

Bell System Data Communications

TECHNICAL REFERENCE

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DATA SET 113A

**INTERFACE
SPECIFICATION**

MAY 1969

American Telephone & Telegraph Company

Engineering Director Data Communications



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Data Set 113A
Interface Specifications

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ENGINEERING DIRECTOR - DATA COMMUNICATIONS



NOTICE

This Technical Reference is specifically intended for the developers and designers of business machine data terminal equipments and devices which interface with Bell System data communications equipment and for technical consultants for use in designing data communications systems and arrangements employing Bell System data communications services and equipments. The right to revise this Technical Reference for any reason, such as conformity with USASI, EIA, CCITT or other standards, to utilize new advances in the state of the technical arts, or to reflect changes in the design of the equipment and/or service described herein is expressly reserved.

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DATA SET 113A - INTERFACE SPECIFICATION

1. GENERAL

Data Set 113A is a low-speed (up to 300 bauds), originate only, full-duplex serial data set. It provides for DATA-PHONE[®] service, over the DDD network, with alternate TALK-DATA transfer. Either rotary or TOUCH-TONE[®] dialing is furnished; call origination and control can only be performed manually.

With one exception (CC-Data Set Ready) the interface to the data terminal conforms to EIA RS-232-B specifications. The data set is designed for use with Bell System or customer-provided data terminals operating over switched telephone facilities. A major application of this set is to provide originate only data communication for remote access time-shared computer service.

Data Set 113A, unlike other 100-series data sets, obtains its operating power from the telephone line. Therefore, no commercially available power source is required.

2. COMPATIBILITY WITH EXISTING DATA SETS.

The interface and line signals of the Data Set 113A are generally compatible with those of other low-speed data sets.

(a) Interface Compatibility

With one exception (CC-Data Set Ready), the interface of the Data Set 113A is compatible with the originate-only aspects of the interfaces employed in 103-type data sets. The differences that do exist are pointed out in the following sections. It is expected that any manually operated terminal device that operates in a manual originate mode with a 103-type data set will be capable of operating in the originate mode with the Data Set 113A without modification of either the data set or the terminal device (except as may be necessitated by circuit CC), taking into consideration the required manual operation of the data set.

(b) On-Line Compatibility

Data Set 113A will be able to communicate with 101- and 103-type data sets used in DATA-PHONE service that employ the normal mark and space frequency assignments used in TWX service. The data set has been designed to complement a totally manual type of call origination and control, and therefore, does not incorporate any "long" or "short" space disconnect options or carrier failure features as employed by 101- or 103-type data sets. Because the Data Set 113A does not contain a carrier detector nor any other threshold-sensitive mark-hold circuitry, erratic operation may be expected when the input to the data set consists only of a very weak signal or noise. However, the receiver output will tend to be held to mark in these cases due to the design of the receiver in the data set. Manual disconnect resulting in a loss-of-carrier condition is the only disconnecting procedure provided. Although the Data Set 113A is not sensitive to extended periods of spacing signal, the data set with which it is communicating may be (e.g., Data Set 101C or Data Set 103E). Therefore, a terminal device employing the Data Set 113A should exercise care not to send unnecessary, continuous spacing signals that might disrupt the normal operation at a distant station.

3. INTERFACE DESCRIPTION

With the exception of circuit CC (Data Set Ready) the data processing terminal equipment interface provided with the Data Set 113A conforms with the specifications given in EIA RS-232-B. The deviation from EIA specifications is the result of no power being available when the data set is not in the DATA mode.

A total of seven interchange leads are provided for connection to the data processing terminal equipment or the installer's test equipment as follows:

[®]Registered Service Mark of AT& T Co.

