DATA SET 202A

DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section contains information concerning the description and operation of Data Set (DS) 202A. This practice does not contain information concerning the business machine associated with the data set.

1.02 This section is reissued to update and add information on the description and operation of DS 202A and to add information concerning the power output level of the data set at the serving central office. Due to extensive revision, change arrows, ordinarily used to indicate changes, have been omitted.

1.03 Data Set 202A is an integrated unit, combining a transmitter and receiver with a 6-button telephone set in one 2-tone gray housing.

1.04 Data Set 202A is a nonsynchronous medium-speed device operating at speeds up to 1800 bits per second (bps). It accepts serial binary data from a business machine in the form of positive and negative dc voltage signals. The data set converts the signals to voice frequency tones which are transmitted over telephone facilities. At the distant data set, the tones are received, converted back to dc form, and delivered to the business machine.

1.05 Data Set 202A can be used in one-way or 2-way nonsimultaneous transmission on a 2-wire basis only. When used on the switched network, the maximum bit rate is 1200 bps. In private line service over properly conditioned facilities, the maximum rate is 1800 bps.

2. PHYSICAL DESCRIPTION

2.01 The dimensions of the data set are shown in Fig. 1. The data set weighs approximately 15 pounds, consumes approximately 7 watts of ac power, and will operate satisfactorily over a temperature range of +40 to +120°F and a relative humidity range of 20 to 95 percent.

2.02 Data Set 202A consists of a 6-button key unit, a telephone handset, a dial, an FM modulator and demodulator with a line coil for a 2-wire telephone line, a power supply, a remote test circuit, and an unattended answering circuit. Figures 2 and 3 show the location of terminal boards and miscellaneous parts. The power supply fuses are located under the power supply cover (Fig. 2).

2.03 The 6-button 589 key unit mounted on the front of the set has the following functions:

(a) Keys one and two are pickup keys for additional lines (telephone, not data) and are also convertible to signal keys if desired.

(b) Key three can be used as either an automatic answer key (Z option) or in the same manner as keys one and two (Y option).

Note: The pickup keys are independent of the data circuit and can be used while the set is in the data mode. The associated lamps, if used, must obtain power from an external source, ie, 1A or 1A1 line unit. The set comes equipped with 52A lamps, and it may be necessary to replace the lamps to conform to the key telephone system power supply. The 52A lamps have a rating of 24 volts and are intended for use with 700- and 701-type keys.

