2m} signal warbled by 50 cycles, eg, 1270 to 1220 cps or 2225 to 2175 cps.

3.07 The restrainer circuit in data set 101C recognizes the restraint signal and causes the following actions to be taken during the period when the signal is being received.

- (1) Lights the REST lamp. (This informs the attendant to decrease typing speed.)
- (2) Causes TD to stop. When restrainer signal ceases, the TD will automatically restart.
- (3) The CO data converter interrupts restrainer signal by transmitting a break signal when the number of charac-

ters in storage reaches 17. Receipt of the break signal locks REST lamp in the ON condition as an indication that a break signal was transmitted to avoid overflow of the data converter storage. In this case, the REST lamp will remain ON until the BRK-RLS key is operated.

(4) A disconnect signal is transmitted if the number of characters in the data converter storage unit reaches 20. A disconnect signal will return all elements of the data set to on-hook condition and thus the REST lamp will be extinguished. When this condition occurs the call will have to be re-initiated.

4. OPERATION

Originating Calls

4.01 To initiate a call, the attendant operates ORIG (originate) key on the attendant circuit. Operation of this key turns on the TTY motor and presents an off-hook signal to the central office. The switching equipment will return dial tone as in the case of a normal telephone call. The attendant circuit has a loudspeaker so that dial tone can be heard. On hearing dial tone, the attendant dials the number of the station to be reached as if this were an ordinary telephone call. The central office equipment is arranged to recognize whether or not the called station is another 4-row station. If it is a 4-row station, the connection will be established directly. If the called number is a 3-row station, the call is routed via a data converter. The originating attendant is able to monitor the progress of the call by listening to call progress tones from the loudspeaker.

4.02 Most attempts to reach the answering station will be automatically answered at the first ring; therefore, the ringback tone may not be heard by the originator. If there is a delay in answering, ringback tone will be heard. If all trunks are busy or the station is busy, appropriate tones will be heard. The call may then be re-originated at some suitable time.

Answering

4.03 When a station that is ready to accept a call is rung, it will automatically answer by turning on its TTY motor and by going off-hook. This will cause the answering station to send an off-hook signal to its serving central office and trip ringing. This off-hook signal is sent back to the originating station's serving office for charge and record purposes.

4.04 If the TTY of the called station is not ready to accept a call or if the LCL key in the attendant circuit is depressed, the automatic answering device is disabled; however, the ringer of the attendant circuit will sound unless the OUT-OF-SVC key is operated.

4.05 It is possible to override the "don't answer" condition at a station by depressing the ANS (answer) key.

Connecting

4.06 When the answering station goes off-hook, a timing interval of approximately 1.4 seconds is generated. No tone is transmitted from the answering station during this interval. This interval is called the single frequency guard interval. Timing is required to guarantee the propagation of the off-hook signal from the answering to the originating office.

4.07 F_{2m} is transmitted from the answering station at the end of the 1.4-second timing interval. The originating station is tuned to recognize the f_2 frequency band. However, no action is taken until the f_{2m} signal has persisted for about 1/2 second. This mark timing interval allows sufficient time for the echo suppressors to be disabled and also to guard against signal initiation by noise. At the end of the mark timing interval, the originating station connects its demodulator output through to the TTY receiver.

4.08 The originating station transmits f_{1m} frequency to the answering station where the demodulator is tuned to the

f_1 band. Frequency f_{1m} is received and timed at the answering station. At the end of about 1/4 second, the demodulator is connected through to the TTY receiver. The data set at the answering station then triggers a device in the TTY which sends an answer-back by generating one or more selected characters. Operation of either TTY keyboard or tape transmitter will cause sending contacts to modulate one of the data transmission channels.

Breaking

4.09 Either station can interrupt the transmission by depressing the BREAK key on the TTY. This causes the transmission of a spacing signal of a fixed duration, regardless of the length of time the key is depressed. This interval (approximately 200 msec) is long enough to enable the other end to identify the signal as a break and not a TTY character and is short enough not to cause a disconnection.

Disconnection

4.10 Either of the two connected stations can initiate a disconnect sequence. The normal method consists of transmission

of the EOT (end of transmission) TTY character. This closes a contact in the stunt boxes of both sending and receiving TTY. Each station then times an interval of about 50 msec during which it sends its marking frequency, after which the station restores to its normal on-hook condition. The timed marking interval prevents a hit character from being printed at the other end due to the possible difference in operating times of the circuits. However, this means of disconnecting two stations cannot be used if call has been placed through the TWX assistance operator.

4.11 An alternate way to disconnect consists of the depression of the CLR key at either station. The station will then transmit a three-quarter second burst of spacing carrier to the distant station and cause both stations to go on-hook. However, a hit character may be printed at the distant station during the disconnect sequence. If this method is used and either station is equipped with a data set 105A and a D-controller, it will signal an alarm.