- (a) AA – Protective Ground: Connected to frame ground of the data set.
- (b) AB – Signal Ground: Connected to protective ground.
- (c) BA – Transmitted Data: The BA circuit is designed to accept serial data from the customer's terminal equipment. The customer has control of this circuit whenever circuit CC (Data Set Ready) is in the ON condition. At the time of call origination or whenever the station is in the TALK mode, the BA circuit should be held in the marking condition so that when the interface is enabled, circuit BA will cause the proper F1 signal (mark) to be sent to complete the handshaking routine.
- (d) BB – Received Data: The BB circuit is designed to deliver serial data signals to the customer's terminal equipment. When the data set is not in the DATA mode, the signal on circuit BB is zero volts. This is because there is no power available in the data set when it is not in the DATA mode. During the handshaking procedure, the BB circuit is held in the marking condition by the incoming marking line signal.
- (e) CA – Request to Send: Connected directly to the CB (Clear to Send) circuit.
- (f) CB – Clear to Send: Connected directly to the CA (Request to Send) circuit. The CA-CB loop is provided to satisfy those existing customer terminal equipments that expect a Clear-to-Send indication in response to a Request-to-Send signal. In all other cases, it is suggested that no use be made of circuits CA and CB since they provide no useful function.
- (g) CC – Data Set Ready: The CC circuit informs the customer's terminal equipment that the data set is in the DATA mode and is ready to communicate. The customer's terminal equipment can then process the signal to enable itself.

The signal on the CC circuit is the only interface signal which does not conform to EIA RS-232-B specifications. The ON state of this signal is a positive voltage which meets the specifications. The OFF condition, however, is zero volts.

This deviation from EIA specifications is unavoidable since no power is available in the data set when it is not in the DATA mode.

The CC circuit will be in the OFF condition when either –

- (1) the power is OFF in the data set,
- (2) the telephone handset is off-hook, or
- (3) the data set is in the "TEST" mode.

The design of the Data Set 113A has been predicated on its use in a totally manual operating environment. Consequently, the data set does not provide for any timed delay from the moment that F1 tone is sent to the answering station to when circuit CC is turned ON, as was the case in the 103-type data sets. Now, since the BA circuit is enabled when the CC circuit is turned ON, an automatic sending device could start transmission of data immediately after the generation of the F1 tone. However, a 103-type data set employed at the distant station does not remove its mark hold clamp on its BB circuit until after 135 ± 65 milliseconds of F1 marking carrier is received. Hence, any data transmitted before the distant station removed its mark hold clamp would be lost. Therefore, if the Data Set 113A is to be employed with an automatic terminal device that initiates transmission as the result of a signal from the data set interface, the customer's terminal equipment should provide an appropriate delay (minimum 200 milliseconds) to insure proper system operation.

Pin assignments are as follows:

Pin #	Circuit
1	AA
2	BA
3	BB
4	CA
5	CB
6	CC
7	AB

4. MODES OF OPERATION

The control circuits of the Data Set 113A provide for the following modes of operation:

- (a) Call Origination
- (b) TALK Mode
- (c) TALK to DATA and DATA to TALK Transfer
- (d) DATA Mode
- (e) TEST Mode
- (f) Disconnect

A detailed description covering the above operations is covered in the following sections.

4.1 Call Origination and TALK mode

For call origination and TALK mode operation the attendant must pick up the handset and operate the TALK key; the order in which the two operations are performed is immaterial. Dial tone is heard and the attendant proceeds to dial the desired telephone number.

The combined action of the two operations ties the telephone network across tip and ring of the telephone line. At this time no power is supplied to the data set.

A call may be answered in the TALK mode by the same two previously-mentioned operations. However, data transmission is not possible in this case.

4.2 DATA Mode

Since the Data Set 113A is an originating station only, a call to a distant station must have been established and an answer tone (F2 mark) received prior to entering the DATA mode from the TALK mode. The operation is performed in the following manner. Upon hearing the answer tone, the attendant must first operate (and release) the DATA key, and then place the handset on-hook. Power is supplied to the data set when the DATA key is depressed. Circuit CC is kept

OFF and the modulator is squelched until the handset is placed on-hook. The time between the reception of the answer tone and the completion of this procedure must be short enough to prevent the answering station from aborting the call. This abort time can be as short as 4 seconds in the case of 101C-type data sets generally associated with 33- or 35-type teletypewriters. At least 0.3 seconds is required between the times the DATA key is depressed and the switchhook is operated, in order to allow startup transients to disappear.

Once the handset is on-hook, the data set will send the F1 signal (mark or space) corresponding to the state of the BA circuit from the terminal device. Therefore, the terminal device should be arranged to "idle" in a mark-hold condition so that circuit BA is marking when the DATA key is operated and the telephone handset is placed in the on-hook state. The handset of the Data Set 113A must be on-hook during data transmission. Going off-hook will inhibit the data set modulator from marking and turn circuit CC OFF.