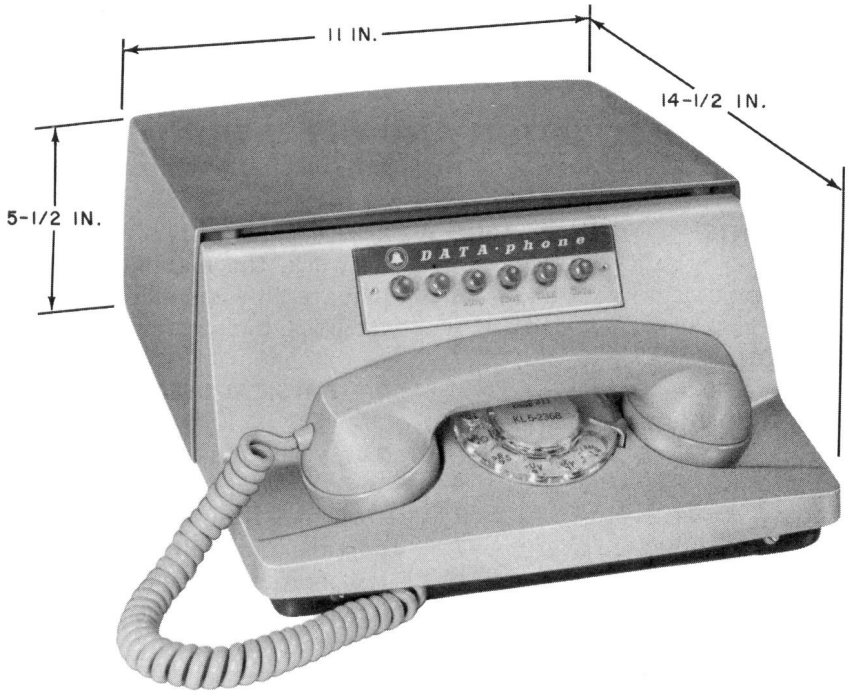


Fig. 1—Data Set 202A

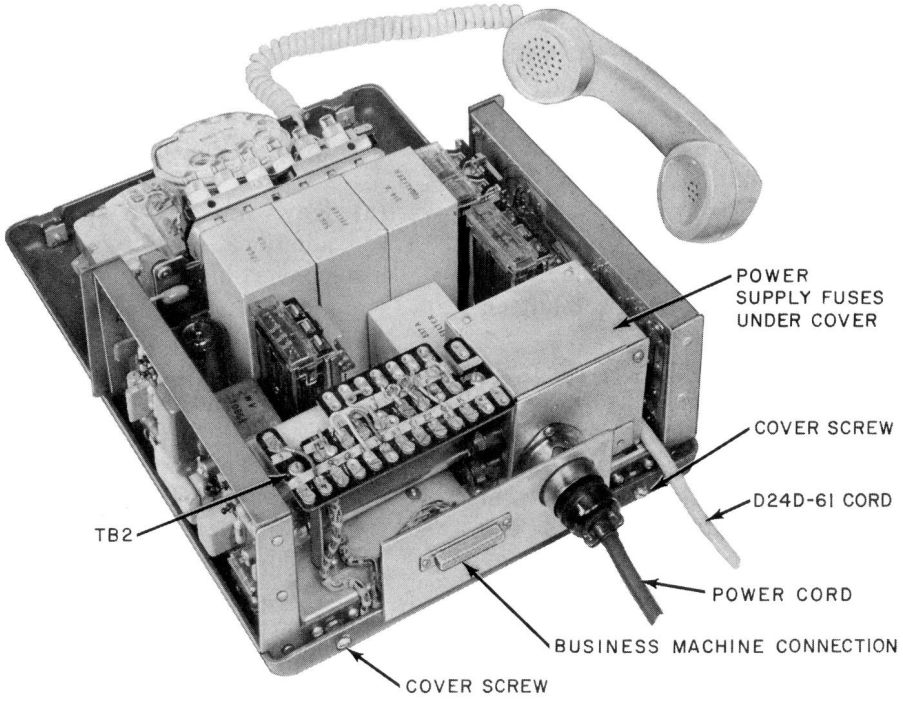


Fig. 2—Data Set 202A, Rear View—Covers Removed

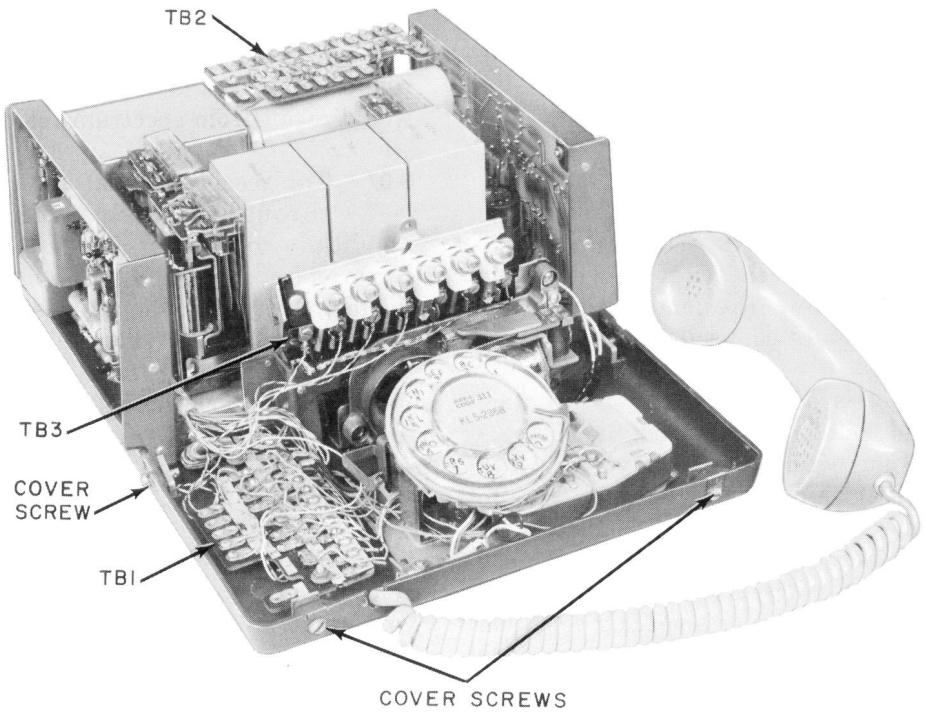


Fig. 3—Data Set 202A, Front View—Covers Removed

(c) Key four, nonlocking, is used as a TEST key for testing the data set through the data test center or a remote testing station.

