COMPUTER ACCESS FOR "PICTUREPHONE®" SERVICE
USING DISPLAY DATA SET F-58167
DESCRIPTION

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1. GENERAL

1.01 This instruction covers the provision of computer access for initial PICTUREPHONE service. Computer access is obtained through the use of a data set currently coded Display Data Set F-58167 in conjunction with Data Set (DS) 403E5 and an appropriate equalizer. This data set system, when associated with an appropriately programmed (customer-provided) computer, permits video-telephone users to communicate with the computer as well as with other video-telephone stations. Computer access is considered as a feature addition to the basic PICTUREPHONE service, which is primarily intended for face-to-face communication.

DISPLAY DATA SET

1.02 Display Data Set F-58167 serves to connect the PICTUREPHONE network with a customer's computer. To the network, it appears as a standard video-telephone station that can be "called" by any video-telephone station on the network aware of its PICTUREPHONE number. To the computer, the data set presents a standard EIA electrical interface in accordance with specification RS-232-C. As illustrated in Fig. 1, the display data set can be connected directly to a computer port on an EIA basis ("Local" arrangement), or it can be connected via a standard, private line, 4-wire voiceband data link to a computer port using Data Sets 202D3 ("Remote" arrangement).

1.03 Figure 2 shows a simple block diagram of the basic data set system. The data set goes "off-hook," under computer control, in response to an incoming call from the network and signals the computer when a working connection has been established with the calling party. Thereafter, the video-telephone user signals the computer with his TOUCH-TONE® dial, and the computer responds with alphanumeric information which is displayed on the video-telephone screen. The data set is arranged to translate TOUCH-TONE signals to ASCII (American National Standard Code for Information Interchange) for the computer and to translate ASCII from the computer to video signals which draw alphanumeric symbols or graph symbols on the distant station display unit. A maximum of 484 characters can be stored in the display data set. Sample displays are shown in Fig. 3 and 4.

1.04 The video-telephone customer can add a low-speed (110-baud) data transmitter in addition to the PICTUREPHONE station arrangement. A DS 108A1 is optionally included in the display data set design to support this operation. The video-telephone user couples a data transmitter (eg, a keyboard or teleprinter) to the voice pair. In this arrangement, DS 108A1 accepts FSK-modulated ASCII characters, instead of TOUCH-TONE signals, from the video-telephone user and transmits them to the computer. This option expands the available user interaction capability and permits further extension of the basic services.

1.05 The capability for the user to directly edit and update a display is provided. An ASCII generating input device is required at the video-telephone station. To use this feature, the display data set is put in a local loop by the computer in which ASCII inputs from the user are directly entered into the display data set refresher storage. Means are also provided for transmitting (dumping) an edited file back into the computer for subsequent retrieval by this or other video-telephone users.

TRANSMISSION AND OPERATING PLAN

1.06 Display Data Set F-58167 serves only one video-telephone user at a time and requires a dedicated computer port for its use.

1.07 Each display data set system appears as a standard video-telephone station to either the central office PBX, key system, or intercom arrangement. The display data set requires access to video incoming and outgoing pairs and to the voice pair. Video transmit and receive levels are adjusted to PICTUREPHONE service standards; no data is transmitted from the display data set over the voice pair.

1.08 Communication with the computer is nonsynchronous at either 1200 or 2400 bits per second (bps), provided the computer is connected directly to Display Data Set F-58167 (within 50 ft). If the computer is more than 50 ft from the display data set, then only 1200 bps can be used. Also, each display data set then requires a dedicated

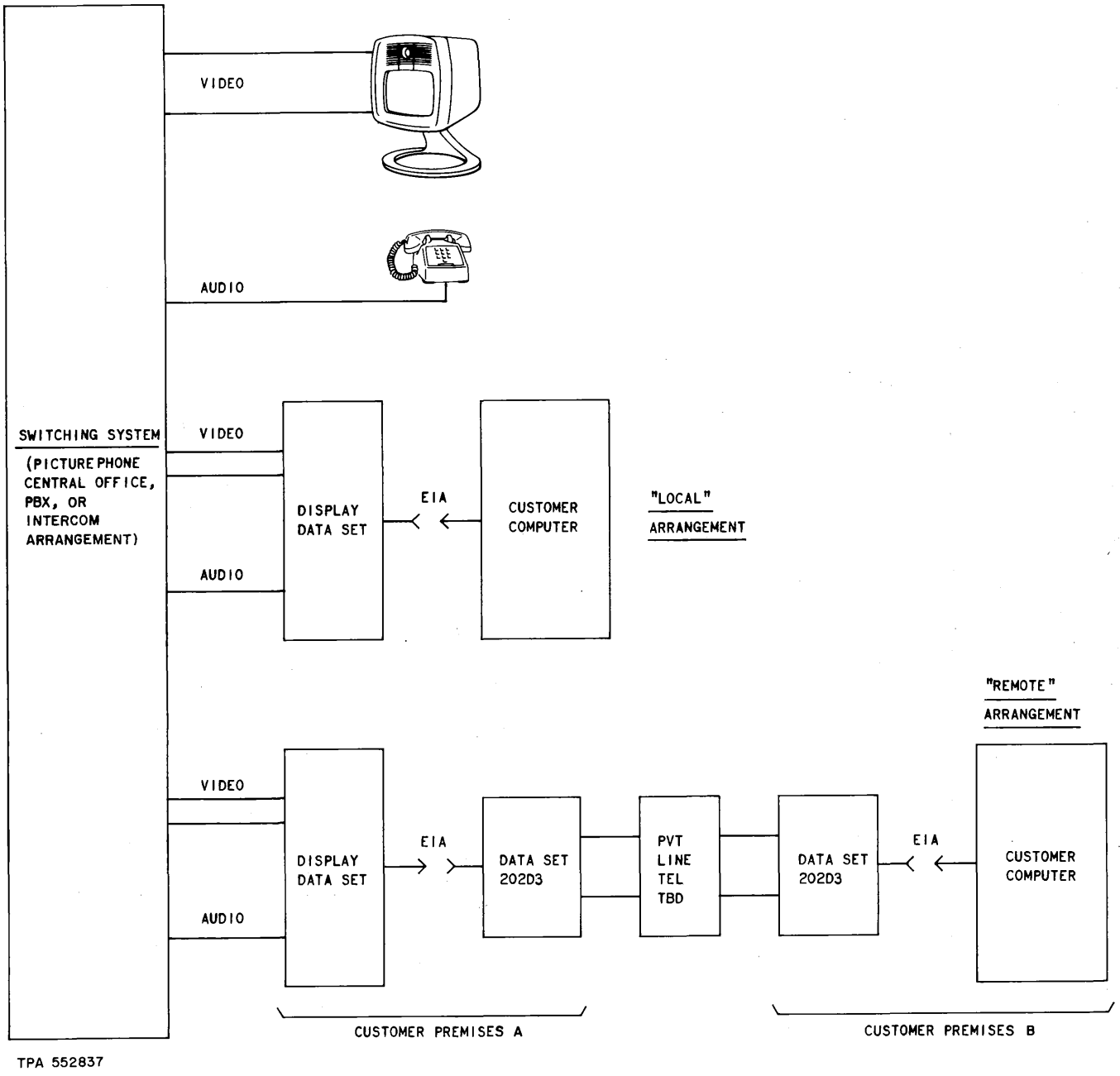


Fig. 1—Typical Computer Access Arrangement

private line voice channel terminated in a 4-wire, full-duplex DS 202D3 located within 50 feet of the display data set at one end and another DS 202D3 at the computer at the other end. Existing operating procedures for such private line services apply. Refer to Sections 592-016-ZZZ.

POWER REQUIREMENTS

1.09 Display Data Set F-58167 and DS 403E5 require standard, grounded receptacles providing a total of 250 watts of 110-vac, 60-Hz power. If DS 202D3 is used, a third receptacle is

needed. This power should be fused separately from other services, though all display data sets can share the same fused bus within the limitation of the fuse rating. The ac mains should be of the uninterrupted type since momentary interruptions will affect calls in progress.

2. PHYSICAL DESCRIPTION

DISPLAY DATA SET

2.01 The display data set system consists of two equipment entities: a standard DS 403E5 and Display Data Set F-58167.

2.02 Figure 5 shows the physical arrangement of the display data set. The rear view of the display data set is provided by Fig. 6.

2.03 The DS 403E5 is mounted in a KS-20018-L1 cabinet 11 inches high, 12 inches deep, and 24 inches wide at the base. Display Data Set F-58167 is installed in a KS-20018-L7 cabinet 30 inches high, 17 inches deep, and 24 inches wide at the base.

2.04 Data Set 202D3 is 5-1/2 inches high, 10-1/2 inches deep, and 11 inches wide at the base. The DS 403E5 cabinet can be placed on top of the display data set cabinet, and DS 202D3 can be placed on top of DS 403E5 cabinet. Refer to Fig. 7. Connections between cabinets and to other system elements are made by connector-ended cables.

INTERCONNECTION FACILITIES

2.05 Interconnection between cabinets and to associated equipment is by means of connector-ended cables. Connection to the PICTUREPHONE service network is made via a KS-16786-L4 connector (J406) on the KS-20018-L7 cabinet. Connector pins have been selected for compatibility with video-telephone installation practice. Data Set 403E5 and the display data set interface is made via a 25-pin connector to P403 and a 50-pin connector to J407. The computer interface appears on a standard EIA connector compatible with direct connection to a computer on J405 or DS 202D3 on P404 as necessary. Connector pin selection is compatible with EIA specification RS-232-C.

SPECIAL TEST FACILITIES

2.06 A key switch is mounted at the front of the assembly for test purposes. Associated with this switch are terminals to supply power to a light probe (eg, DIGI-PROBE model 1210) used for signal tracing.

3. FUNCTIONAL DESCRIPTION

OVERALL SYSTEM OPERATION

3.01 Before describing operation of the display data set in some detail, a review of overall system operation is in order. Reference to Fig. 2 will be helpful.

3.02 When a video-telephone station calls, the DS 403E5 in the display data set system reacts by going "off-hook" and causing a "service request" character to be transmitted to the associated computer. The computer may respond with a "hello" message which is stored in the Refresh Memory as ASCII-coded symbols. The Refresh Memory then repetitively transmits the message to the video-telephone station by way of a translator which produces the video signal that causes the message to be drawn on the cathode-ray tube (CRT) of the display unit. The message is drawn on the CRT at the standard video-telephone frame rate (30 frames/second, 2 fields/frame) in order to appear flickerfree to the viewer. The Refresh Memory relieves the computer of the task of repetitively transmitting the message to be viewed, thus saving computer processor time.

3.03 When the computer answers, the caller signals the computer by sending numerically coded sequences from his TOUCH-TONE dial. The TOUCH-TONE signals are detected in the DS 403E5 and passed on to a translator in the display data set which converts these signals to ASCII-coded characters which are transmitted nonsynchronously to the computer. The computer may respond to each interrogation by transmitting new or additional information to the Refresh Memory as previously described.

3.04 At the conclusion of the call, the display data set transmits a terminate character to the computer.

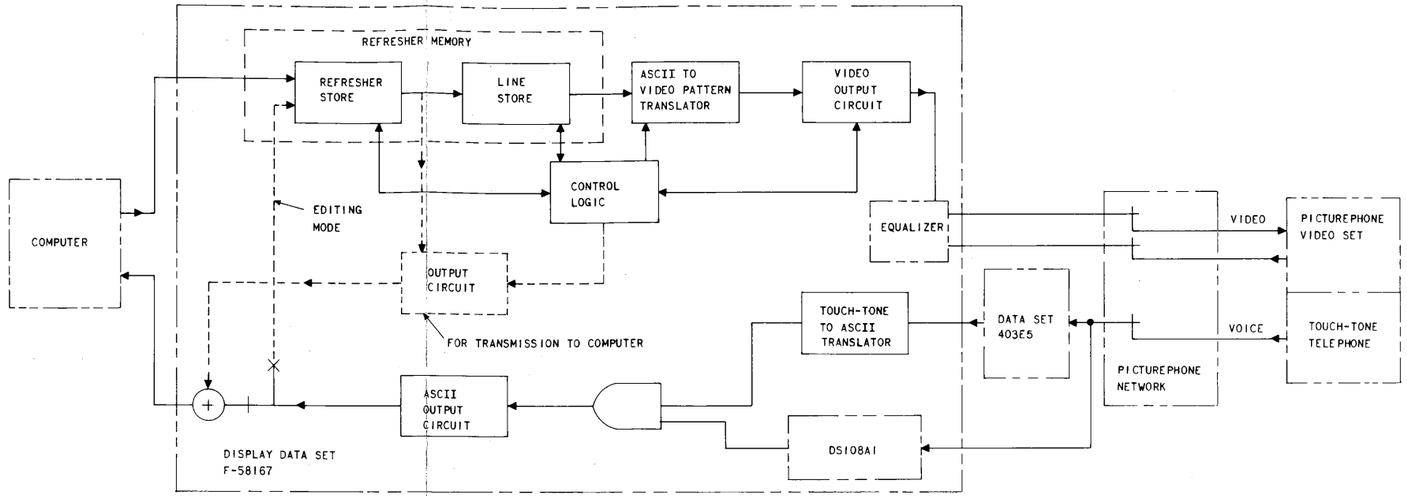


Fig. 2—Block Diagram of Display Data Set System

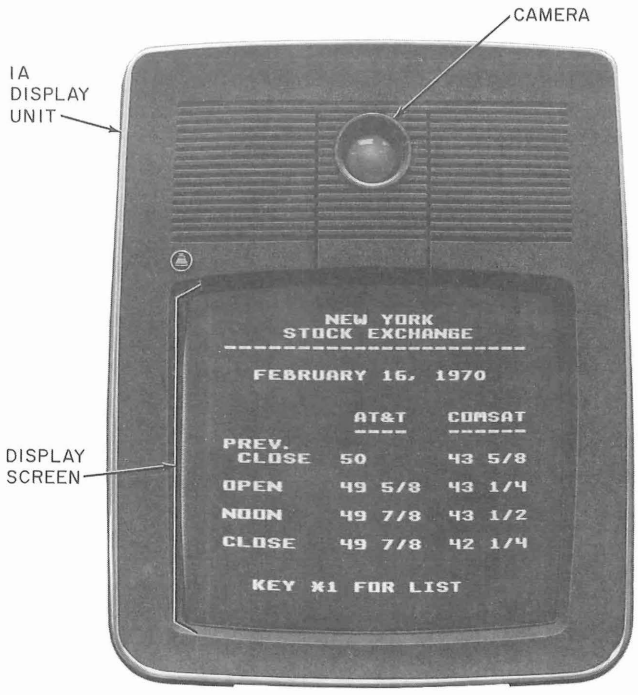


Fig. 3—Display Unit—Alphanumeric Characters

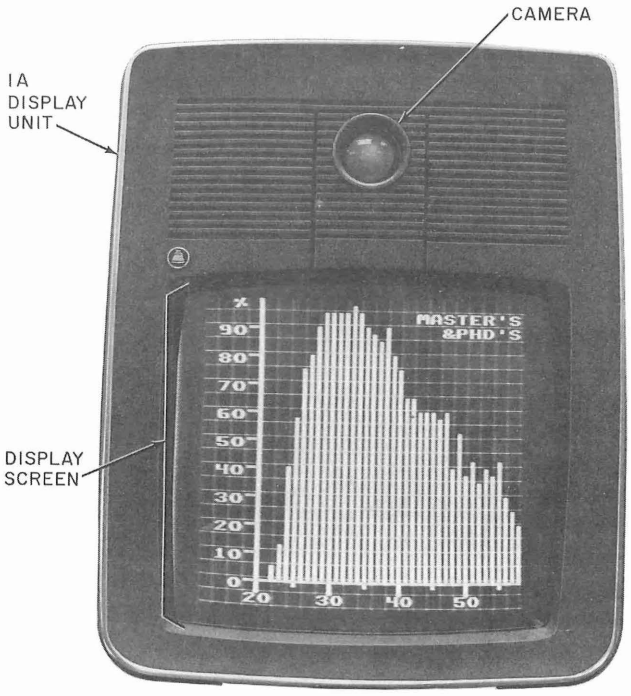


Fig. 4—Display Unit—Special Graphic Characters

DISPLAY DATA SET OPERATION

3.05 Except under certain conditions to be described later, the inward (station-to-computer) and outward (computer-to-station) signal paths are independent and will be so treated in the following description.

A. Station-to-Computer

3.06 Figure 8 is a block diagram of the inward circuit functions. Signals flow from right to left.

TOUCH-TONE Signal Detection

3.07 The DS 403E5 provides on-hook/off-hook control and detection of TOUCH-TONE signals. This is a standard Bell System data set. A detailed description of its internal operation will not be contained in this section. The description will include only enough information to retain continuity of thought. Refer to Sections 594-026-ZZZ for a complete description of DS 403E5. The DS 403E5 terminates the voice pair of the video-telephone loop. Its output consists of an on-hook/off-hook indication, a parallel-lead representation of a detected TOUCH-TONE digit (2-out-of-8 code), and a lead indicating presence of a detected digit.

Control Character Generation

3.08 The output of the on-hook/off-hook indicator is connected to a character generator. A transition from on-hook to off-hook causes the generator to enter a "start" character (ASCII character ENQ) into the output shift register which then serially shifts this character out toward the computer port under the control of a start-stop clock.

> *Note:* ASCII character ETX follows every character generated by the display data set except during the dump. In the case of the dump, the ETX character follows the dump of the contents of the memory.

A transition from off-hook to on-hook causes the "terminate" character (ASCII:EOT) to be transmitted in the same manner.