As soon as the distant station detects the F1 marking signal, the handshaking will be complete and the transmission of data may proceed. The "human" timer that is assumed in a totally manual operation will generally provide sufficient time for the handshaking to be completed before transmission from this originating station would be expected to commence.

4.3 TALK to DATA and DATA to TALK Transfer

In transferring from the TALK mode to the DATA mode it is essential that no action be taken on the part of the Data Set 113A until the distant end is placed in the DATA mode. This enables the distant end to transmit the F2 mark signal with the Data Set 113A modulator inhibited. This disables the echo suppressors on the line. Then, as indicated above for DATA Mode, the attendant at the Data Set 113A, after hearing the answer tone, depresses the DATA key and places the handset on-hook within 4 seconds, completing the handshaking procedure. In the DATA to TALK transfer case, the attendant first picks up the handset and then depresses the TALK key. It is imperative that this sequence be followed so that the data set will not disconnect.

4.4 TEST Mode

To enter into the TEST mode, the attendant calls the central office and requests a remote test. The central office then calls a data test center, which in turn calls the customer. The customer answers the call in the TALK mode, where he is advised of the steps to be performed in order to place the data set in the TEST mode. The sequence is: (1) after receiving the F2 mark tone from the test center, depress the DATA key, (2) operate the TEST key, and (3) return the handset to the on-hook condition. The attendant now waits for a prearranged length of time and then transfers back to the TALK mode by first going off-hook and then pressing the TALK key. The last sequence must be followed or the data set will disconnect and the connection will be lost. The data test center then advises the attendant of the results of the test and the appropriate action to be taken.

In the TEST mode the Data Set Ready (CC) circuit and the transmitted Data (BA) circuit are opened to the terminal device. Internal to the data set the receiver output is connected to the transmitter input, as well as to the Received Data (BB) circuit.

4.5 Disconnection

In order to disconnect the Data Set 113A, the attendant operates (depresses) the TALK key with the handset on-hook. The handset must be on-hook; otherwise the data set will go in the TALK mode. Disconnecting the data set removes the power source and all data set circuits are de-energized. The data set may also be disconnected by a momentary break (greater than 5 msec) of the telephone line.

The attendant must take care not to either leave the data set in the DATA mode after completing data communication, nor accidentally place the data set in the DATA mode (by going off-hook, pressing the DATA key, and returning the handset on-hook) and leave it there. In either case, if a dc interruption of sufficient length is generated by the serving central office, the data set will be cleared from the line. However, generation of such a dc interruption is not guaranteed.

5. MANUAL CONTROLS PROVIDED WITH DATA SET 113A

The Data Set 113A has the attendant's set integrated into the same housing as the data set

modem. A rotary dial is provided in the Data Set 113-A-L1, while a TOUCH-TONE dial is provided in Data Set 113A-L1A. Both types of dials are intended for use in providing DATA-PHONE Service and are therefore equipped with telephone handsets. No options, other than the type of dial, are provided with the Data Set 113A.

Control of the data set is provided by a six-button key assembly. Three keys are unused and are therefore blocked. The designations and functions of the other three keys are as follows (from right to left):

DATA: This key is nonlocking, releasing on the upstroke. Its operation transfers the telephone line from the telephone set to the modem, thus placing the data set in the DATA mode.

TALK: This is a locking-releasing key which allows the operator to place the data set in the TALK mode or to terminate a data call when the telephone handset is on-hook.

TEST: Operation of this locking-releasing key places the data set in the TEST mode for remote testing by a data test center.

6. SEQUENCE CHARTS

The sequence charts in Figures 2 through 5 show the status of interface circuits as the data set progresses through handshaking and disconnecting. Comments regarding key operations, attendant operations and answering data set operations are given to aid in the understanding of the operation.

7. PHYSICAL CHARACTERISTICS

The Data Set 113A is packaged in the Bell System standard, medium-size integrated housing. The outside dimensions of the set are $11\frac{1}{2} \times 8\text{-}3/4 \times 3\text{-}3/4$ inches. The total weight is 8 pounds.