(d) Key five is the TALK key associated with the data line.

(e) Key six, nonlocking, is the DATA key, used to change from the talk to data mode of operation. This key will also release any depressed key.

2.04 The customer must provide a 105- to 120-volt, 60 ($\pm$ 15) Hz source not under switch control and on the same ac circuit which serves the associated business machine (to minimize noise-causing impulse potentials by using the same ground bus). The data set power supply provides an unregulated dc output of $\pm$17.5 $\pm$2.5 volts capable of supplying the current necessary for operation of transistor circuitry and relays. An adjustment tap is available on the transformer winding for increasing the ac voltage on the transformer secondary at installations which might have exceptionally low voltage on the ac power line.

2.05 For data set cover removal and replacement, see the section entitled Data Set 202A, Maintenance (592-013-300).

2.06 Level requirements on the switched network require that the power level at the central office be -12 dBm or lower. If the output level of the data set minus the loop loss is greater than -12 dBm, the installation may require an external pad. The value of the external pad will depend on the data set output and the amount of loop loss. If the -12 dBm output (options L, M) is available and strapped in the data set, an external pad is not required. See the section entitled Data Set 202A, Installation and Connections (592-013-200) for information concerning the external pad.

2.07 Two cords are supplied with the data set:

- A 10-foot 3-conductor power cord, KS-14532-L15, equipped with a Hubbell Co. No. 7484 receptacle
- A 5-foot 6-inch D24D-61 telephone line cord.

2.08 The cord connecting the business machine to the data set is supplied by the customer. The connector for this interface is located at the rear of the data set (Fig. 2).

3. FUNCTIONAL DESCRIPTION

3.01 Figure 4 shows a functional block diagram of DS 202A. This diagram shows the functional relationship of the circuits within the data set. Table A shows the lead designations for the customer interface connections.

3.02 The data set is designed to receive contact closure and voltage signals from the business machine. A closure between ready (RY) and remote control (RC) or a closure between remote control (RC) and remote release (RR) indicates an ***on*** condition. Other signals from the business machine are voltage signals between +5 and +25 volts to indicate either an ***on*** or a spacing condition and −5 and −25 volts to indicate either an ***off*** or a marking condition.

3.03 The transmitter and receiver use voltage control of a multivibrator frequency at the transmitter and zero crossing detection at the receiver. The control circuitry is composed mostly of relays. The data set operates on plus and minus dc voltages derived from the power supply.

3.04 The modulator circuit converts the customer's data signals into a frequency-modulated signal suitable for transmission over the voice network. It responds to two distinct signals from the customer's data equipment: request to send and send data. It provides a clear-to-send signal to the customer's equipment. An ***off*** signal from the customer's equipment on the request-to-send lead keeps carrier off and gives an ***off*** signal on the clear-to-send lead. An ***on*** request-to-send signal starts carrier and causes the clear-to-send circuit in the data set to generate an ***on*** signal.

3.05 The transmitted frequencies are generated by a free-running multivibrator which has an output frequency proportional to a reference voltage. The reference voltage is applied from the mark-space control through a pulse-shaping network. The mark-space control is a precision voltage divider having an output voltage dependent on the mark or space condition of the send data lead. The mark and space frequencies are 1200 $\pm$12 and 2200 $\pm$22 Hz, respectively.

3.06 The pulse-shaping network slows down mark-to-space and space-to-mark transitions, forcing the transitions to be symmetrical and reducing unwanted frequency components which would result from spectrum foldover.

3.07 The received signal enters the demodulator through a bandpass filter. Delay and amplitude distortion are reduced by means of compromise delay and amplitude equalization. A limiter squares up the signals and zero crossings are marked by differentiation of the limited signal. A full-wave rectifier gives a train of pulses used to trigger a monopulser which generates an accurately timed pulse for each triggering pulse.

3.08 One side of the monopulser output goes to the clamp and carrier on-off. When a signal is present, the clamp on the receiver output is removed after a 50 $\pm$10 millisecond delay, and an ***on*** output is passed to the business machine over the carrier on-off lead.