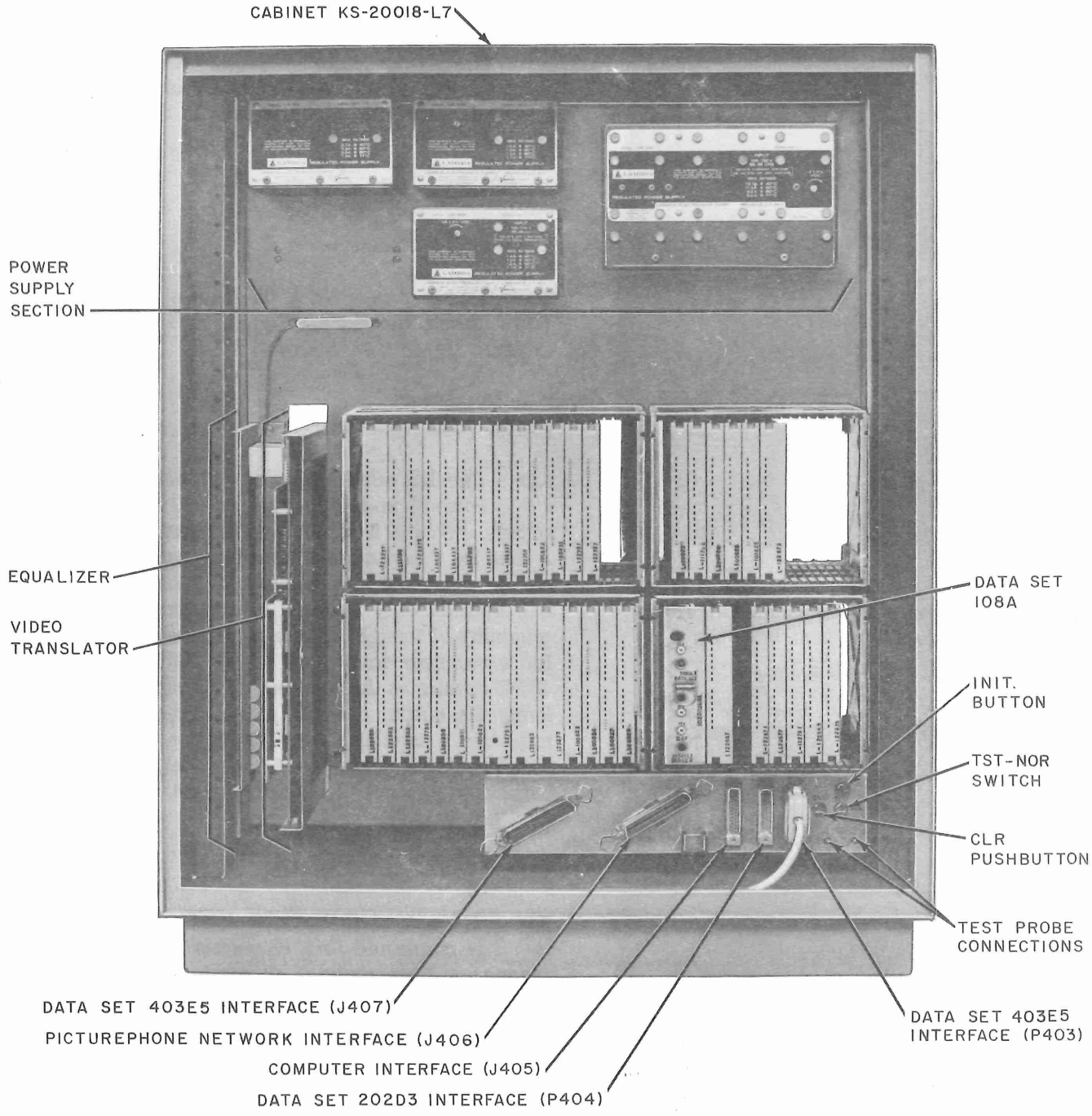


Fig. 5—Display Data Set F-58167—Physical Arrangement

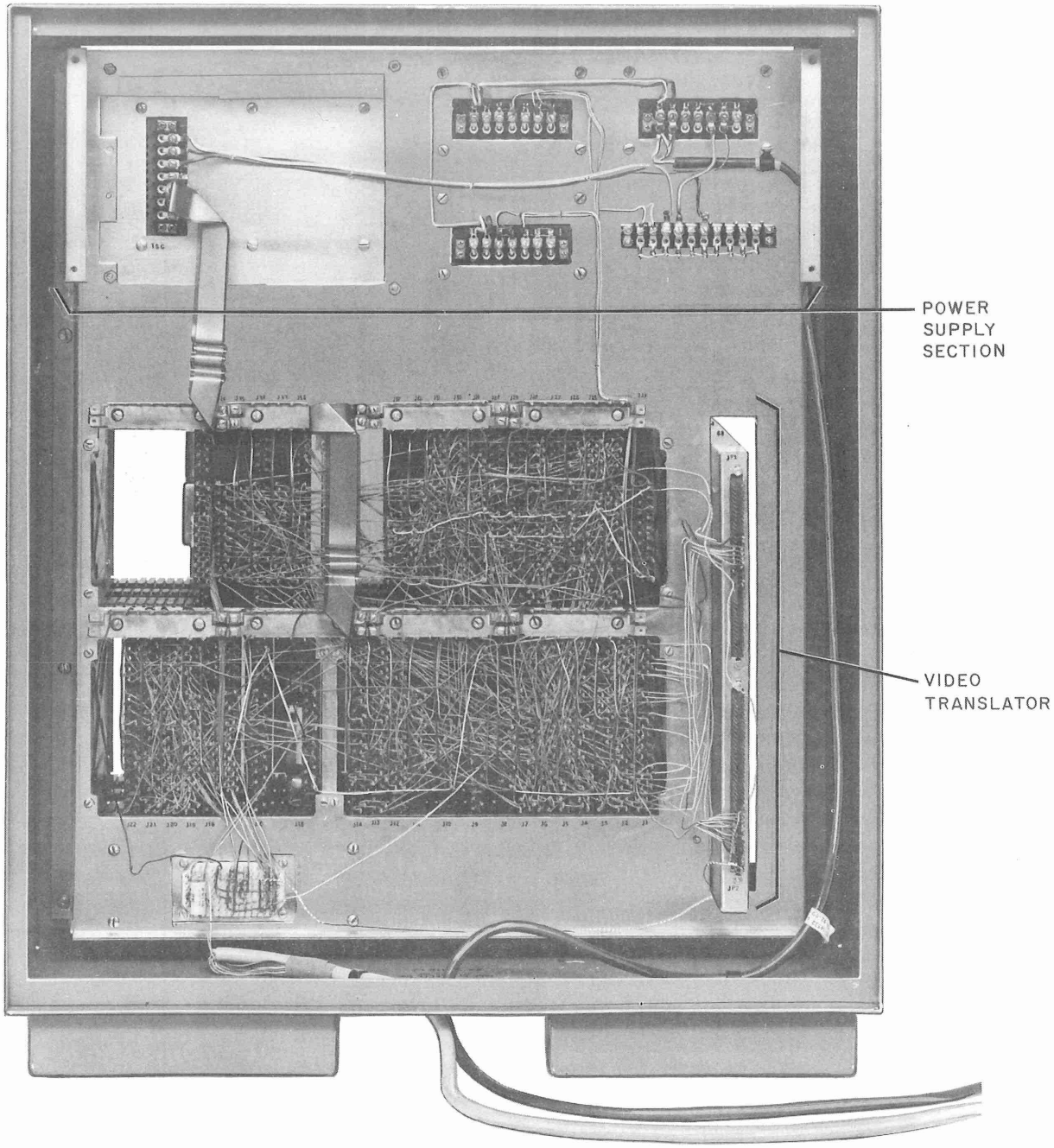


Fig. 6—Display Data Set F-58167—Rear View

TOUCH-TONE ASCII Translation

3.09 While the call is in progress, received TOUCH-TONE digits are presented to the translator under control of the "digit present" (DCD) lead. The translator enters an ASCII-coded equivalent of the TOUCH-TONE digit into the output shift register which passes this character to the computer in the way mentioned above. Each TOUCH-TONE digit received causes an equivalent ASCII-coded character to be transmitted.

B. Computer-to-Station

3.10 Before describing the signal flow path through the display data set from computer to station,

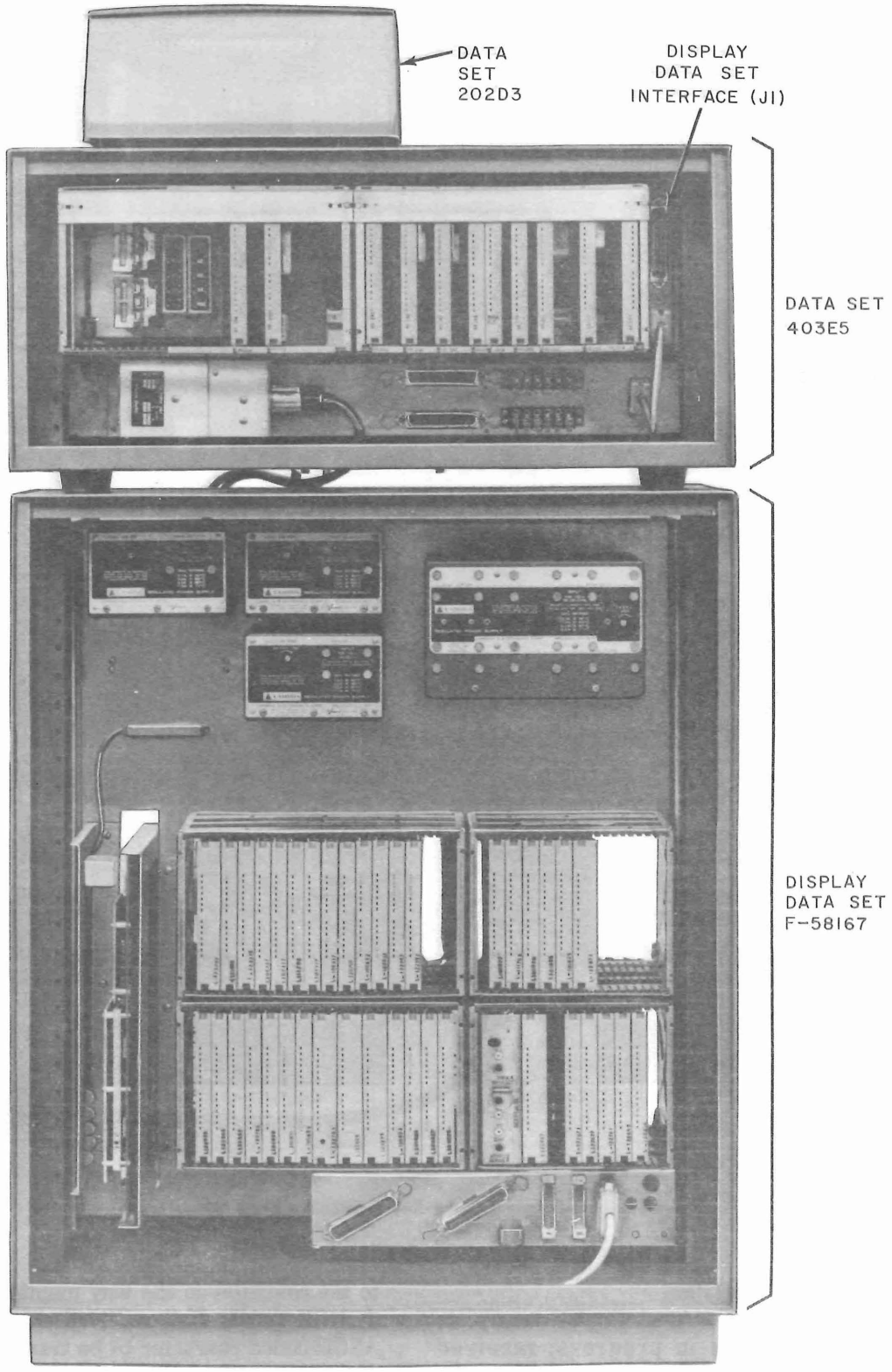


Fig. 7—Typical Arrangement of Display Data Set F-58167 and Data Sets 403E5 and 202D3

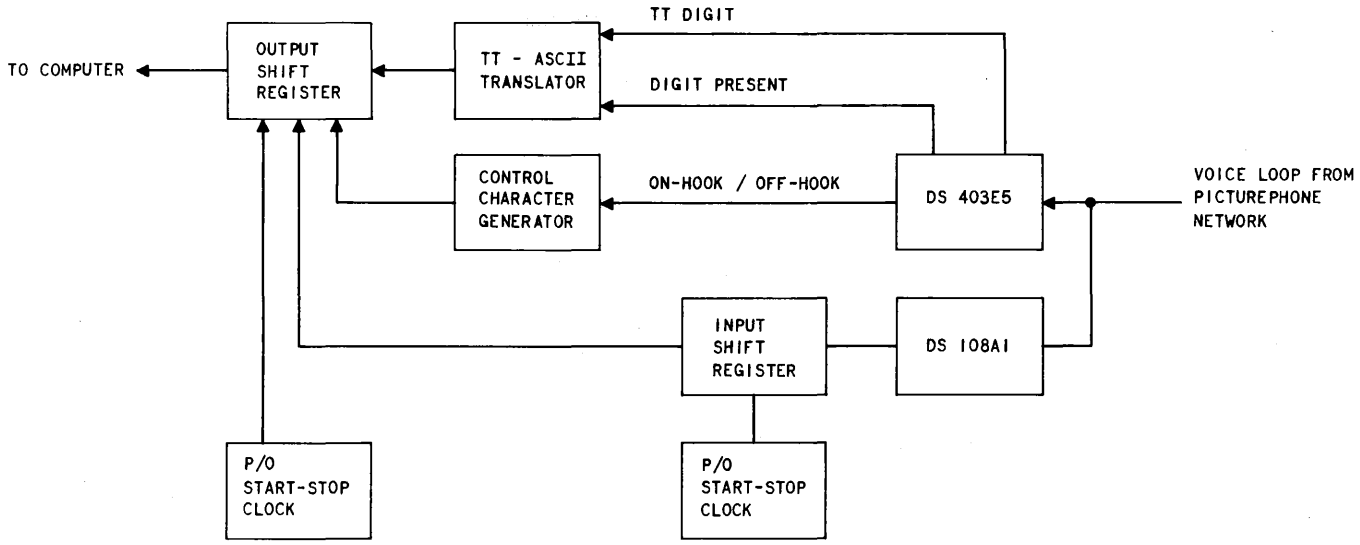


Fig. 8—Station-to-Computer Functional Block Diagram

a brief discussion of how characters are drawn on the video-telephone screen is in order.

3.11 The PICTUREPHONE uses a raster scan display; two interlaced fields produce a single video frame every 1/30th of a second. As the CRT electron beam traverses the screen, it is intensity-modulated to reproduce the transmitted visual image. For data display purposes, the beam is modulated to produce a pattern of "white" and "black" segments, the collection of which will appear as alphanumeric characters to the viewer. The technique is illustrated in Fig. 9. Part of a single field is shown as the characters "T", "H", and "E" are drawn by the electron beam. Also shown are the line signals that produce the image. Note that each character is drawn piecemeal: the first scan lines draws the bar of the "T", part of the two posts of the "H", and the top bar of the "E"; the second scan line draws part of the posts of the "T", "H", and "E", and so forth. The ASCII-to-video translator (or character generator) that controls this operation will be described in 3.17. The complete repertoire of characters is shown by Fig. 10.

3.12 It is sufficient here to emphasize that each line of characters appearing on the video screen is drawn by a number of scan lines, and because of the low persistence of the CRT phosphor, the characters must be continually redrawn to appear flickerfree to the viewers. These considerations govern the functional organization of the display data set.

3.13 Refer to Fig. 11 for a block diagram of video-circuit functions. Signal flow is from left to right.

Input Sampling

3.14 The input from the computer consists of up to 484 ASCII-coded characters at either 1200 or 2400 bps. An ASCII-coded character consists of 7 information bits (for a maximum of 128 possible character codes) plus a parity bit. Since transmission is nonsynchronous, these eight bits are imbedded between a start pulse and a single or double stop pulse which keeps sending and receiving clocks in synchronism on a character-by-character basis. The serial bit stream is sampled by the input sample clock and entered into the input shift register. When the clock control logic indicates that the seven significant bits of a character are present, the character is transferred in parallel into a 7-bit character buffer register for eventual entry into the frame store. Meanwhile, the input shift register is free to assemble a subsequent character. The input sampling clock, which is restarted on each new character start pulse, is sufficiently accurate to permit operation with up to 40 percent distortion in the incoming data.