The data set will operate in an ambient temperature between 40°F and 120°F and relative humidity between 20 and 95 percent.

The data set obtains its required power from the telephone line, so provision of commercially available power is not required.

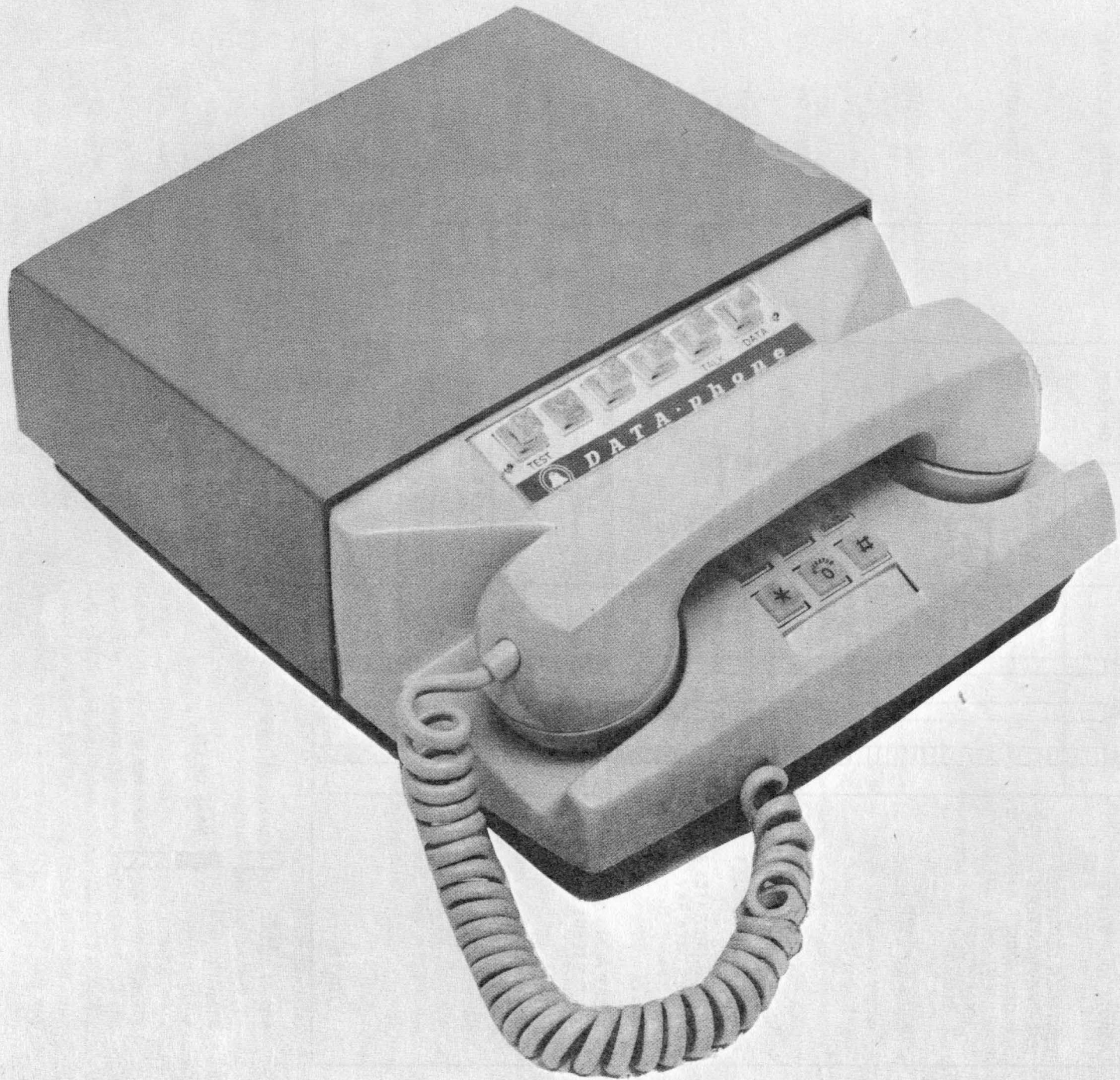


Figure 1 Data Set 113A

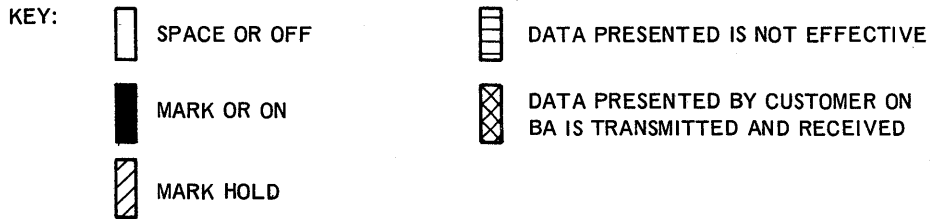
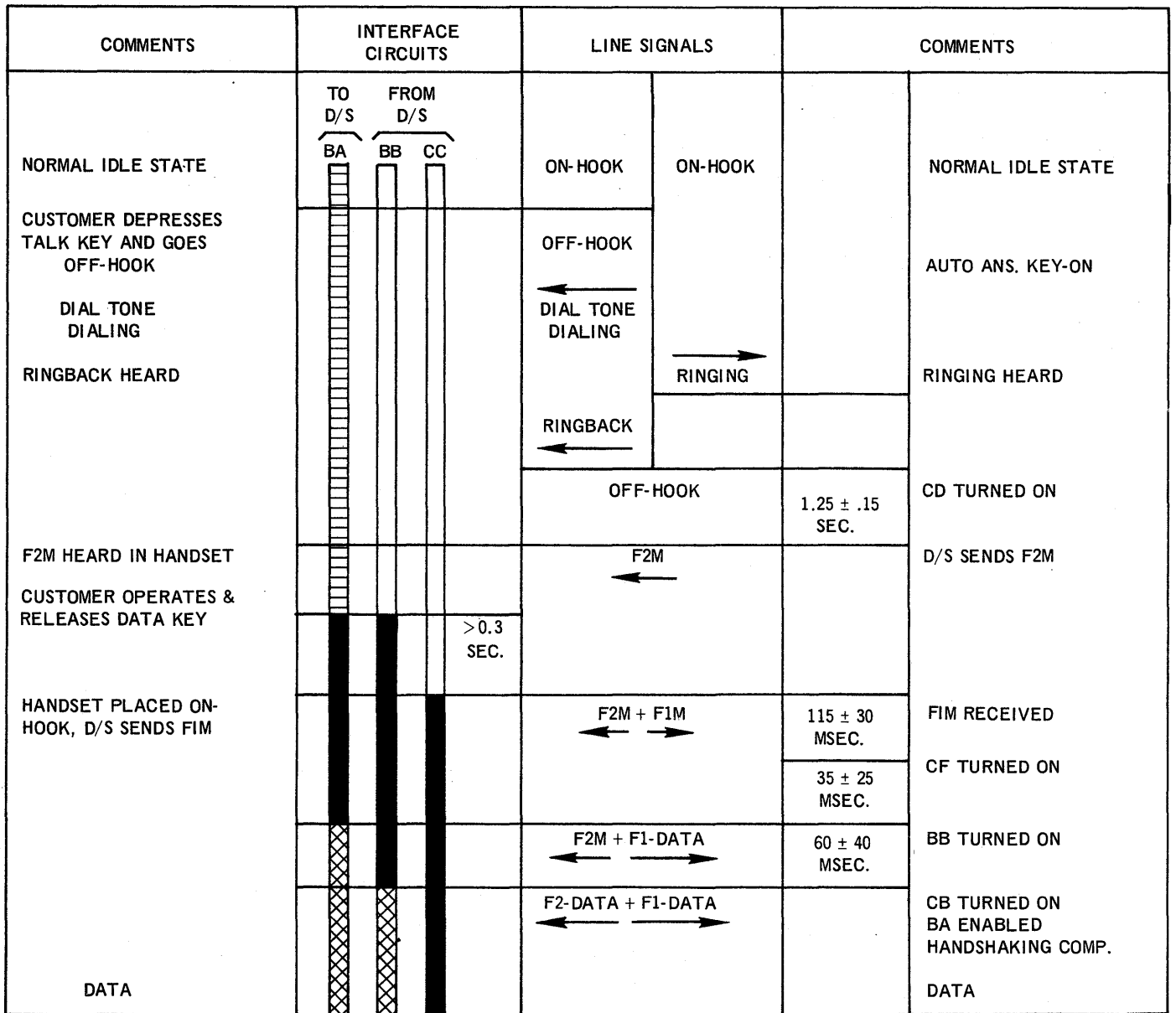


Figure 2 – Call origination to 103E-type data set, answering automatically in the DATA mode.