3.09 The signal on the other side of the monopulser passes through a low-pass filter which integrates the pulses giving a more positive voltage output for mark than for space. The slicing-amplifier level is set by precision resistors to distinguish between mark and space voltages. The resulting data signals are then delivered to the customer's equipment over the receive data lead.

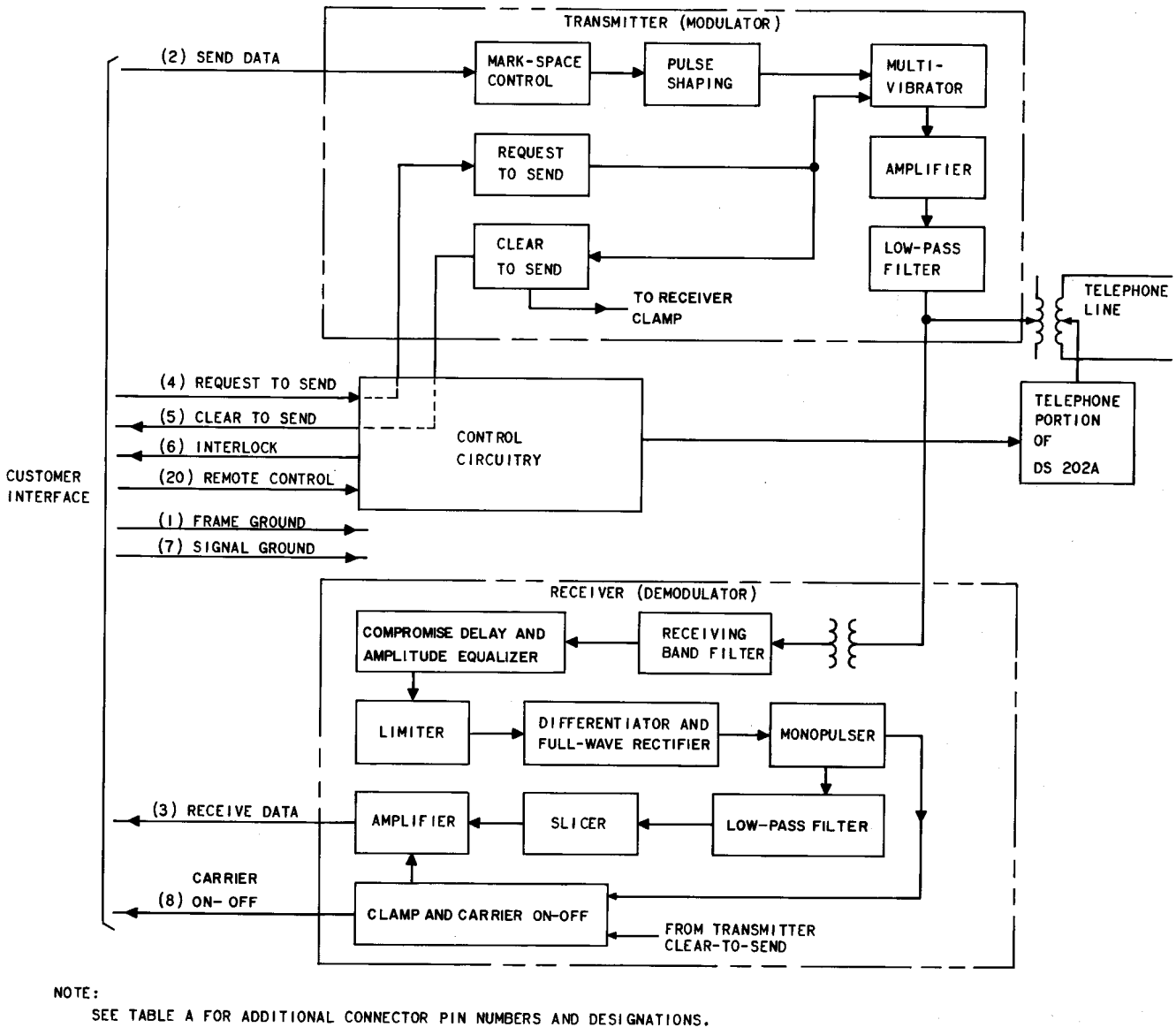
4. OPERATION

4.01 Data Set 202A can transmit or receive data, but not simultaneously. The operation of the business machine determines whether the set is in the transmit or receive condition. When used as a transmitter, the receiver portion monitors outgoing data for the customer.