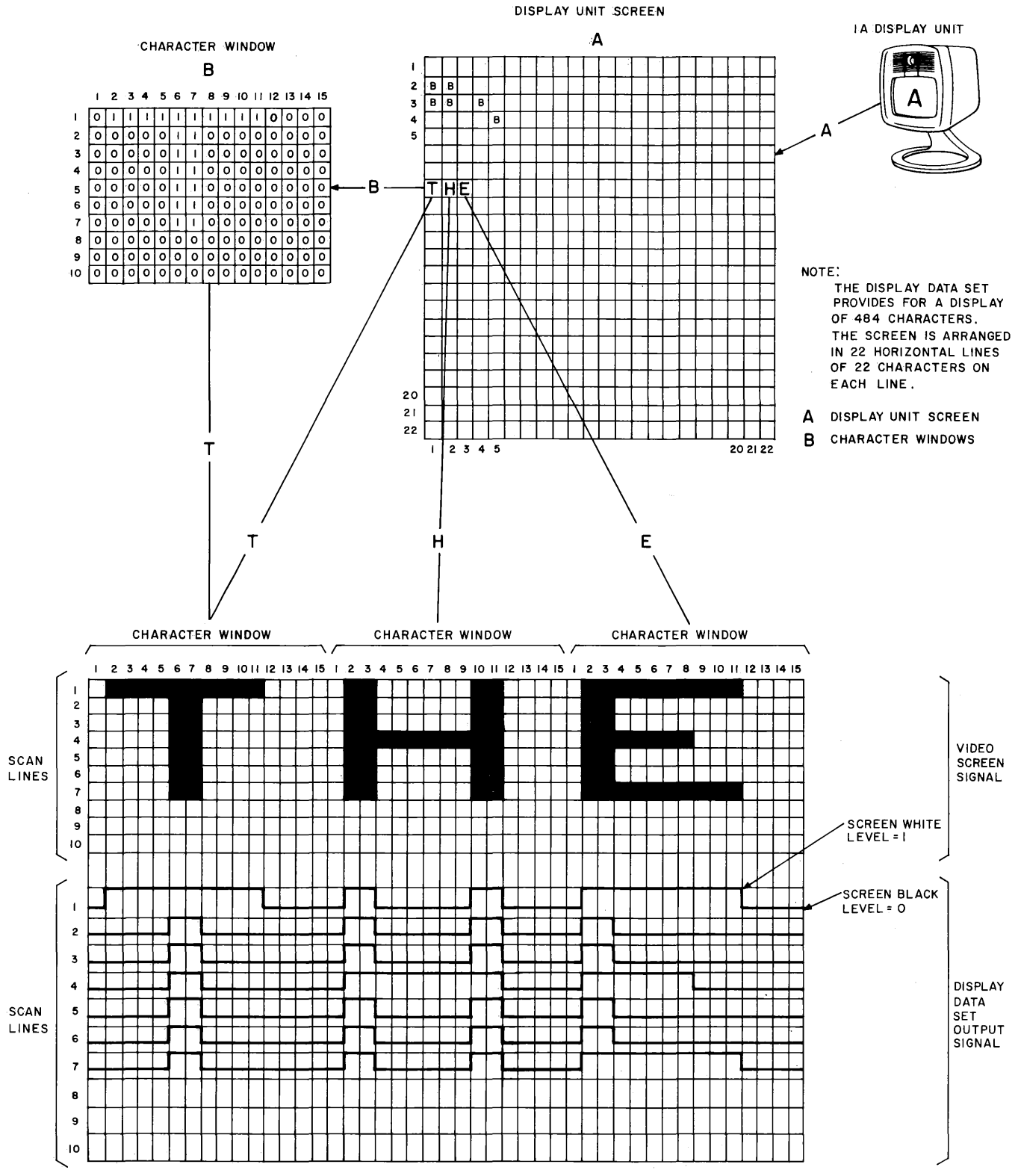


Fig. 9—Character Generation Technique

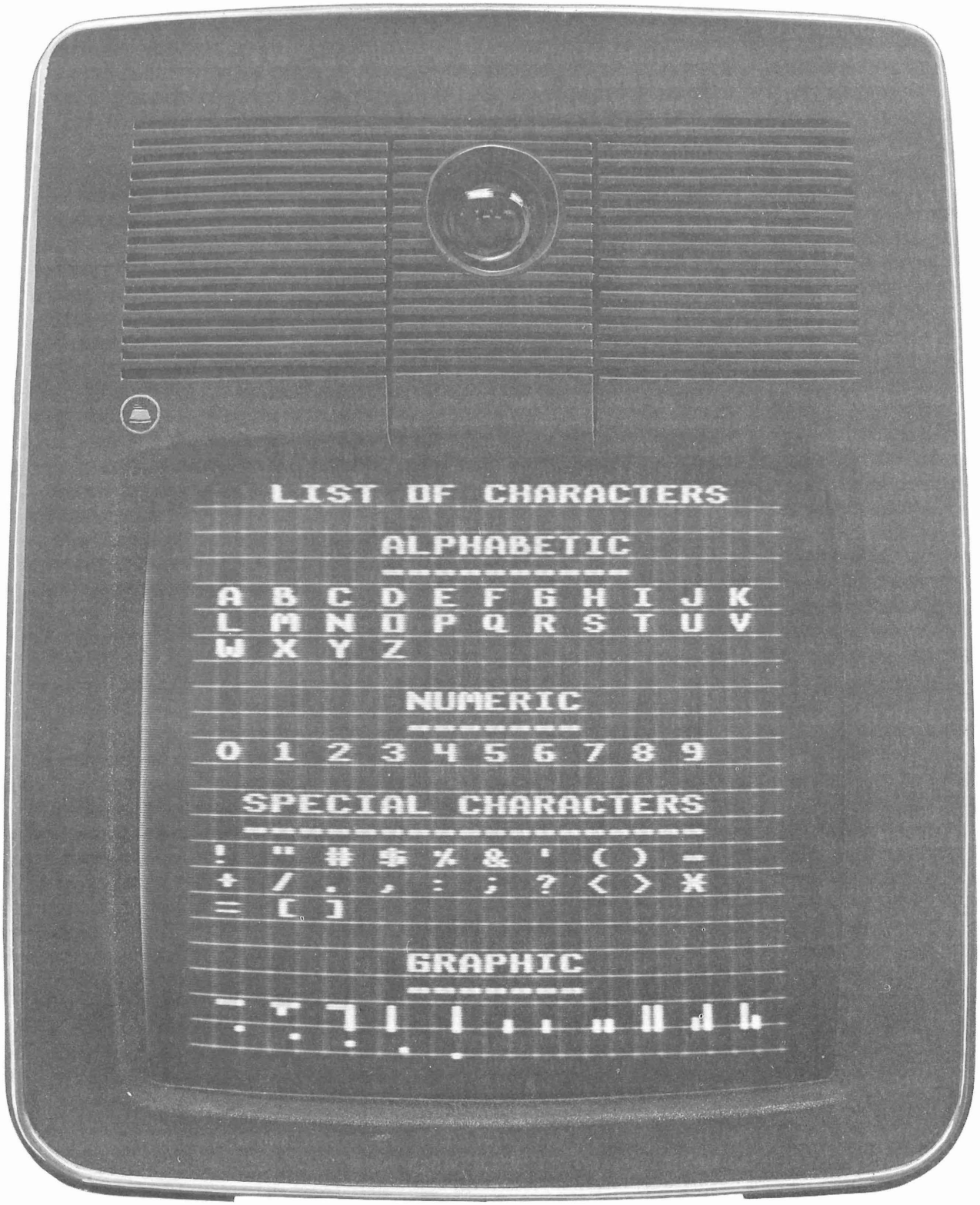


Fig. 10—Character Repertoire

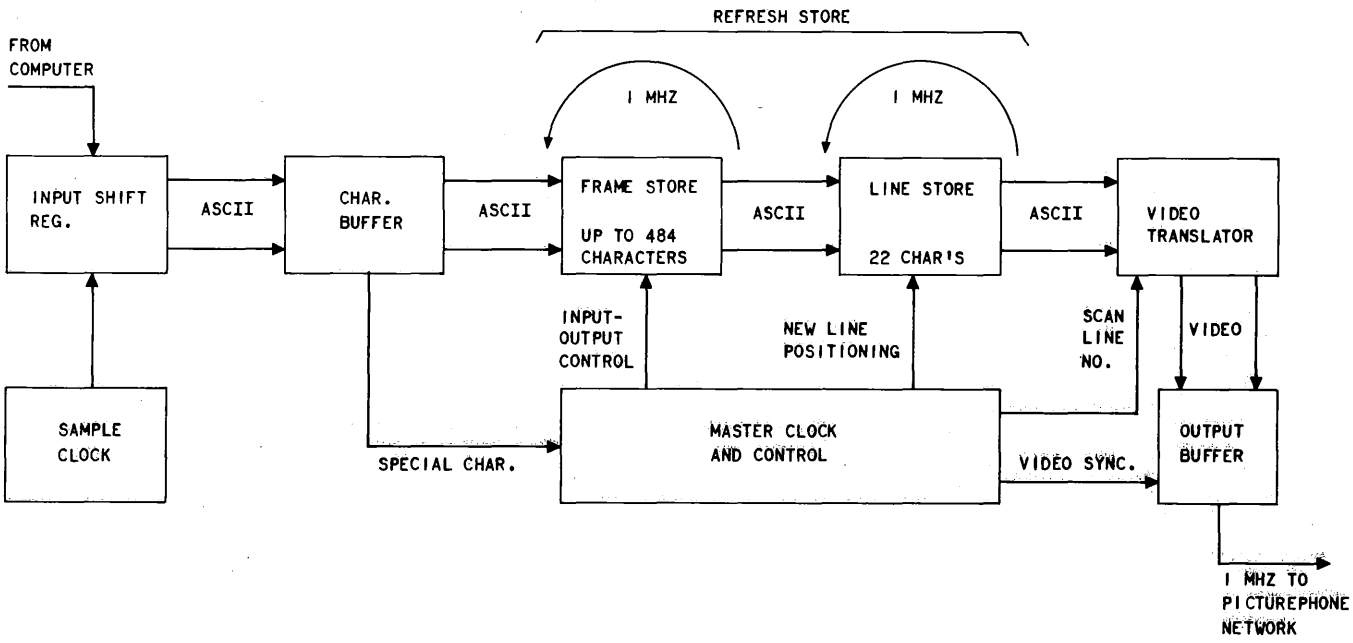


Fig. 11—Computer-to-Station Functional Block Diagram

Frame Store

3.15 The frame store represents the bulk of the Refresh Memory function:

(a) The frame store consists of nine 484-bit shift registers all driven by the same master clock, that is, all shift registers advance information in unison. Seven of the registers are used to store 7-bit ASCII characters in parallel. That is, each register position holds one significant bit of the character stored, the eighth register contains a flag bit that marks the position of the last character received from the computer, while the ninth is used for dump control. Though the store is capable of holding up to 484 characters, the maximum guaranteed number of characters that can be displayed on the PICTUREPHONE station screen is 440: 20 lines of 22 characters per line. The top and bottom lines may not be completely visible due to drift of the PICTUREPHONE set and, therefore, are not recommended for use.

Note: When the display is going to include only 440 characters, the computer program must compensate for the absence of these lines.

(b) The frame store shift registers are connected tail-to-head so that once information is entered, it can be recirculated indefinitely until replaced by new information.

(c) The frame store must serve two demands. When a character is present in the input buffer, the store must rotate the next available character position (as marked by the flag in the eighth shift register) to the input position to accept that character before it is supplanted by another input character. Similarly, when the line store to which it connects demands the next group of characters to be displayed, the frame store must be in position to serve that request. The store can be looked upon as a circular track with an entrance and an exit gate. The gates are controlled so that characters entering from the input are placed at the spot marked by the flag in the frame store; characters leaving are removed from the head of the train.

(d) A single control character (ASCII:RS) received from the computer will erase the stored train of characters in preparation for a new display message. Because of the independent input and output demands on the store, the store clock drives the store at a 1 mHz rate.

Line Store

3.16 Recalling the introduction to this section, each line of characters appearing on the video screen is drawn by a number of sequential scan lines under control of the video translator. Each line of characters must be presented a number of times to the translator before the next line of characters can be drawn. The line store serves to store the line of characters currently being drawn. There are 22 character "windows" on a line; therefore, each line store holds 22 characters. It is connected head-to-tail just as the frame store, so that a train of 22 characters will continue to travel around the store until replaced by a new train. Each character in the train is presented sequentially to the video translator again and again until the translator has completed drawing one field of that line of characters. Then the control circuitry arranges for the subsequent line of 22 characters to be read from the frame store into the line store and the process is repeated. When all 22 lines of characters are drawn, the process begins again at line one to draw the second field.

ASCII-to-Video Translation

3.17 The video translator produces the pattern of white and black segments which appear as characters on the video screen. Its output is a binary "word" with the two possible levels representing white and black, respectively. The translator produces this output under control of an input consisting of an ASCII-coded character from the line store and a control signal indicating which scan line of the seven possible is currently traversing the screen.

> *Note:* Alphanumeric characters use a maximum of seven scan lines where a graphic character uses a maximum of ten scan lines.

An alphanumeric character is drawn in a matrix 12 bits wide by 7 scan lines high (graph characters 14 bits by 10 scan lines). The 15th bit is always used for spacing and, in the case of alphanumeric characters, the 13th, 14th, and 15th are used for spacing. Refer again to Fig. 9. The video translator is, in reality, a read-only memory in which are stored 12-bit words representing required black-white patterns. These words are selected by an address consisting of six bits of the 7-bit ASCII character to be translated and a 3-bit scan line identifier. The read-only memory contains all of the possible bit patterns for the alphanumeric symbol set to be drawn, that is, seven 12-bit words are stored for each character to be displayed. Graph characters are created by combinational logic and "OR'd" with the memory output.

Video Buffering

3.18 The 14-bit video word appears at the output of the video translator in parallel. This word is entered into either of two alternating feed shift registers in the buffer. The shift register shifts the word serially to the line by way of buffering amplifiers which set the signal levels to PICTUREPHONE network standards.

Master Clock and Display Control

3.19 This contains the system clocks and circuitry for controlling the sequencing of the stores and translator. It also provides the video sync signals necessary to keep the distant video telephone in time-synchronism with the display. These sync signals are sent by way of the video buffer where they are brought together with the video information output so that, in effect, the output of the display data set appears no different from that of any video-telephone transmitter.

3.20 In those cases where the TOUCH-TONE dial is not adequate for input, an input device, eg keyboard, may be coupled to the station voice pair. The addition of the input device, together with the capability to exchange control signals between the station, display data set, and computer, will allow the input device to be used both for input and for editing displays stored in the display data set. This editing capability will be a function of the display data set; however, once a user has modified a display, he may have it transmitted to the computer.

C. Interface

PICTUREPHONE Network Interface

3.21 The display data set appears as a standard video-telephone station to the PICTUREPHONE network. A 939-type equalizer or 877-type equalizer is required as part of Display Data Set F-58167. Refer to Part 8 for a discussion of the different equalization configurations. The connections appear on a standard 25-pair connector conforming to key telephone installation procedures.

Computer Interface

3.22 In the local case, the interface toward the computer conforms electrically to the practices described in EIA Standard RS-232-C. In accordance with this practice, the display data set should be installed within 50 cable feet of a computer port.

3.23 In the remote case, the interface toward the computer conforms electrically to the practices described in EIA Standard RS-232-A. In accordance with this practice, DS 202D3 should be installed within 50 cable feet of the computer port.

4. INSTALLATION

GENERAL

4.01 There are presently two types of station arrangements, ie, exchange/PBX and intercom. The installation procedures for these station arrangements are described in the following paragraphs.

4.02 Data Set 403E5 is recommended for all installations. Data Set 403E2 can be used on exchange/PBX station arrangements without modification; however, if DS 403E2 is to be used on intercom-type station arrangements, it must be modified. DS 403E2 can be used in place of DS 403E5 by replacing CP AR253 with CP AR429. If CP AR429 is not available, then the modification is made by installing hard wire straps between pins 21 and 23 and between pins 33 and 34 on CP AR253 connector J3.

4.03 Display Data Set F-58167 shall be installed in conformance with existing practices covering installation of station sets.

4.04 The set must be located within range of the interface connector cord supplied by the customer. This cord should not exceed 50 feet. If the distance from the computer to the display data set is greater than 50 feet, two DSs 202D3 should be used. The distance between the computer and the associated DS 202D3 should not be over 50 feet (see RS-232-A).

4.05 The customer must furnish 3-wire outlets (to accept a plug with two parallel blades and a U-shaped grounding pin). The outlet should not be under control of a switch.

To ensure that the data set and the business machine grounds are at the same potential, the data set should be served from the same ac service cabinet as the business machine. If this condition does not exist, a test using the 6A impulse counter should be made to detect noise. This test procedure is described in 7.24.

4.06 The customer must provide and maintain a room temperature of 40° to 120°F for proper operation of the data set. If DS 202D3 is required, minimum temperature is 50°F.

4.07 In the case of exchange/PBX arrangement, verify with local test center that loop facilities have been tested and meet transmission requirements specified in Sections 340-200-501, 340-200-505, and 340-200-507. In the case of an intercom arrangement, there is no local test center.

4.08 Refer to Part 8 for installation of the equalizer.

CARD INSERTION

4.09 The separately packed AR cards are inserted in accordance with either Fig. 12 or 13.

Power should be off when cards are initially inserted; however, the power does not have to be disconnected when changing single cards except for L123273. Do not remove this card with power ON.

These cards contain integrated circuitry. Care should be taken not to place undue pressure on the components when handling the cards.

In later models of Display Data Set F-58167, card L106337 is replaced by L129176, card L123275 by L129177, and card L123277 by L123277-2. These changes do not affect the functioning of the display data set; however, they must be implemented entirely or not at all.

4.10 When all cards have been inserted, interconnection with the associated DS 403E5 is made in accordance with either Fig. 14, 15, 16,

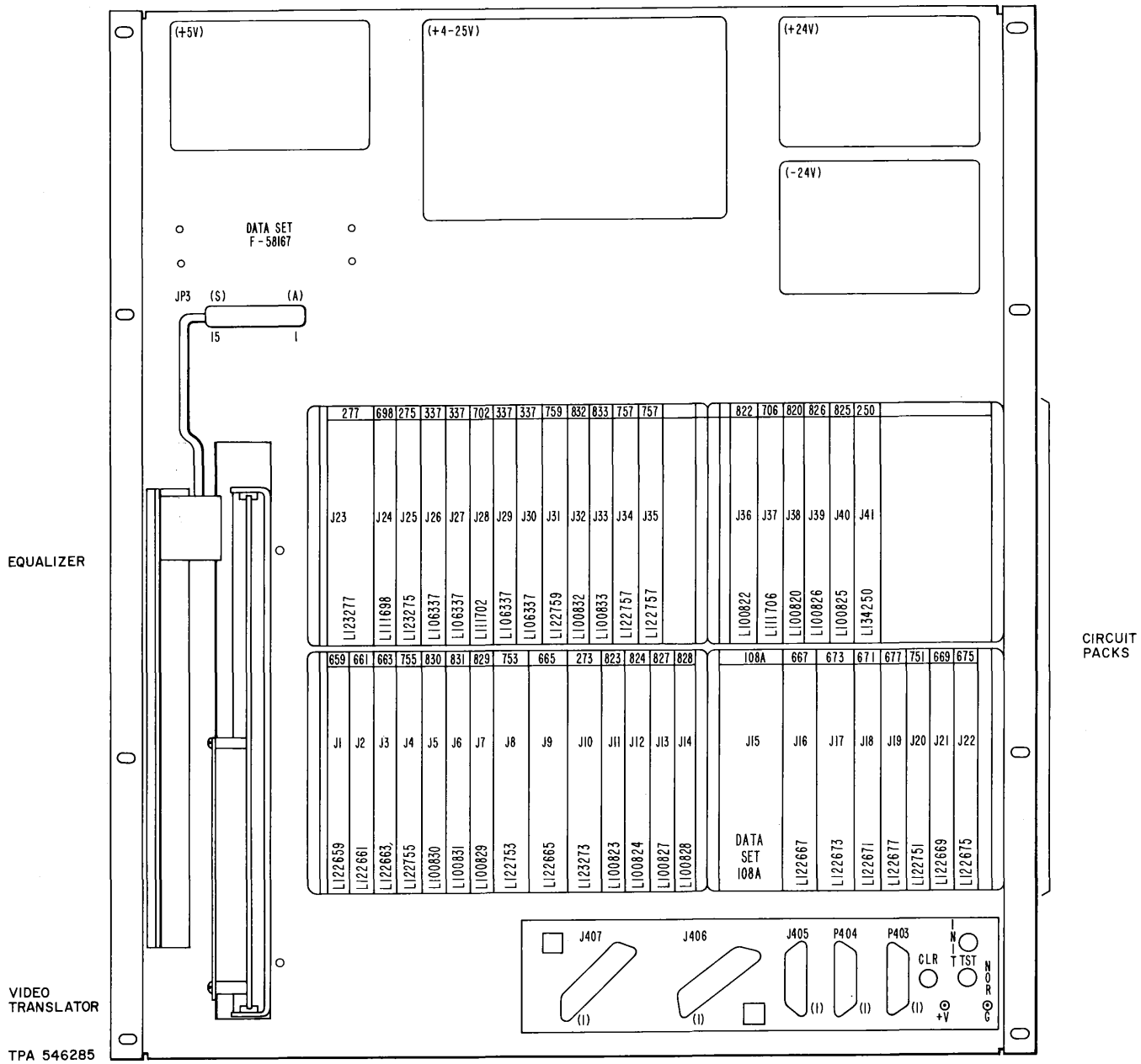


Fig. 12—Circuit Pack Arrangement

or 17 and ac power is connected to both Display Data Set F-58167 and DS 403E5.