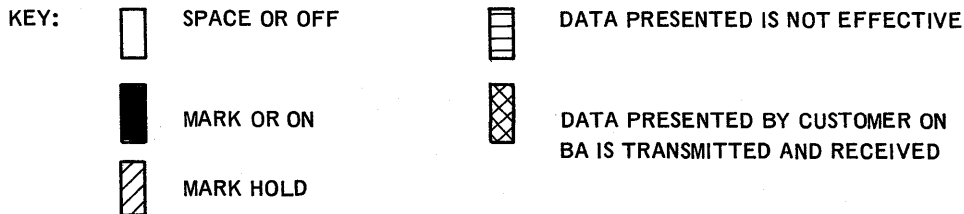
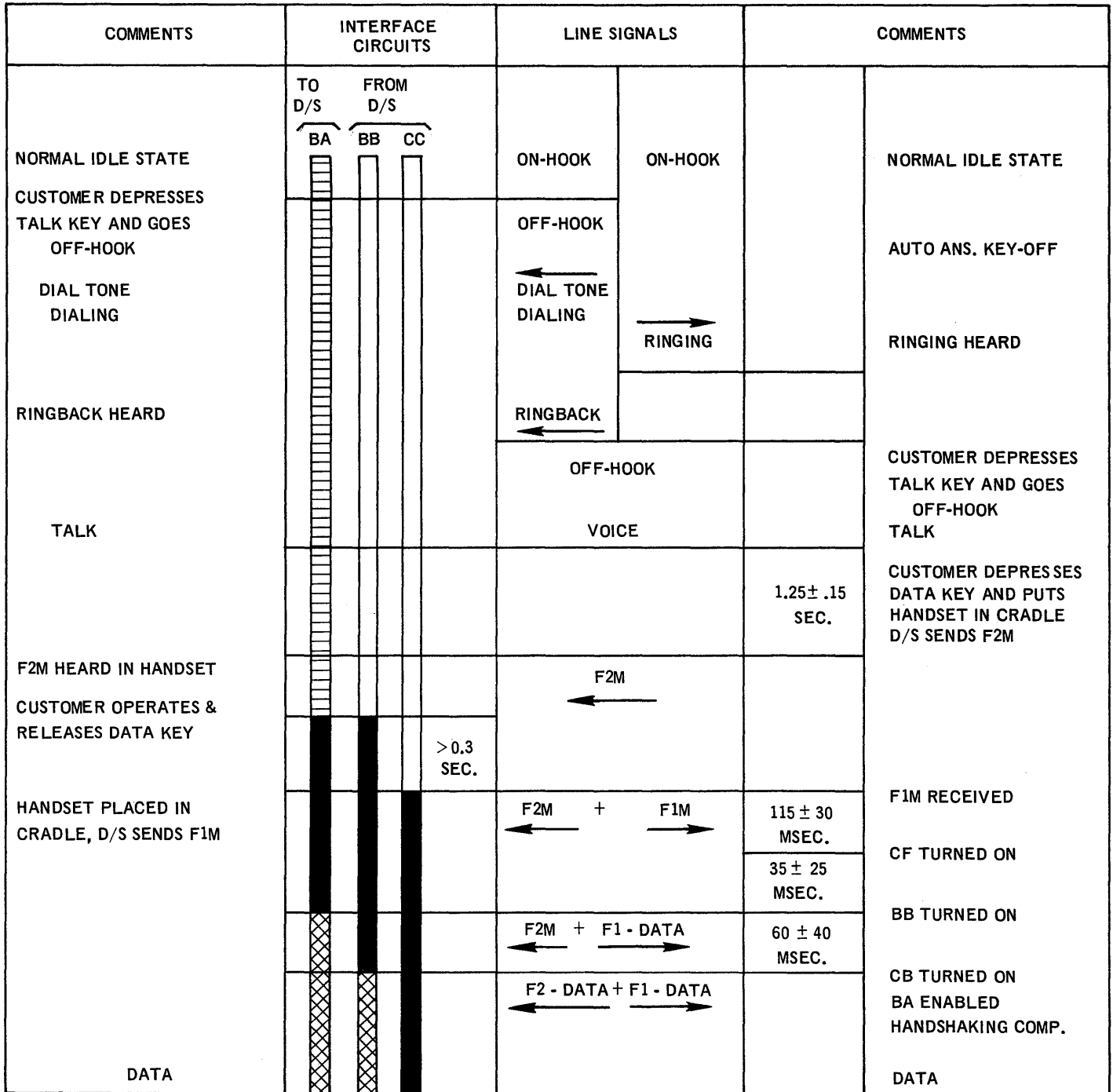