4.02 ***Originating a Data Call:*** The operator depresses the TALK key and places a telephone call to the distant terminal in the normal manner. After the distant terminal answers:

(a) Manually: Verbal agreement is reached as to when data is to be sent. The DATA key is depressed until the associated lamp lights. No answer-back tone is heard during attended operation.

(b) Automatically: A 1200-Hz tone will be heard for a few seconds, indicating that the far-end



NOTE:
SEE TABLE A FOR ADDITIONAL CONNECTOR PIN NUMBERS AND DESIGNATIONS.

Fig. 4—Data Set 202A, Block Diagram

set is ready to receive data. The operator must depress the DATA key until the associated lamp lights.

Note: If the receiving station goes to data mode first, talking or room noise picked up by the transmitting station handset may cause false signals to be received. This problem can be minimized by covering the telephone transmitter or making sure that the transmitting station goes to the data mode first on manually answered calls.

4.03 ***Answering a Data Call:***

(a) Manually: The operator should ensure that the TALK key is depressed and answered in the normal manner. When verbal agreement is reached as to when transmission of data is to begin, the operator must depress the DATA key until its associated lamp lights. The set is now in the data mode and transmission can begin.

(b) Automatically: This is a built-in feature of the data set. This feature can be controlled

TABLE A

CUSTOMER INTERFACE CONNECTIONS

PIN NUMBER	LEAD DESIGNATION	EIA (RS-232-A) STANDARD NOMENCLATURE
1	Frame Ground (FG)	Protective Ground (AA)
2	Send Data (SD)	Transmitted Data (BA)
3	Received Data (RD)	Received Data (BB)
4	Request to Send (RS)	Request to Send (CA)
5	Clear to Send (CS)	Clear to Send (CB)
6	Interlock (IT)	Data Set Ready (CC)
7	Signal Ground (SG)	Signal Ground (AB)
8	Carrier On-Off (CO)	Data Carrier Detector (CF)
9	+ Power (+17.5V)	Reserved for Testing (+P)
10	— Power (—17.5V)	Reserved for Testing (—P)
19	Remote Release (RR)	—
20	Remote Control (RC)	Data Terminal Ready (CD)
21	Ready (RY)	—
22	Ring Indicator 1 (RG1)	Ring Indicator (CE)
23	Ring Indicator 2 (RG2)	—

Note: Unlisted pin numbers are not used.

by the AUTO answer key and the business machine or by bypassing the automatic answer key and placing this feature directly under control of the business machine.

Note: There is a possibility that an unattended transmitting station might start transmitting data erroneously if it is reached by a party who has called the wrong number. To avoid this false transmission, it is recommended that reception of a discrete start code be used before transmission is started.

4.04 ***Terminating a Data Call:*** A data call can be terminated in two ways. The operator can depress the TALK key, lift the handset, and hang up, or the business machines can be arranged to use the remote release feature to terminate the call.

4.05 ***Remote Test Feature:*** Data Set 202A is equipped with a remote test feature which permits a test from a centralized data test center. Remote testing is performed at a central testing location in the telephone plant by means of tones sent over the telephone line. The test circuit operates as follows:

(1) Establish contact with test center in the normal telephone manner.

(2) When test center is ready, a 1200-Hz test tone is placed on the line. This is the cue to push the TEST key and place the data set in the test mode.

(3) The data test center checks the following items during this test period:

(a) Modulator mark and space frequency

(b) Demodulator output and slicing level, carrier detector, request-to-send, clear-to-send, receive, and send-data circuits

(c) In some cases, transmitting level and receiver sensitivity if line loss is known.

Note: If the customer should accidentally depress the TEST button when dial tone or a high-level tone is present, the data set will lock in the test condition. This condition may be terminated by (1) placing the handset on-hook and (2) depressing TEST button.

4.06 In addition to the remote testing feature, equipment is available that permits the business machines to be replaced by test sets, and dynamic tests can be carried out to give an indication of the performance of the system. Refer to the section entitled Data Set 202A, Test Procedures (592-013-500) when testing the system.

5. REFERENCES

5.01 Additional Bell System Practices covering Data Set 202A are as follows:

SECTION	TITLE
592-013-200	Data Set 202A, Installation and Connections
592-013-300	Data Set 202A, Maintenance
592-013-500	Data Set 202A, Test Procedures

5.02 For additional information concerning DS 202A, refer to CD- and SD-1D003-01.