INTERFACE CONNECTIONS

4.11 The station interface connections are shown by Fig. 14, 15, 16, and 17.

(a) ***Video Interface:*** The video interface is the same whether DS 202D3 is required or not. Connection to the PICTUREPHONE loop is via a 25-pair connector (J406) compatible with an A25C cable connector. The PICTUREPHONE network connections are made with these pairs:

- ***COT*** and ***COR***—Central office T & R for the audio loop
- ***VIT*** and ***VIR***—Video incoming T & R for incoming video lines

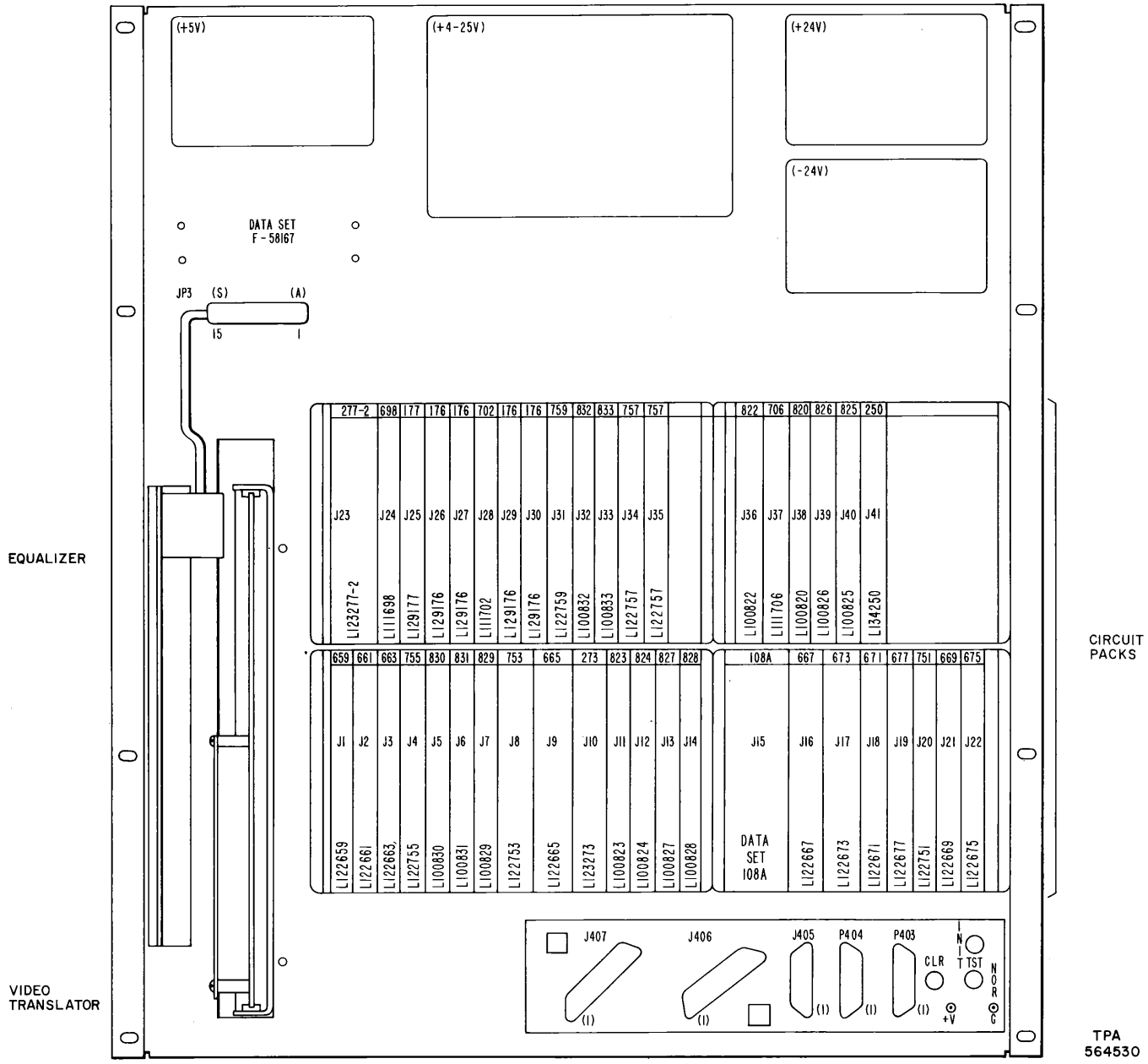


Fig. 13—Circuit Pack Arrangement

- ***VOT*** and ***VOR***—Video outgoing T & R for outgoing (from display data set) video line.
- ***A***—Station A Lead Control—Off hook.
- ***A1***—Station A1 lead control ground.
- ***SB***—Station Busy—Supplies ground when the station is receiving video.

(b) ***Data Set 403E5 Interface:*** The DS 403E5 interface is the same if DS 202D3 is provided or not, except for ring indicator (RI). The RI

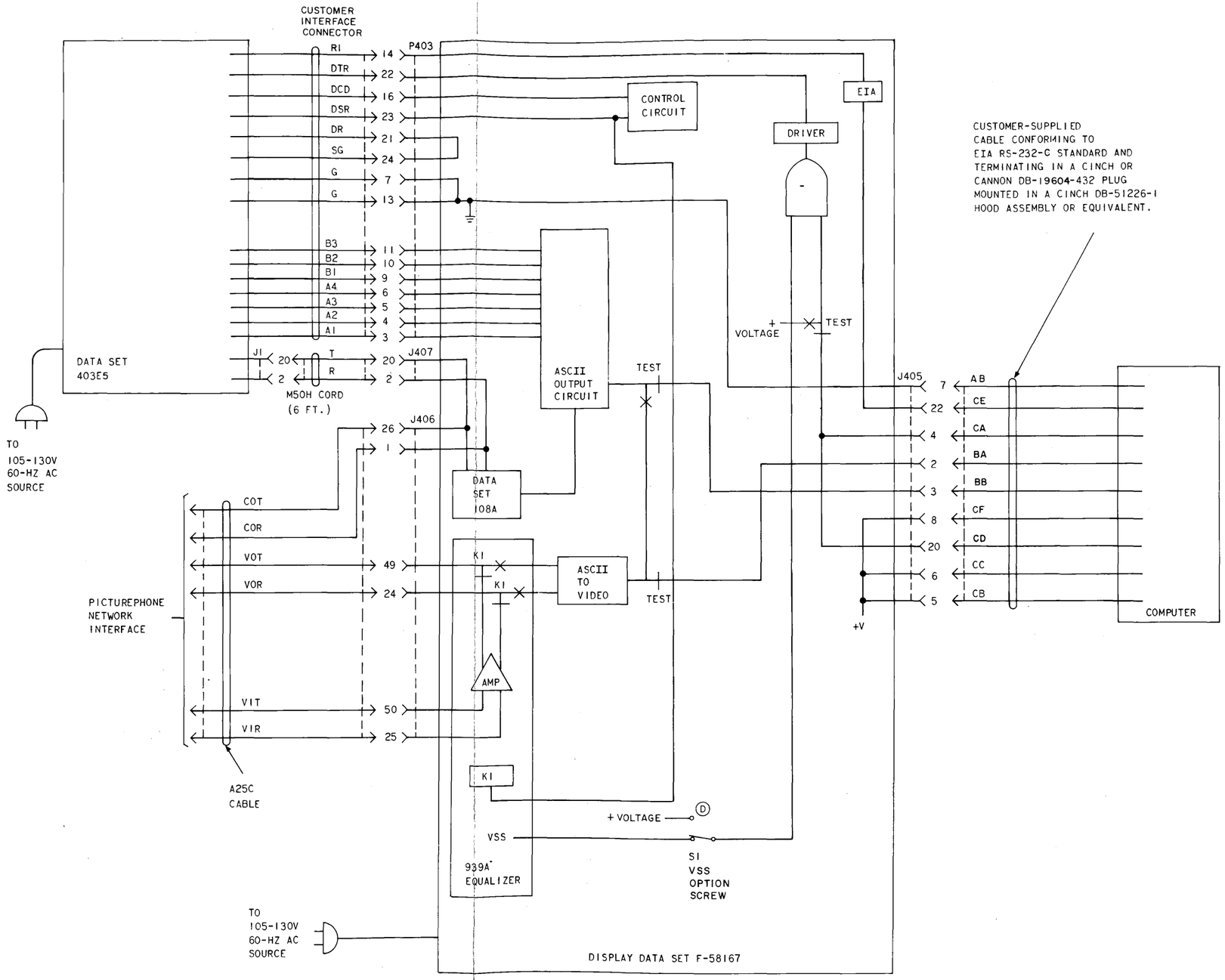


Fig. 14—Display Data Set F-58167 and Data Set 403E5—Connection Diagram (Within 50 Feet of the Computer and for Exchange/PBX Connection)

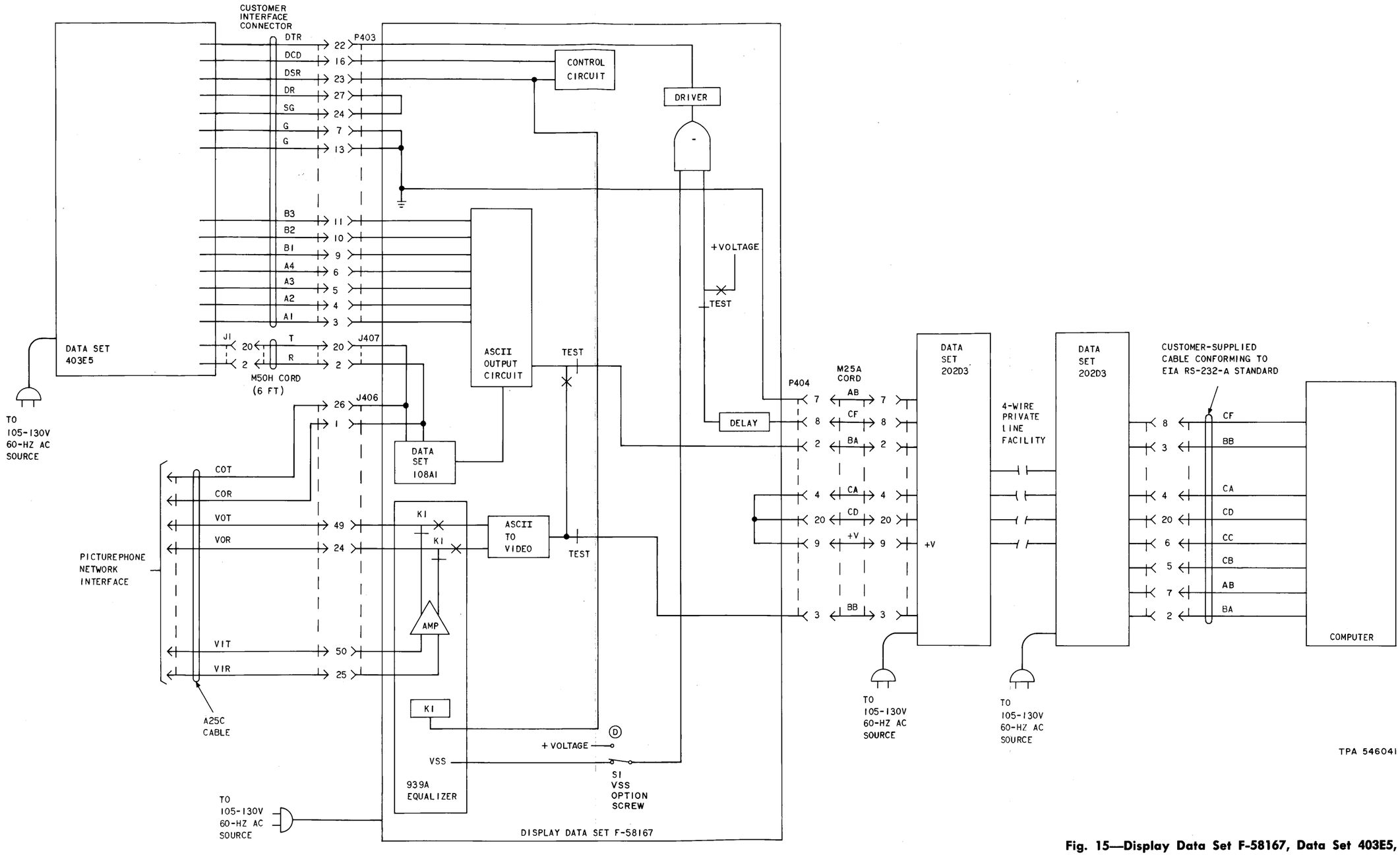


Fig. 15—Display Data Set F-58167, Data Set 403E5, and Data Set 202D3—Connection Diagram (More Than 50 Feet From Computer and for Exchange/PBX Connection)

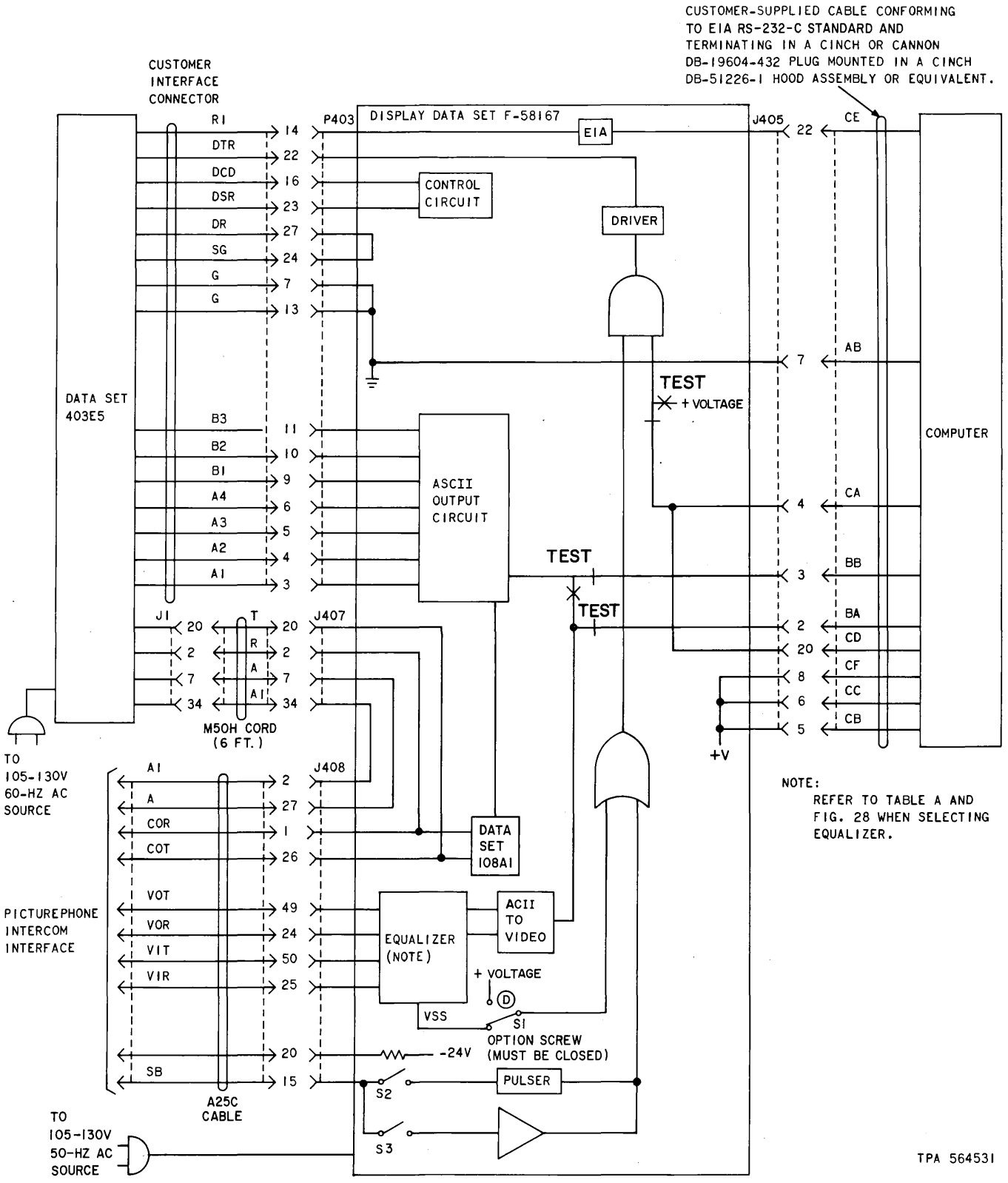


Fig. 16—Display Data Set F-58167, Data Set 403E5 (Less Than 50 Feet From the Computer—Intercom Arrangement) Connection Diagram

feature is not used when DS 202D3 is provided. The connection to DS 403E5 is via a 25-pin connector (P403) compatible with an M25A-61 cable connector and a 50-pin connector (J407) compatible with an M50H cord. The following is a brief description of the interconnecting lead designations:

Note: T, R, A, A1 connection is provided by the 50-pin display data set interface connector J1. The remaining DS 403E5 connections are provided by DS 403E5 customer interface cord.