Figure 3 – Call Origination to 103E-type data set, answered in the TALK mode.

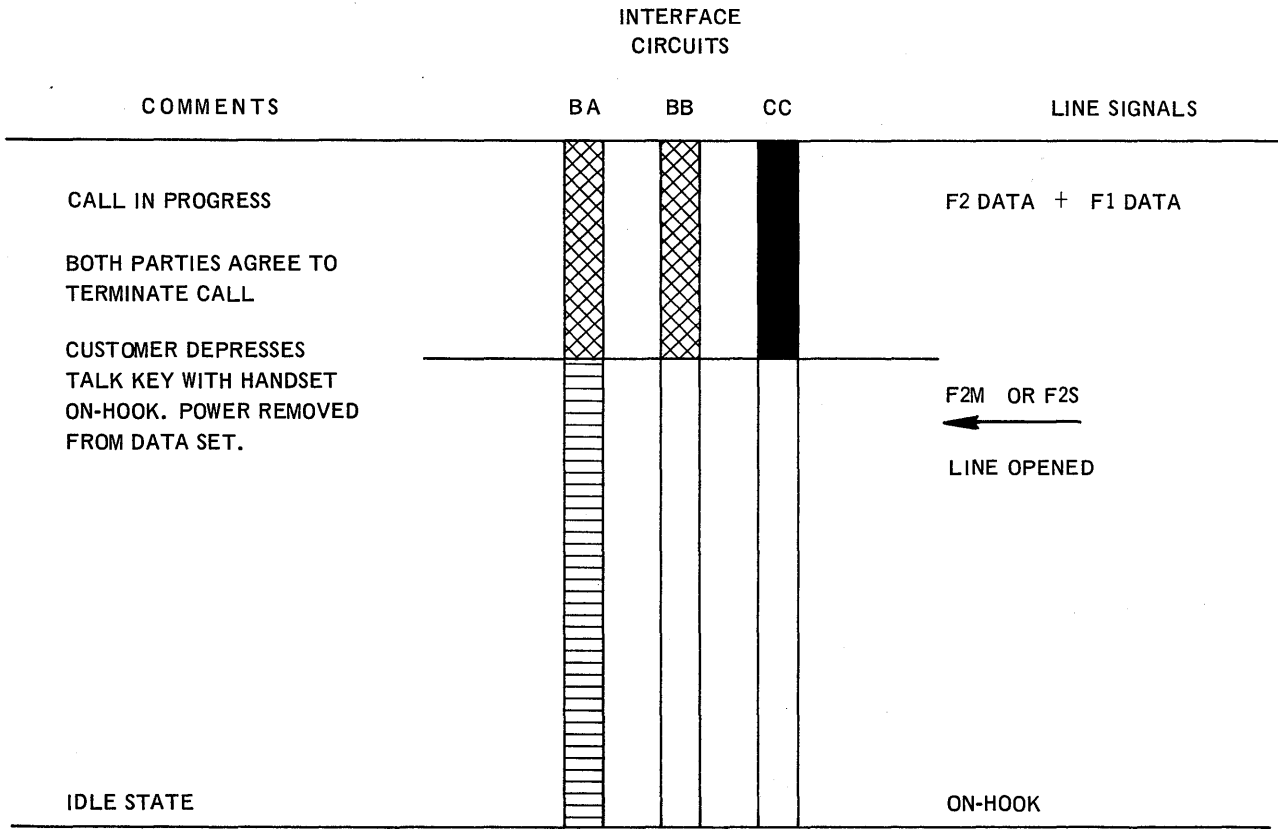