- ***A***—Station A Lead Control—Off hook.
- ***A1***—Station A1 lead control ground.
- ***T*** and ***R***—Central office tip and ring for the audio loop.
- ***RI***—Ring Indicator—A ground on this lead indicates to the computer via the EIA circuit and CE lead that a ringing signal is being received from a remote station.
- ***DTR***—Data Terminal Ready—Ground signal supplied from the display data set to DS 403E5 indicating that the computer is ready to transmit and receive data.
- ***DSR***—Data Set Ready—A ground signal from DS 403E5 to the display data set which causes the loop-back to be disabled and a start character to be sent to the computer when all conditions are met for transmission.
- ***DCD***—Data Carrier Detector—Provides a ground to the control circuits when DS 403E5 detects incoming data.
- ***DR***—Data Received—This lead must be grounded to enable DS 403E5 to receive data. In this application, this lead is permanently grounded.
- ***SG***—Signal Ground—Data set power supply ground.
- ***A1***—A1 Data Output Terminal—Gives contact closure to pin 7.
- ***A2***—A2 Data Output Terminal—Gives contact closure to pin 7.
- ***A3***—A3 Data Output Terminal—Gives contact closure to pin 7.
- ***A4***—A4 Data Output Terminal—Gives contact closure to pin 7.
- ***A Common***—A channel common data output terminal (pin 7).
- ***B1***—B1 Data Output Terminal—Gives contact closure to pin 13.
- ***B2***—B2 Data Output Terminal—Gives contact closure to pin 13.
- ***B3***—B3 Data Output Terminal—Gives contact closure to pin 13.
- ***B Common***—B channel common data output terminal (pin 13).

(c) ***Computer Interface:*** The connection to the computer is via a 25-pin connector (J405) compatible with a KS-19196-L2 cable connector. The following is a brief description of the interconnecting lead designations:

- ***CA***—Request to Send—This lead is wired to the CD lead. The computer places an ON (high) signal on this lead when it is ready to answer a call. An OFF condition terminates the call.
- ***CB***—Clear to Send—(In this application, leads CB, CC, and CF are tied together and are strapped to + voltage.) Signals the computer that the display data set is powered.
- ***CC***—Data Set Ready—This lead is wired to the CB lead.
- ***CD***—Data Terminal Ready—This lead is wired to the CA lead.
- ***CE***—Ring Indicator—Signals the computer that an incoming call is being received.
- ***CF***—Data Carrier Detector—This lead is wired to the CB lead.
- ***BA***—Transmitted Data—Customer data presented to data set.

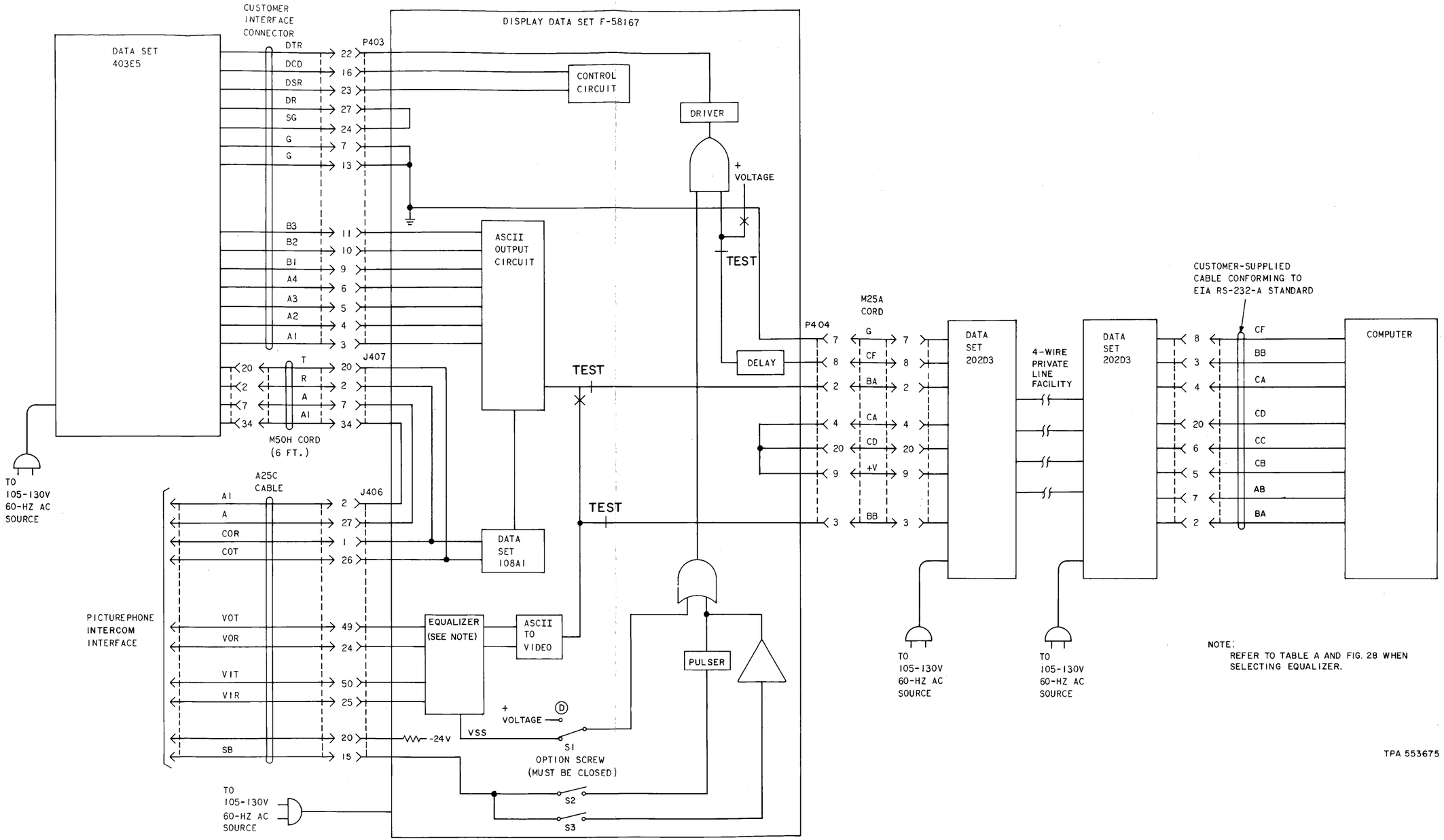


Fig. 17—Display Data Set F-58167, Data Set 403E5, and Data Set 202D3 (More Than 50 Feet From the Computer—Intercom Arrangement) Connection Diagram

- ***BB***—Received Data—Data output presented to computer.

(d) ***Data Set 202D3 Interface:*** The connection to Data Set 202D3 is via a 25-pin connector (P404) compatible with a KS-19196-L2 cable connector. The following is a brief description of the interconnecting lead designations:

- ***CA***—Request to Send—The display data set places an ON (high) signal on this lead when power is applied. This turns on DS 202D3 carrier toward the computer.

- ***CB***—Clear to Send—Not used.

- ***CC***—Data Set Ready—Not used.

- ***CD***—Data Terminal Ready—An ON signal on this lead places DS 202D3 in the data mode. CD is ON (high) any time power is applied.

- ***CF***—Data Carrier Detector—An ON signal on this lead indicates that DS 202D3 is receiving carrier. This lead must be ON (high) for the display data set to answer and maintain an incoming call.

- ***BA***—Transmitted Data—Display data set output data presented to DS 202D3.

- ***BB***—Received Data—DS 202D3 receive data presented to the display data set.

5. OPTIONS

5.01 Certain options are required for the different pieces of equipment in this station arrangement. Other options are determined by the customer's preference. The following is a description of the options that are required for this type station arrangement.

5.02 ***Display Data Set F-58167 Options:*** The following options are available in Display Data Set F-58167:

- ***Option A***—Incoming Data Speed—Close option screws S1.0A and S1.0B on circuit pack L122665 for incoming data speed of 1200 bps from the computer. Open both option screws for incoming data speed of 2400 bps. Always close S1.1A and S1.1B on L122667 for any keyboard operation.

- ***Option B***—Outgoing Data Speed—Close option screws S1.1A and S1.1B on circuit pack L122665 and close S1.0A and S1.0B on L122667 for outgoing data speed of 1200 bps from display data set to the computer. Open option screws S1.1A and S1.1B on circuit pack L122665, and open S1.0A and S1.0B on L122667 for outgoing data speed of 2400 bps.

Note: Options A and B must be for the same speed for the loop-back test to operate properly. Factory-wired for 1200 bps.

- ***Option C***—Clear Screen on Hang-Up—When provided, clears contents of refresher store when call is terminated. To provide this option, open option screw S1B and close option screw S1A on circuit pack L122759. When not provided, close S1B and open S1A. The last display will remain visible until changed by the computer. Factory-provided.

- ***Option D***—VSS Supervision—When provided, call supervision is controlled by the video supervisory signal (VSS). The call will not be answered unless VSS is present and will terminate if VSS disappears. Refer to Table A—VSS Supervision Option—for the option screw conditions and required equalizer to install this option.

5.03 ***Data Set 403E-Type Options:*** Data Set 403E-type is described in Section 594-026-ZZZ.

(a) Following is a list of options required in the exchange-type installation: A, N, R, T, W, Y, and ZC.

(b) Following is a list of the options and strapping required in the intercom-type installation:

- Options required—A, N, R, T, W, and Y.

- Strap in a combination of options ZA and ZB on CP AR250: 1-2, 8-9, 12-13, 15-16, 30-31, 39-40, 47-48.

- Strap 15 to 24 on TB1.

TABLE A

VSS SUPERVISION OPTION

STATION ARRANGEMENT	VSS SUPERVISION	CIRCUIT PACK	OPEN	CLOSE	EQUALIZER
Intercom	Provided	L134250	S1	S2	939A
		L123277	—	S1	
	Not Provided	L134250	S2	S1	939B or 877-Type
		L123277	—	S1	
Exchange/PBX	Provided	L134250	S1 and S2	—	939A
		L123277	—	S1	
	Not Provided	L134250	S1	S2	939A
		L123277	S1	—	

5.04 ***Data Set 108A Options:*** Data Set 108A should provide the following options:

- Screw switch D desensitizing pad strapping for 7.1 or greater (See Table B of Section 591-023-201.)
- Hybrid network strapping for loop impedance of 900 ohms. (See Table D of Section 591-023-201.)

5.05 ***Data Set 202D3 Options:*** Data Set 202D3 is described in Section 592-016-ZZZ, Issue 4 or later. Following is a list of options required in this installation: A, E, N, S, V, X, Y, ZB, ZE, ZH, ZJ, and either G, H, J, or K as required; also either Z or RL as required.

6. OPERATION

GENERAL

6.01 To place a call to the computer, a PICTUREPHONE user dials a number associated with the computer just as he would dial another PICTUREPHONE user. The display data station detects the incoming call, alerts the computer, and answers the call if the computer is ready to accept the call. The display data station is now in a condition in which it functions as a signal converter between the user and computer. This condition persists until the call is terminated.

6.02 The user can now use the TOUCH-TONE dial as an input device. As digits are keyed, they are received by the display data set, converted to ASCII characters, and sent to the computer. The computer responds to inquiries by sending ASCII characters to the display data set. The display data set stores the characters from the computer, converts them to video format, and transmits them to the PICTUREPHONE station as required to refresh the display. The display data set stores the received characters in its memory until they are erased or changed by either the computer or station.

6.03 In those cases where the TOUCH-TONE dial is not adequate for input, an input device, eg keyboard, may be coupled to the station voice pair. The addition of the input device, together with the capability to exchange control signals between the station, display data set, and computer, allows the input device to be used both for input and for editing displays stored in the display data set. This editing capability is a function of the display data set; however, once a user has modified a display, he may have it transmitted to the computer.

6.04 The call may be terminated by either the computer causing leads CA or CD to go low to the display data set or by the user hanging up provided the VSS supervision option is used. In the latter case, the display data set detects loss of VSS, sends an end-of-call signal to the computer, and goes on-hook. If the VSS supervision option is not used, the call may not be terminated unless the computer terminates the call.

SYSTEM OPERATION WITHOUT DATA SETS 202D3

6.05 In this station arrangement, the computer interface is connected directly to the display data set via J405 (Fig. 14). The computer has the option of answering or not answering incoming PICTUREPHONE calls. When an incoming call occurs, ringing is detected by the DS 403E5. This provides a ground via the RI lead to the EIA circuit in the display data set. The EIA circuit converts this ground into an EIA voltage and provides an indication of ringing to the computer via interface lead CE. If the computer wishes to answer, an ON (high) signal is applied to the CA or CD leads (CA and CD are tied together by the display data set). If the computer does not wish to answer, interface leads CA and CD will be OFF. The ON signal on the CA lead is compared with the video supervisory signal in a gate. When both the CA and VSS signals are present, the display data set provides a DTR ON signal to DS 403E5. (When VSS supervision is not used, the CA lead alone is sufficient to provide a DTR ON signal.) This enables DS 403E5. In this case, the DS 403E5 will automatically answer the incoming call and trip ringing. After sending about one-half second of answer tone (heard only on the exchange/PBX type station arrangement), the DS 403E5 data mode is established. Establishment of the data mode is indicated to the display data set by an ON signal on the DSR interface lead. The DSR ON signal is applied to the K1 relay of the 939A equalizer (if provided) and the control circuit. The video incoming pair (VIT and VIR) and the video outgoing pair (VOT and VOR) are tied together by the K1 relay of the 939A equalizer which is housed inside of the display data set. Relay K1 is usually de-energized and provides for video continuity testing. The DSR ON (low) signal operates relay K1. This disables the video continuity loop and enables the video transmission facilities. The DSR signal is also supplied to a control circuit which provides a start signal to the display data set. The display data set then sends the ASCII characters ENQ and ETX to the computer to indicate the start of a call. A list of all the hardware-generated and hardware-detected characters used by the system is provided in Tables B and C.

6.06 After the call has been established, TOUCH-TONE signals from the PICTUREPHONE station set are received by the DS 403E5, converted to ASCII by the display data set, and sent to the computer at optionally 1200 or 2400 bps via interface circuit BB. The presence of a received TOUCH-TONE digit is indicated on the DCD interface lead of DS 403E5. ASCII signals from the computer, also at 1200 or 2400 bps, pass via interface circuit BA to the ASCII-to-video portion of the display data set and then to the PICTUREPHONE station user via the video outgoing pair (VOT and VOR). The system can display 60 standard ASCII alphanumeric characters plus the 16 special graph characters shown in Fig. 18. The ASCII characters @ ^, —, and \ are not used and are displayed as spaces if transmitted.

6.07 The display data set provides for a display of 484 characters arranged in 22 lines of 22 characters each. However, the top and bottom lines are not guaranteed to be visible due to drifting in the PICTUREPHONE display unit. The user's display format should be altered to compensate for not using these lines. This can be done by filling the top line with 22 spacing characters or by sending a form feed (ASCII/FF) after clearing the screen. As mentioned previously, input devices may be optionally connected at the PICTUREPHONE station by means of a data set which transmits serial frequency shift-keying (FSK) signals at 110 baud. Upon instruction that the user wishes to switch to an input device, the computer sends DC1 to the display data set which places it in the keyboard mode. The DS 108A1 (used to detect FSK signals) is enabled causing F2 mark to be sent toward the station. The display data set then initiates a 10-second timing period. If return carrier is received before the end of the 10-second period, the display data set remains in the keyboard mode, and DC1 is sent to the computer. If carrier is not received within 10 seconds or at any subsequent time that carrier is lost, the display data set reverts to the normal TOUCH-TONE mode and informs the computer by sending DC3.

6.08 If a user wishes to edit, he must first enter the keyboard mode and obtain the computer

TABLE B

HARDWARE DETECTED CHARACTERS

DESIGNATION	FUNCTION	FROM COMPUTER	FROM AUX. KEYBOARD
BS	Move cursor one space to the left.	X	
DC1	Enter keyboard mode.	X	
DC2	Transmit contents of display data set memory to computer and disable the cursor.	X	
	Leave edit mode and send DC2 to computer.		X
FF	Move cursor down one line.	X	
HT	Move cursor one space to the right.	X	
LF	Move cursor to start of next line.	X	
RS	Clear screen.	X	
SUB	Enable cursor and enter edit mode.	X	
SYN	Fill character.	X	
VT	Move cursor up one line.	X	

TABLE C

HARDWARE GENERATED CHARACTERS

DESIGNATION	FUNCTION
DC1	Carrier received by DS 108A.
DC3	Carrier not received during 10-second timing interval by DS 108A or lost while in keyboard mode.
ENQ	Start of Call.
EOT	End of Call.
ETX	Final character in every message. ETX is appended to every character burst sent to the computer, even if the message is only one character.

file he wishes to edit. He then sends an edit request to the computer. Having verified the user's clearance to edit, the computer sends SUB to the display data set which places the set in the edit mode and enables the cursor. (The cursor is a blinking underline movable to any character position on the screen.) The user may then access the display data set's memory directly and edit the display. (Cursor control characters are listed in Table B.) Having completed editing a display, the user sends DC2 from his input device. This code is intercepted by the display data set which then sends a DC2 character to the computer and leaves the edit mode. The computer may then send DC2 back to the display data set causing it to transmit the contents of its memory to the computer and disable the cursor.

6.09 At any time, the computer may clear the screen by sending RS. After sending RS or cursor control characters FF, VT, or LF, the computer uses fill characters (SYN) to allow the display data set time to perform the specified operations. The required number of SYN characters depends on the control character and transmission speed, as shown in Table D.

6.10 If the computer wishes to terminate a call, it may do so by removing the ON signal on

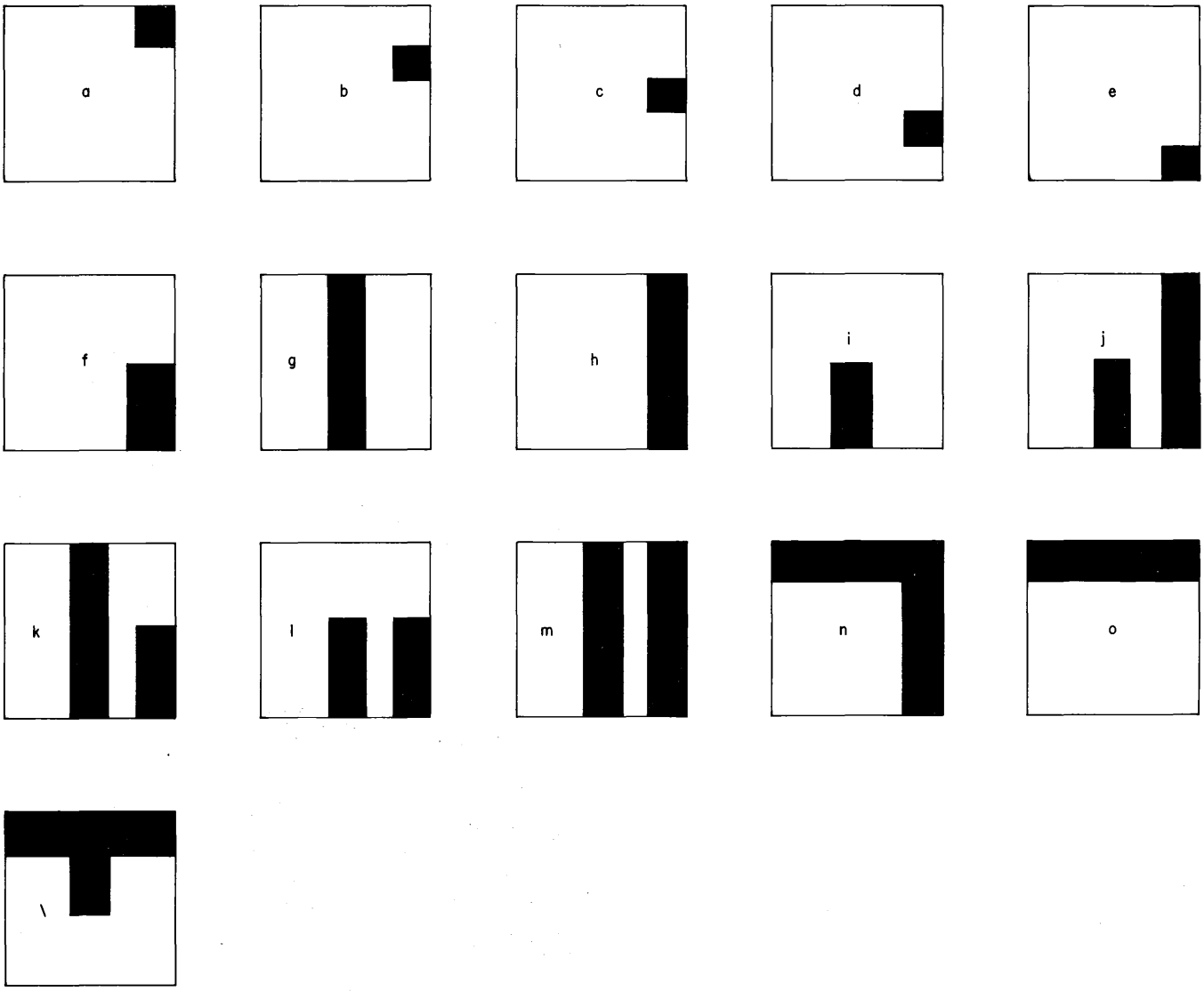


Fig. 18—Graph Characters

TABLE D

REQUIRED NUMBER OF FILL CHARACTERS

CONTROL CHARACTERS	1200 BPS	2400 BPS
RS	3 Req.	6 Req.
FF	3 Req.	6 Req.
VT	3 Req.	6 Req.
LF	40 Req.	80 Req.

CA/CD interface circuit. The DS 403E5 then goes on-hook, and the display data set sends EOT to the computer. If the station user wishes to terminate the call, he should signal the computer, which should disconnect as described above. If VSS supervision is used, the disconnect can be effected by the station user simply hanging up.

Note: If VSS supervision is not used and the station user simply hangs up, central office supervision may not be detected by the DS 403E5, and a permanent signal condition may result. In the case of the intercom station arrangement, the intercom will remain disabled until the call is cleared by the computer.

6.11 Computer interface circuits CF, CB, and CC have an ON signal on them any time power is applied to the display data set.

SYSTEM OPERATION WITH DATA SETS 202D3

6.12 Operation with Data Sets 202D3 is similar to operation without them. When Data Sets 202D3 are provided, the computer interfaces with the DS 202D3 at its location. Operation with the DS 202D3 is different in the following respects:

(a) No ringing indication is provided and interface circuit CE is not used.

(b) Interface circuit CD must be high at all times. Interface circuit CA is used to indicate whether or not the computer wishes to answer incoming calls. If the computer wishes to answer, circuit CA is ON, which turns on DS 202D3 carrier toward the display data set. Presence of this carrier is detected by the DS 202D3 at the display data set location and used to enable the DTR interface circuit of DS 403E5, which in turn permits automatic answering of the incoming call.

(c) Only 1200-bps transmission is allowed.

(d) Interface circuit CF being ON indicates presence of received carrier from the DS 202D3 at the display data set. If the display data set and both Data Sets 202D3 are prepared for data transmission, circuits CC and CB will also be ON.

SYSTEM OPERATION SEQUENCE

6.13 Tables E, F, G, and H provide a summary of the operational sequences described in 6.01 through 6.12.

7. MAINTENANCE

LOOP TEST

7.01 The overall design of the display data set has been predicated on the concept that both the remote routine installation testing and the remote trouble-isolating maintenance testing that will be required to provide reliable computer access service can be adequately performed from a standard PICTUREPHONE test desk position (or another PICTUREPHONE station on intercom) that is equipped with a normal PICTUREPHONE station set and has access to PICTUREPHONE loops. In support of this approach, the display data set design incorporates the necessary circuitry from a station service unit so the video loop to the display data set can be tested from a test desk (or by another PICTUREPHONE station on intercom) in the same manner as for a regular PICTUREPHONE station. See test point A, Figure 19.

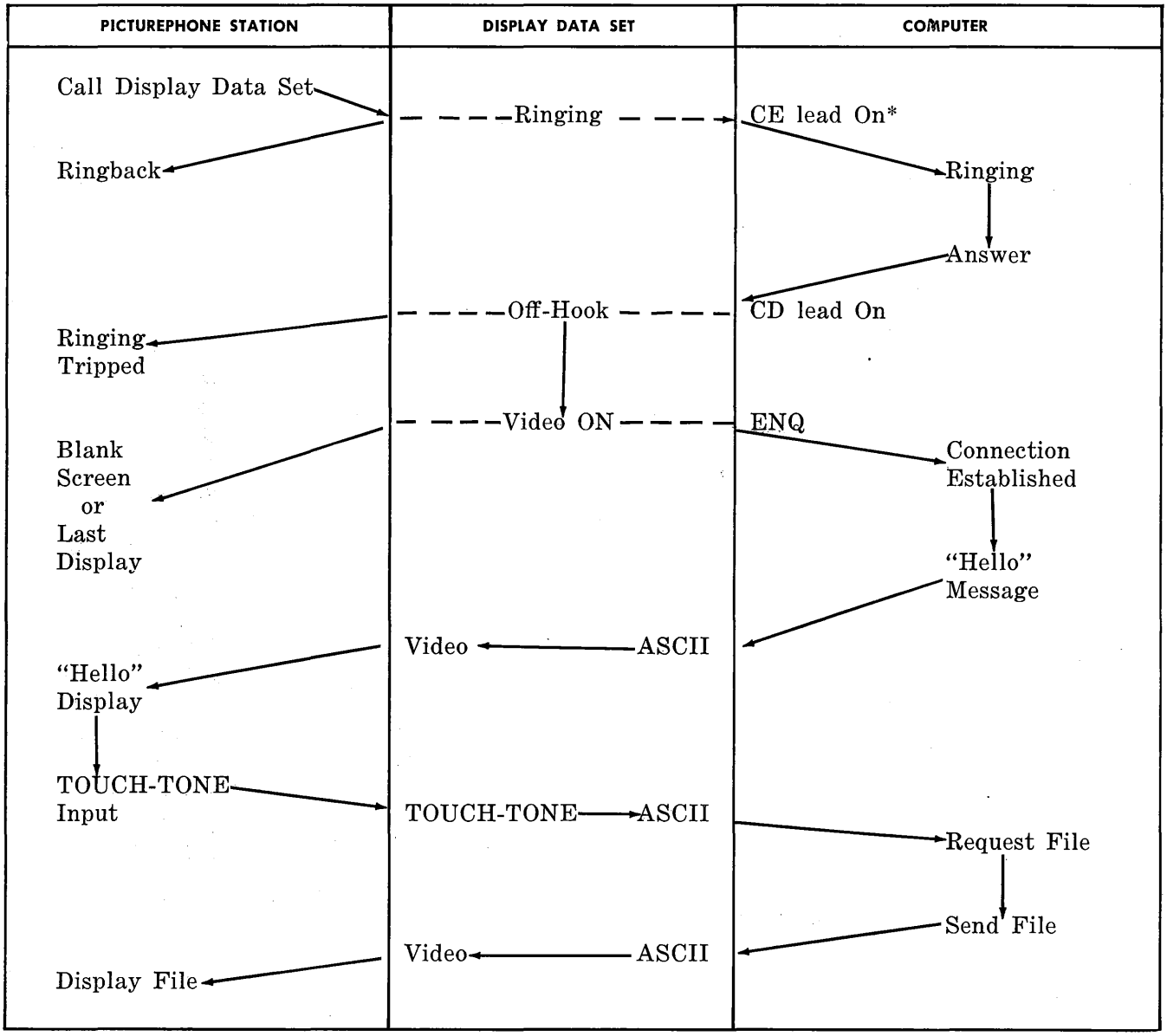
7.02 In addition, as a means for testing display data set operation and isolating system troubles, the display data set has been designed to include a test feature (see test point B, Figure 19). When exercised, this display data set test feature divorces the display data set from the computer (or the DS 202-type) and connects the input/output leads of the display data set together so that TOUCH-TONE signals received from a PICTUREPHONE station are converted to ASCII, looped back to the display data set memory, and displayed on the video screen at the station. It is thus possible for the person conducting the test to key signals from his TOUCH-TONE dial and see them displayed on the screen of his PICTUREPHONE station set. This tests most of the basic functions of the display data set, as well as the loop connections via the PICTUREPHONE network. (Refer to Fig. 14, 15, 16, or 17.)

7.03 This display data set test is obtained by the operation of a key that is located on the display data set unit. When the display data set is located on the customer's premises, the customer will be asked to cooperate and to operate the key upon request. After the key is operated, the person conducting the test can call the display data set without alerting the computer to an incoming call.

7.04 When a voiceband data link (using Data Sets 202-type) is employed to connect the display data set to the computer, there is also a test feature provided with the DS 202D3 at the computer site that permits a similar remote test to be made of the display data set plus the entire voiceband data link. (See test point C, Figure 19.) When exercised, this DS 202D3 test feature divorces the DS 202D3 from the computer and connects the input/output leads of the DS 202D3 together so that signals received from the display data set are looped right back to the display data set memory over the voiceband facility. Thus, it is possible for the person conducting the test to

TABLE E

TYPICAL CALL — ESTABLISHMENT — SEQUENCE CHART



* Local arrangement only.

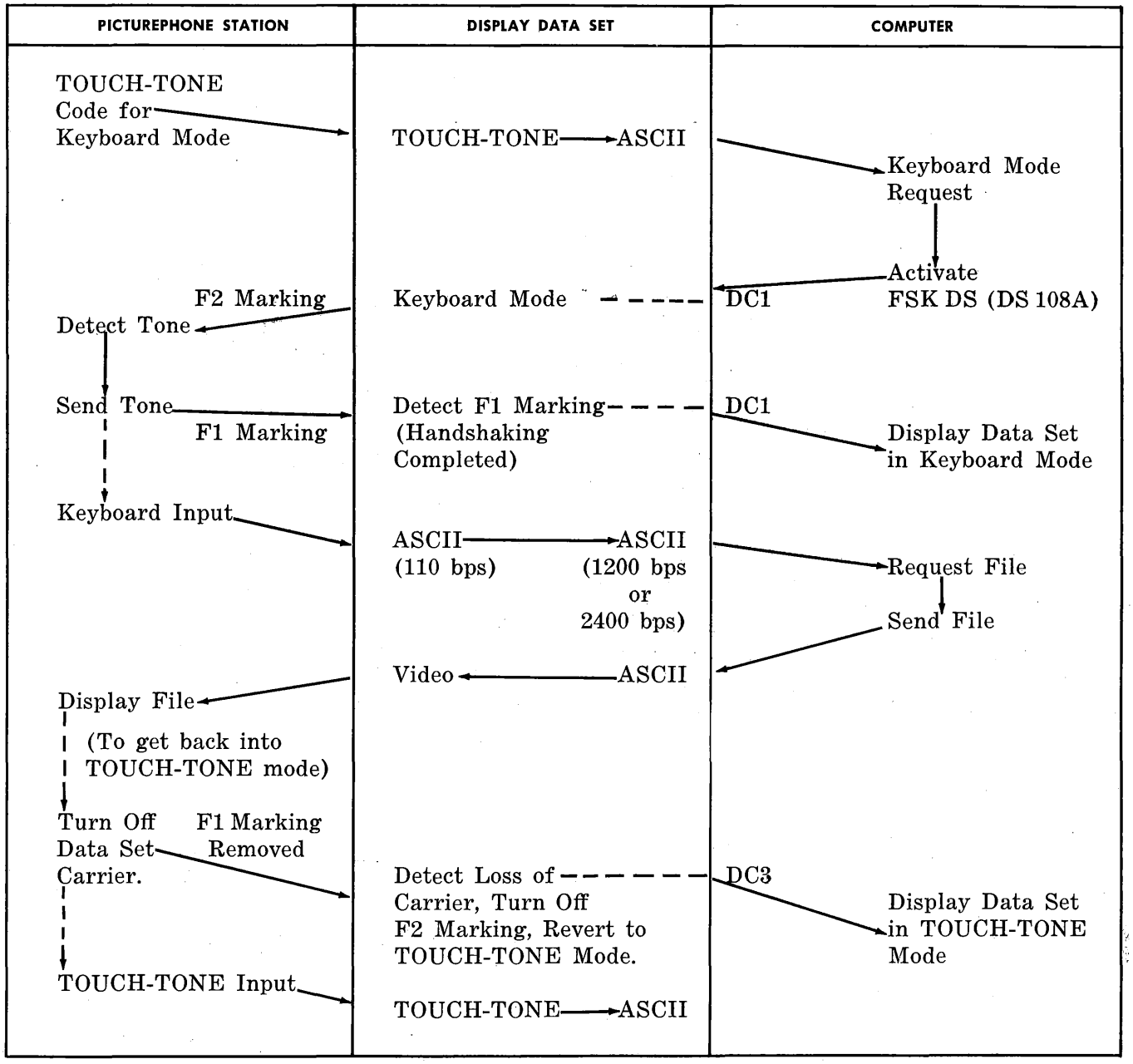
key signals from his TOUCH-TONE dial and see them displayed on the screen of his PICTUREPHONE station set. This tests the entire voiceband data link, including both 202-type data sets, as well as most of the basic functions of the display data set operation itself.

7.05 This DS 202D3 test is obtained by the operation of a key that is located on the DS 202D3 unit. The customer will be asked to cooperate and to operate the key upon request. After the key is operated, the person conducting the test can call the display data set without alerting the computer to an incoming call. Use of these test features will facilitate system trouble isolation to either the computer, the display data set, the display data set loop, or the voiceband data link.

7.06 When a trouble is isolated to the voiceband data link, the private line telephone testboard (through which the data link is routed) should be

TABLE F

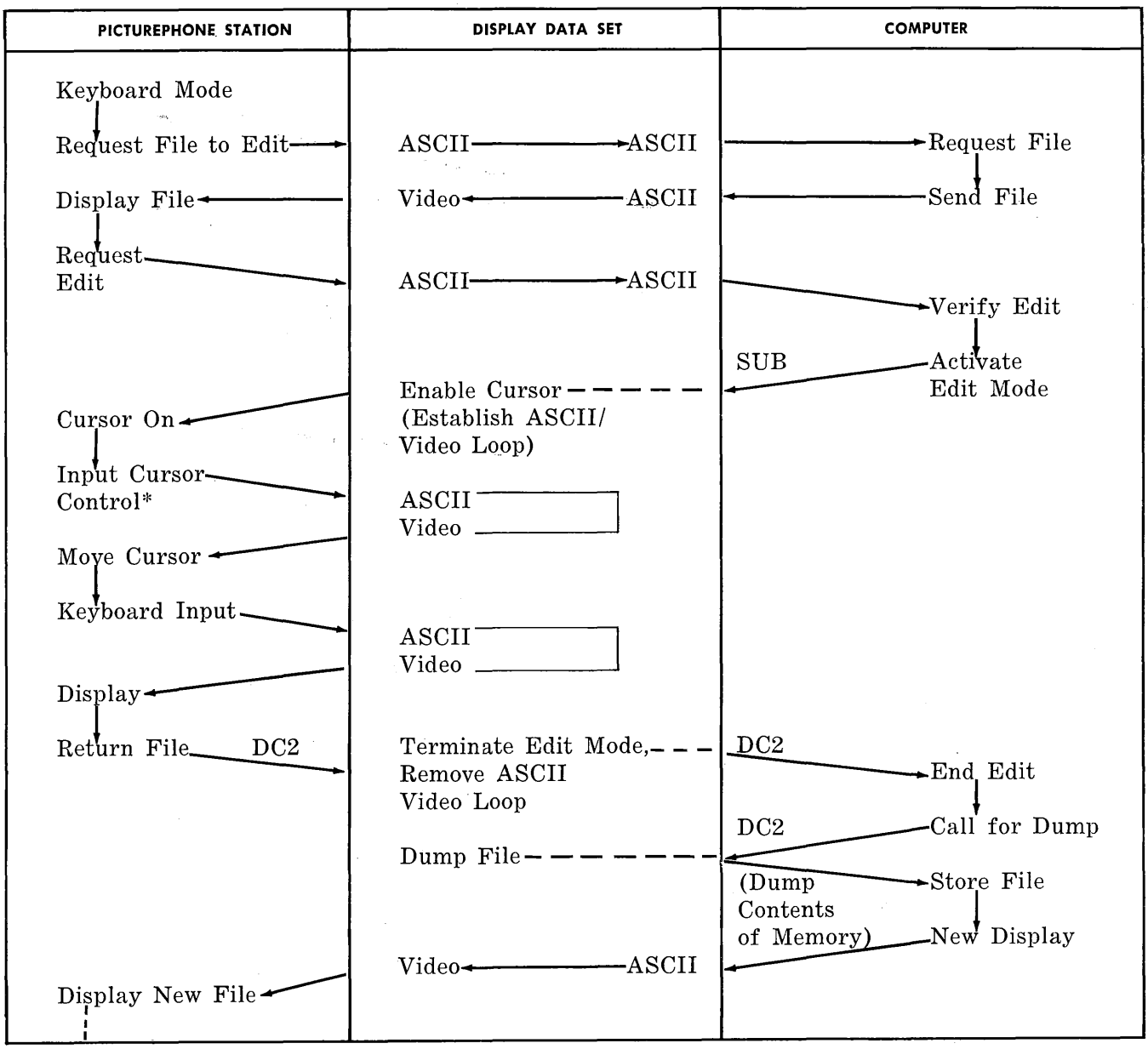
TYPICAL CALL — KEYBOARD MODE — SEQUENCE CHART



informed and given responsibility for clearing the trouble. There are additional loop-back arrangements provided with the voiceband data link to facilitate this subsequent isolation of troubles to specific portions of the voiceband data link. These loop-back arrangements come from auxiliary key assemblies (6017 AR keys) that are a normal part of 4-wire DS 202-type installations. (See test points D and E, Figure 19.) By operating such a key, it is possible to open the transmission line at the data set and to loop it back in both directions—toward the local data set as well as toward the testboard. The loop back toward the testboard allows the private line telephone testboard to check the voiceband facility right up to, but not including, the data set. The loop back toward the data set