Figure 4 – Detailed Disconnect Sequence

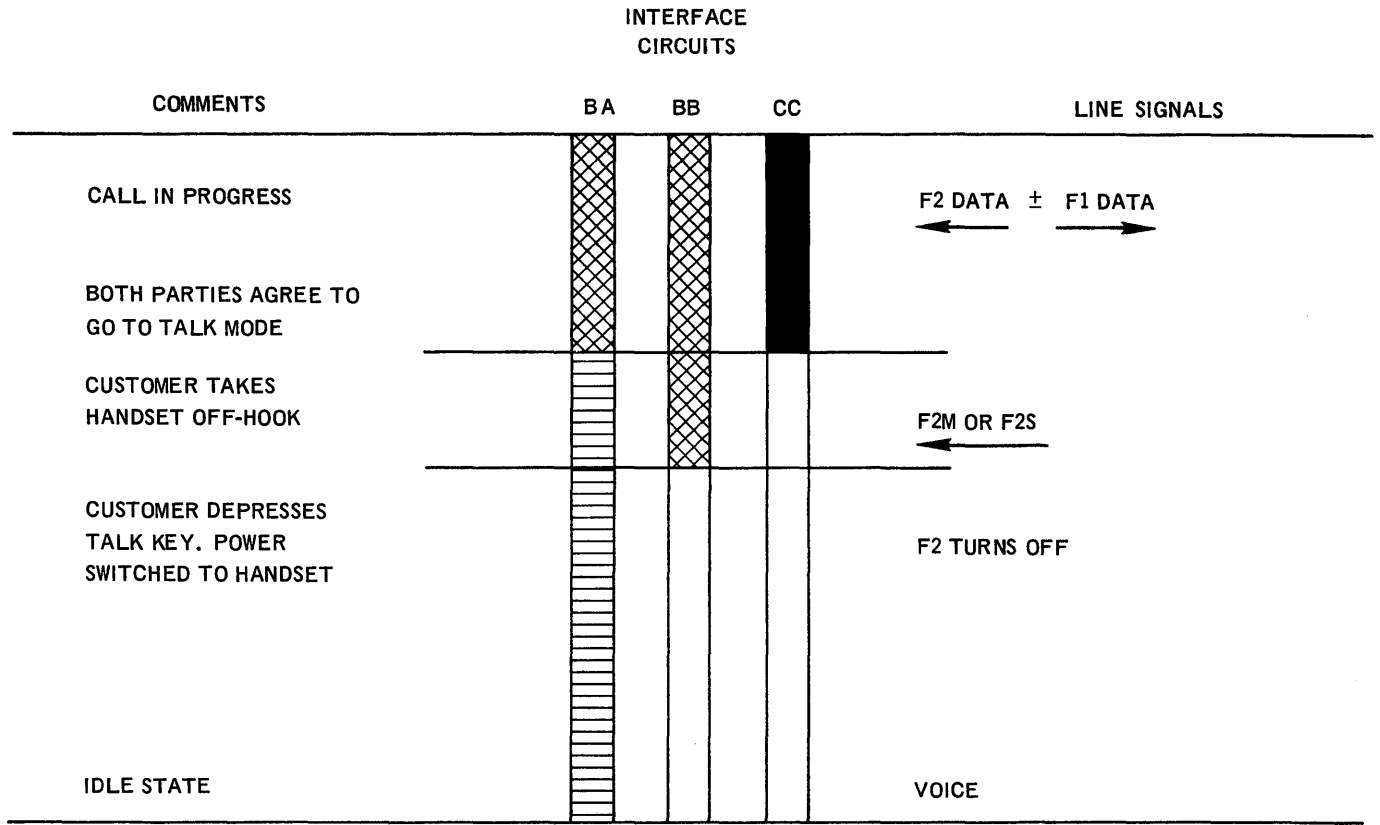


Figure 5 – Detailed DATA to TALK Sequence