TABLE G

TYPICAL CALL — EDIT MODE — SEQUENCE CHART

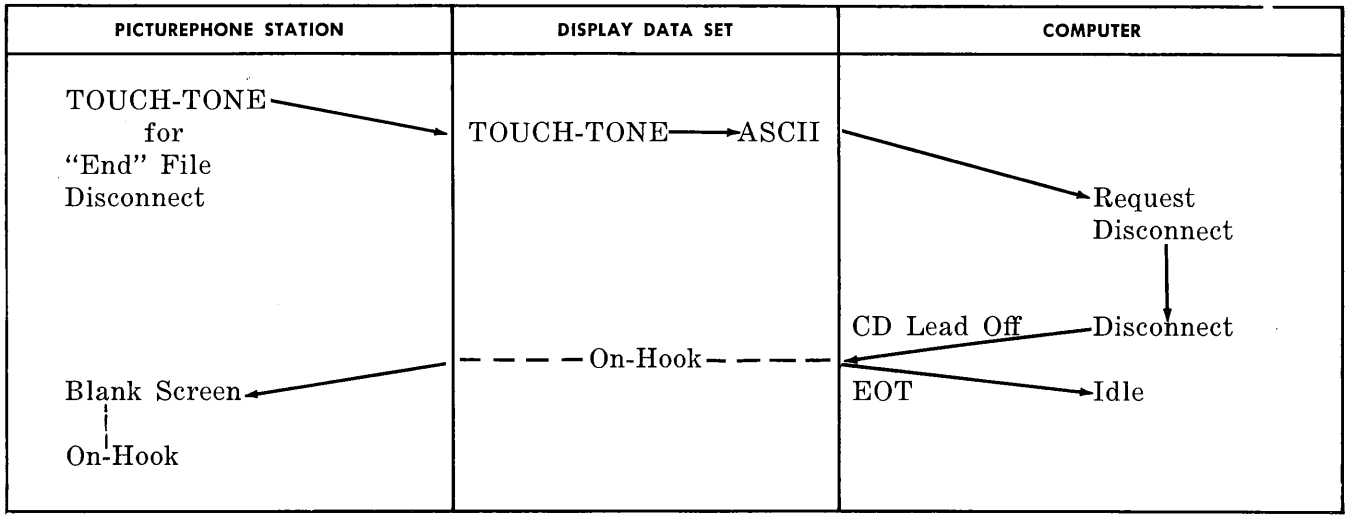


* Cursor Controls:

BS ←
HT →
VT ↑
FF ↓
LF Start of Next Line

TABLE H

TYPICAL CALL — TERMINATION — SEQUENCE CHART



allows the operation of the data set alone to be tested with the terminal device as a part of the terminal system by sending signals to the data set and seeing that they are looped back from the data set. By using both this auxiliary key loop-back capability and the DS 202D3 test feature (described above in 7.04), it is possible to determine from the private line telephone testboard whether a voiceband data link trouble is a facility trouble or a data set trouble. When the voiceband data link trouble is cleared, an acceptance test should be performed to verify a working computer access service circuit.

7.07 The various testing and loop-back arrangements that are provided with each display data set installation are intended to facilitate the isolation of system troubles to the point where the proper maintenance personnel can be dispatched to clear the trouble.

STATION TEST OF DISPLAY DATA SET

Make sure the circuit packs are in their proper slots. Refer to Fig. 12 or 13.

7.08 The person performing the test should place the display data set station in the test mode by setting the TST—NOR switch to TST.

7.09 The person performing the test should call the display data set station. Characters keyed should appear sequentially with a blank space (caused by ETX) between successive characters. Key at least two lines of characters in the event that the top line of characters is not fully visible.

7.10 If the display data set is not wired for "clear screen on hang-up" option, all that can be determined by a loop-back test is that the characters that are keyed appear on the screen. The ETX function cannot be tested.

7.11 At completion of the test, return TST—NOR switch to NOR and momentarily depress the CLR button.

INSTALLATION TEST

7.12 If the display data set is not wired for "clear screen on hang-up" option, install this option for the duration of this test so as to test ETX function.

7.13 The installer should ascertain that the TST—NOR switch is set to NOR and momentarily depress the INIT button. Have the person performing the test call the display data set station. When the display data set answers, the person performing the test should hang up. The installer should momentarily depress the CLR button and then set TST—NOR switch to TST.

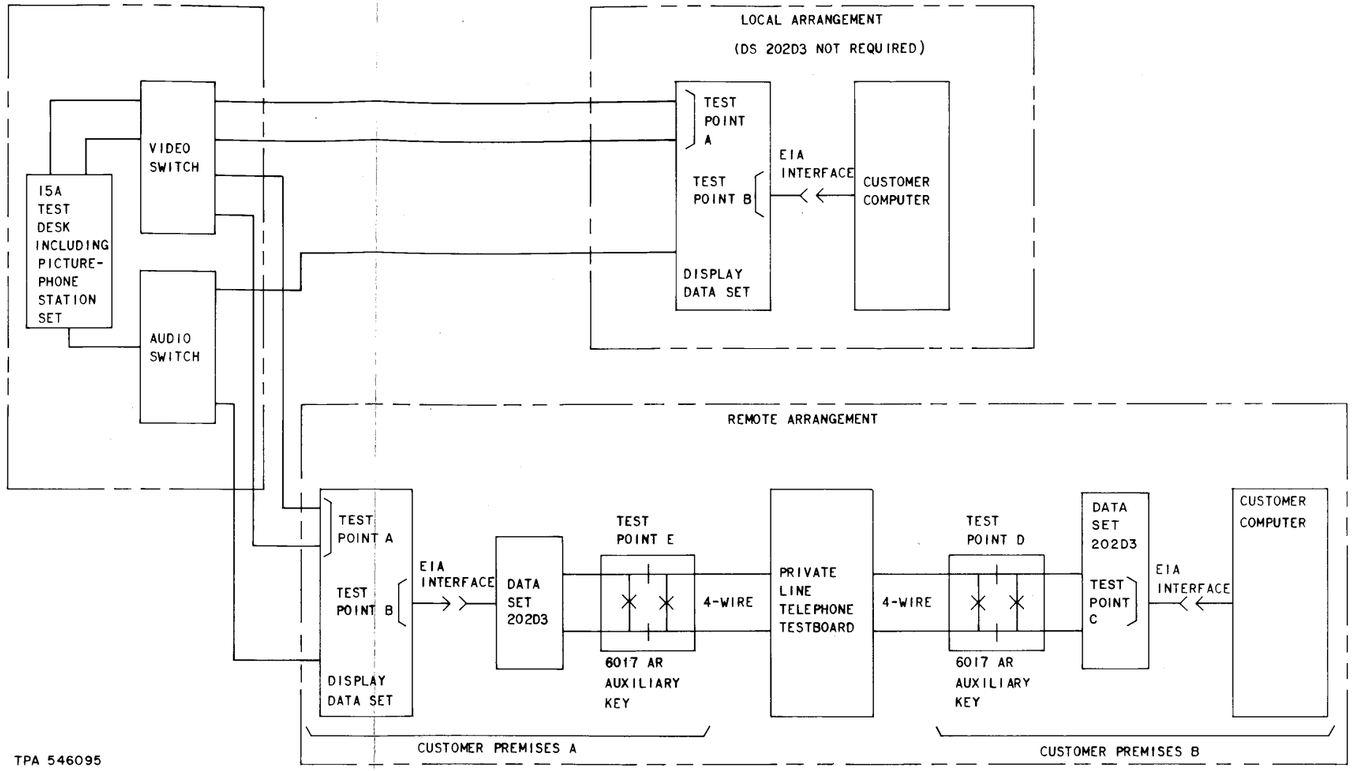


Fig. 19—Test Facilities Provided for Trouble Isolation on Computer Access Service Arrangements

Have the person performing the test call the display data set station again.

7.14 Characters keyed should appear sequentially with a blank space (caused by ETX) between each successive character. Key at least two lines of characters in the event that the top line of characters is not fully visible.

7.15 At completion of the test, return TST—NOR switch to NOR and momentarily depress the CLR button. Remove the "clear screen on hang-up" option if this option is not part of the station arrangement. Momentarily depress INIT button.

TROUBLE ISOLATION

7.16 Table I provides a listing of display data station troubles. Locate the trouble in the table that is most symptomatic of the indicated trouble, then perform the indicated diagnostic test.

DIAGNOSTIC TEST

7.17 The station tests are designed to determine if the data station is operating properly. If the data station does not meet the conditions specified in the tests, refer to diagnostic test to determine the most probable cause of the trouble. The diagnostic tests should be used in conjunction with the loop-back tests.

7.18 The first procedure is to place the display data set in a test mode by placing the TST—NOR switch on the display data set to the TST position. A call is then placed by the person performing the test to the display data set in question. After the DS 403E5 trips ringing and sends an answer tone, the person performing the test then keys via a TOUCH-TONE dial into the display data set.

7.19 A craft employee must be at the display data set with a Pulse Monitors, Incorporated, Model 1210 Digi-Probe.* Refer to Part 9 for operating procedure of the Digi-Probe. A lineman's handset should be clipped across the audio pair to the test desk. The person performing the test must communicate with the test desk during the test.

*Trade mark of Pulse Monitors, Incorporated

7.20 The only actions by the craft employee are to monitor pulses or levels and to change cards. Therefore, a complete set of cards is required. When a card is changed, the INIT button should be depressed, and then the test performed again to determine if this has fixed the trouble. If not, replace the old card and then perform the next procedure.

There are two combinations of cards. These are L123277, L123275, and L106337 (4) or L123277-2, L129177, and L129176 (4). These card combinations must not be mixed. When replacing cards, the card must be replaced with the same number or the entire combination must be replaced.

7.21 To use the diagnostic test, locate the trouble in Table I that is most symptomatic of the indicated trouble. Refer to the indicated figures and, using Digi-Probe Model 1210, perform the procedures indicated by Fig. 20 through 27.

Note: This test procedure assumes that the test equipment is operating properly.

7.22 In the trouble-clearing procedure, more than one CP is usually indicated as the possible cause of failure. The most probable cause is indicated first. Perform whatever function is specified by the diagnostic tests; retest after replacing each part. If this does not clear the trouble, replace the remaining CPs as follows:

(1) Replace CPs one at a time until the trouble is corrected.

(2) Reinstall original CPs one at a time except for the one that cleared the trouble.

(3) Retest to verify that trouble is clear.

7.23 Before proceeding with any test of the data station, verify that:

- Momentarily depressing INIT button does not clear trouble.
- PICTUREPHONE and voiceband loops have been tested and meet requirements as specified in appropriate BSPs.

TABLE I

TROUBLE ISOLATION

TROUBLE NO.	FIGURE NO.	DESCRIPTION
1	20	No raster on PICTUREPHONE screen or picture will not synchronize.
2	21	No letters on PICTUREPHONE display unit screen while keying in test mode — raster present.
3	23	White letters on gray raster appear in test mode, but letters are not what were keyed or some are missing. Shape of letters is good.
4	24	No cursor in edit mode or cursor will not blink regularly.
5	24	Correct letters appear but are misshapen, or a regular pattern of dots appears in addition to the letters.
6	24	Graticule for graphs does not appear or will not disappear.
7	24	Cursor moving commands not obeyed. (Letters do not appear in right place on screen.)
8	24	Cannot erase screen, but letters can be written.
9	24	Graph characters missing or misshapen.
10	24	Not transmitting displays to the computer correctly.
11	24	Sending a single letter fills the screen with that letter or contents of screen appears to roll continuously.
12	25	No start (ENQ) or stop (EOT) characters to the computer.
13	26	Will not go into keyboard mode.
14	22	Will not leave keyboard mode.
15	22	Will not go into edit mode or goes into edit mode prematurely.
16	22	There is no ETX (blank space) between characters when keying in test mode.
17	27	Display data set does not answer in test mode.

- Telephone portion of installation meets standard dc talk, signaling, and supervision requirements.
- Strapping options agree with service order.
- All connections and connectors are properly made.
- All circuit packs are in their proper location. Refer to Fig. 12.

6A IMPULSE COUNTER TEST

7.24 When required, measure the impulse noise between the data set ground and the business machine ground using a 6A impulse counter as follows:

(1) Connect computer ground to the top IN binding post of 6A counter.

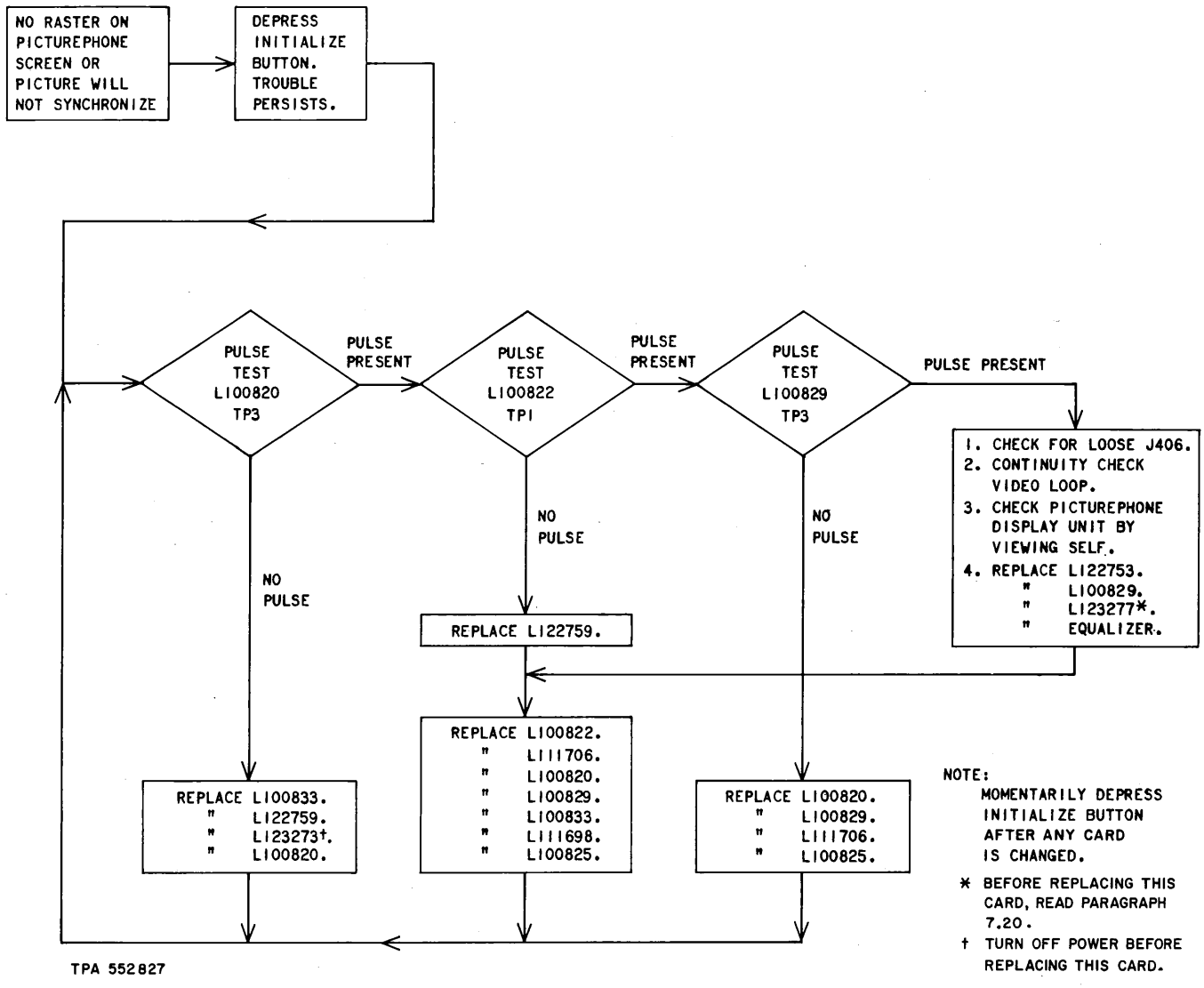


Fig. 20—Trouble 1—No Raster on PICTUREPHONE Screen or Picture Will Not Synchronize

(2) Connect data set ground to the bottom IN binding post of 6A counter.

Do not ground 6A counter for this test.

(3) Set WTG switch to VOICE BAND.

(4) Set REF LEV DBRN toggle switch to ADD 30.

(5) Set REF LEV DBRN rotary switch to 60.

(6) Set MINUTES switch to 15.

(7) Reset counter to 0000 by use of RESET switch.

If any counts are registered in a 15-minute period, grounding arrangements must be improved.

8. EQUALIZATION

8.01 The particular equalizer used in the display data set is determined by the station arrangement and whether or not VSS supervision is used. Refer to Table A.

8.02 The equalizer is not supplied with the display data set. It must be ordered separately. Refer to Table A and Fig. 28 for information on selecting the proper equalizer.

8.03 When the 877-type equalizer is used, an adapter plate is required. The adapter plate is stored on the protective cover for the power supplies in the rear of the display data set. The installation procedures for either the 939-type or 877-type equalizer are shown by Fig. 28.

8.04 When the 939-type equalizer is used, the equalizer must be adjusted. The following preliminary steps should be taken before referring to Section 340-200-501 for the adjustment of equalizer.

(1) Disconnect the video input to the display data set and connect it to the 100-ohm balanced output of cable equalizer test set J-1C-150K.

Note: This connection can be made at J406 of the display data set; however, make connection at a terminal block if possible.

(2) Connect TP1 and TP2 of the 939-type equalizer to the input of the test set.

(3) Refer to Section 340-200-501 for the adjustment procedure.

8.05 There are no equalizer adjustments when the 877-type equalizer is installed.

Note: The VSS supervision option must not be installed when using the 877-type equalizer.

9. DIGI-PROBE

9.01 The Digi-Probe Model 1210 is a hand-held high-impedance probe which provides an indication of the presence of pulses or level at various test points. The Digi-Probe Model 1210 senses logic levels by reference to a standard voltage. In the pulse mode, it detects transitions between logic levels.

9.02 To use the Digi-Probe, connect the power leads to the terminals on the front of the display data set (connect red-to-red and black-to-black). Refer to Fig. 5, 29, and 30.

9.03 To operate in the pulse test mode, set the LEVEL—PULSE selector switch to PULSE. Place the probe tip to the test point to be monitored. Depress and release the CLEAR switch. Observe the indicator lamps. If either the HI or LO indicator lamp lights after the CLEAR switch is released, a pulse has been detected.

9.04 To operate in the level test mode, set the LEVEL—PULSE selector switch to LEVEL. Place the probe tip to the test point to be monitored. The green indicator lamp lights if the test point is LO, while the red lamp lights if the test point is HI.

9.05 The TEST switch and control terminals (I/E, L/O, and L/C) are not used in this application.

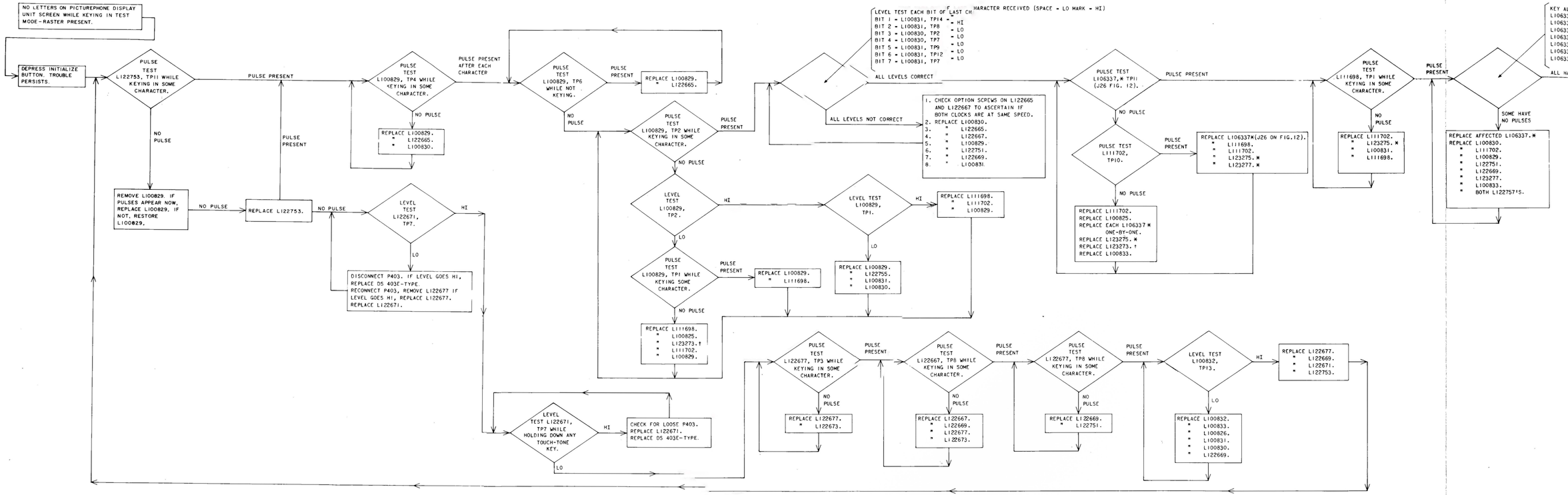
10. REFERENCES

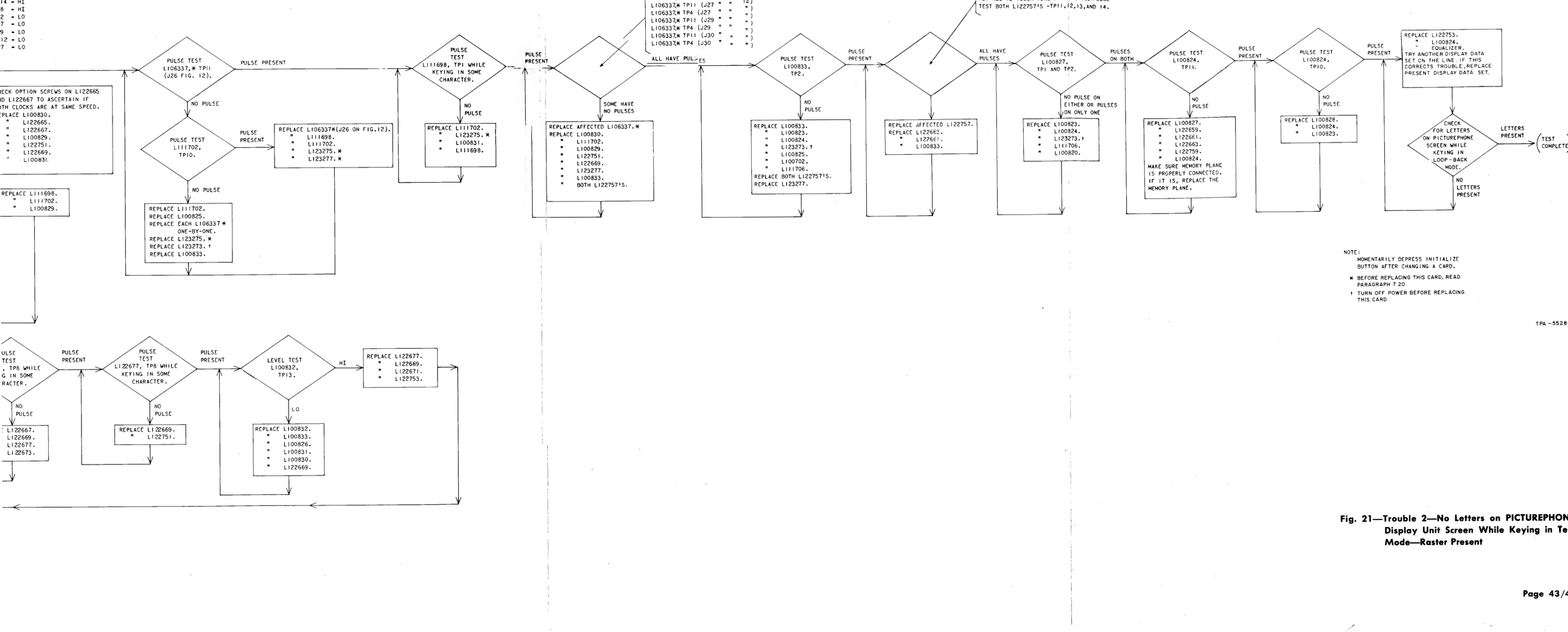
10.01 The circuit descriptions (CDs) and schematic drawings (SDs) for the apparatus associated with Display Data Set F-58167 are as follows:

- CD-3D024-01 and SD-3D024-01—Data Set 108A1
- CD-1D049-01 and SD-1D049-01—Data Set 202D3
- CD-1D093-01 and SD-1D093-01—Data Set 403E5.

10.02 Bell System Practices covering the various equipment associated with the station are given below:

- Data Set 108A, Private Line System Station Application—591-023-ZZZ
- Data Set 202D-Type, Transmitter-Receiver 592-016-ZZZ, Issue 4 or later
- Data Set 403E-Type, Receiver, Identification and Operation—594-023-100
- PICTUREPHONE® Service, Baseband Video Transmission, Initial Service (Phase 0), Cable Equalizers, Video Loop Facility Alignment—340-200-501.


NO LETTERS ON PICTUREPHONE DISPLAY UNIT SCREEN WHILE KEYING IN TEST MODE-RASTER PRESENT.
DEPRESS INITIALIZE BUTTON. TROUBLE PERSISTS.
PULSE TEST L122753, TP11 WHILE KEYING IN SOME CHARACTER.
PULSE PRESENT
NO PULSE
REMOVE L100829. IF PULSES APPEAR NOW, REPLACE L100829. IF NOT, RESTORE L100829.
NO PULSE
REPLACE L122753.
PULSE PRESENT
NO PULSE
LEVEL TEST L122671, TP7.
HI
LO
DISCONNECT P403. IF LEVEL GOES HI, REPLACE DS 403E-TYPE. RECONNECT P403, REMOVE L122677 IF LEVEL GOES HI, REPLACE L122677. REPLACE L122671.
PULSE TEST L100829, TP4 WHILE KEYING IN SOME CHARACTER.
NO PULSE
REPLACE L100829. " L122665. " L100830.
PULSE PRESENT AFTER EACH CHARACTER
PULSE TEST L100829, TP6 WHILE NOT KEYING.
PULSE PRESENT
REPLACE L100829. " L122665.
NO PULSE
PULSE TEST L100829, TP2 WHILE KEYING IN SOME CHARACTER.
PULSE PRESENT
NO PULSE
LEVEL TEST L100829, TP2.
HI
LEVEL TEST L100829, TP1.
HI
REPLACE L111698. " L111702. " L100829.
LO
REPLACE L100829. " L122755. " L100831. " L100830.
PULSE TEST L100829, TP1 WHILE KEYING SOME CHARACTER.
PULSE PRESENT
REPLACE L100829. " L111698.
NO PULSE
REPLACE L111698. " L100825. " L123273.† " L111702. " L100829.
LEVEL TEST L122671, TP7 WHILE HOLDING DOWN ANY TOUCH-TONE KEY.
HI
CHECK FOR LOOSE P403. REPLACE L122671. REPLACE DS 403E-TYPE.
LO
LEVEL TEST EACH BIT OF LAST CHARACTER RECEIVED (SPACE = LO MARK = HI)
BIT 1 - L100831, TP14 = HI
BIT 2 - L100831, TP8 = LO
BIT 3 - L100830, TP2 = LO
BIT 4 - L100830, TP7 = LO
BIT 5 - L100831, TP9 = LO
BIT 6 - L100831, TP12 = LO
BIT 7 - L100831, TP7
ALL LEVELS CORRECT
ALL LEVELS NOT CORRECT
1. CHECK OPTION SCREWS ON L122665 AND L122667 TO ASCERTAIN IF BOTH CLOCKS ARE AT SAME SPEED.
2. REPLACE L100830.
3. " L122665.
4. " L122667.
5. " L100829.
6. " L122751.
7. " L122669.
8. " L100831.
PULSE TEST L106337,* TP11 (J26 FIG. 12).
PULSE PRESENT
NO PULSE
PULSE TEST L111702, TP10.
PULSE PRESENT
REPLACE L106337*(J26 ON FIG.12). " L111698. " L111702. " L123275.* " L123277.*
NO PULSE
REPLACE L111702. REPLACE L100825. REPLACE EACH L106337* ONE-BY-ONE. REPLACE L123275.* REPLACE L123273.† REPLACE L100833.
PULSE TEST L111698, TP1 WHILE KEYING IN SOME CHARACTER.
NO PULSE
REPLACE L111702. " L123275.* " L100831. " L111698.
PULSE PRESENT
SOME HAVE NO PULSES
REPLACE AFFECTED L106337.* REPLACE L100830. " L111702. " L100829. " L122751. " L122669. " L123277. " L100833. " BOTH L122757'S.
KEY AL
L10633
L10633
L10633
L10633
L10633
L10633
ALL HA
PULSE TEST L122677, TP3 WHILE KEYING IN SOME CHARACTER.
PULSE PRESENT
NO PULSE
REPLACE L122677. " L122673.
PULSE TEST L12267, TP8 WHILE KEYING IN SOME CHARACTER.
PULSE PRESENT
NO PULSE
REPLACE L122667. " L122669. " L122677. " L122673.
PULSE TEST L122677, TP8 WHILE KEYING IN SOME CHARACTER.
PULSE PRESENT
NO PULSE
REPLACE L122669. " L122751.
LEVEL TEST L100832, TP13.
HI
LO
REPLACE L100832. " L100833. " L100826. " L100831. " L100830. " L122669.
REPLACE L122677. " L122669. " L122671. " L122753.



NOTE:
MOMENTARILY DEPRESS INITIALIZE BUTTON AFTER CHANGING A CARD.

* BEFORE REPLACING THIS CARD, READ PARAGRAPH 7.20.

† TURN OFF POWER BEFORE REPLACING THIS CARD.

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Fig. 21—Trouble 2—No Letters on PICTUREPHON Display Unit Screen While Keying in Te Mode—Raster Present

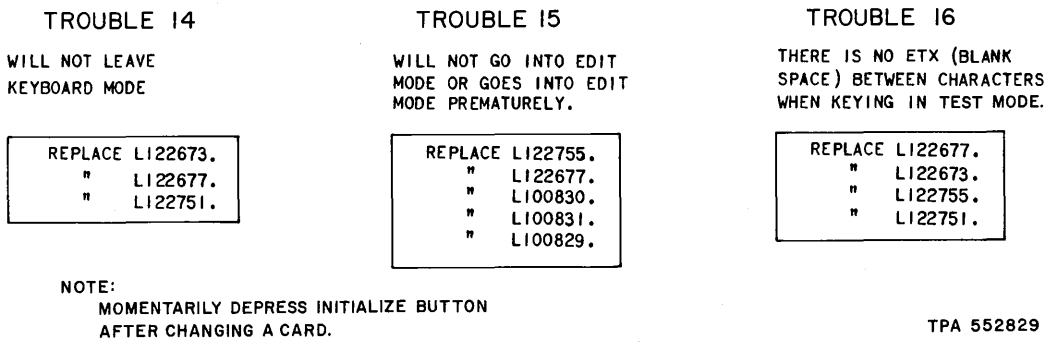

Fig. 22—Troubles 14 Through 16

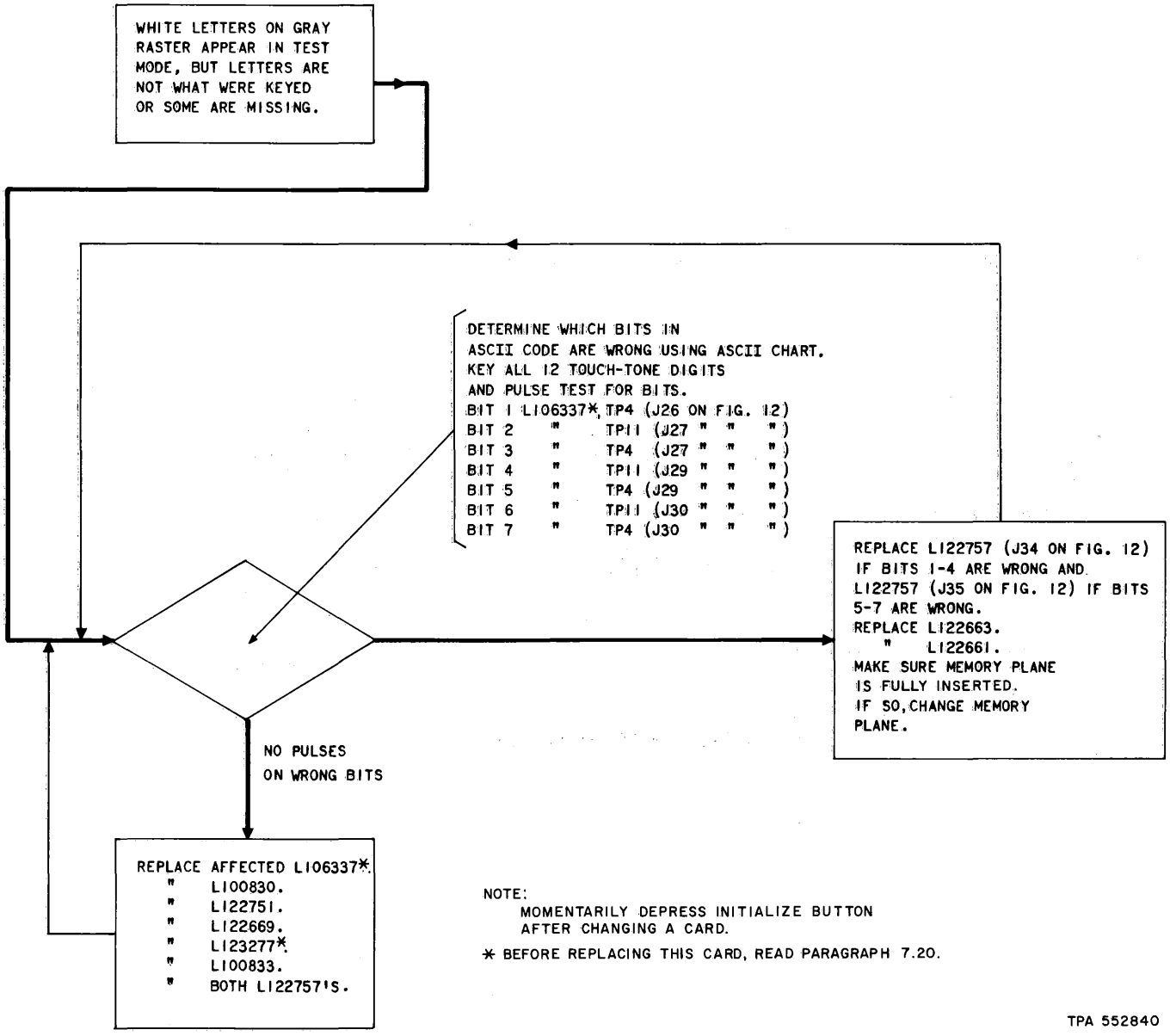

Fig. 23—Trouble 3—White Letters on Gray Raster Appear In Test Mode, but Letters Are Not What Were Keyed or Some Are Missing. Shape of Letters Is Good.

TROUBLE 4

NO CURSOR IN EDIT MODE OR CURSOR WILL NOT BLINK REGULARLY

REPLACE L122659.
" L111702.
" L122755.

TROUBLE 5

CORRECT LETTERS APPEAR BUT ARE MISSHAPEN OR A REGULAR PATTERN OF DOTS APPEARS IN ADDITION TO THE LETTERS

REPLACE L100827.
" L100828
" L100824.
" L100823.
" L122659.
" L123273.†
" L100822.
MAKE SURE MEMORY PLANE IS CONNECTED PROPERLY.
IF SO, CHANGE MEMORY PLANE.
REPLACE L122661.
" L122663.

TROUBLE 6

GRATICULE FOR GRAPHS DOES NOT APPEAR OR WILL NOT DISAPPEAR.

REPLACE L100826.
" L122753.
" L122661.
" L100827.
" L100824.
" L111698.
" L100823.
" L100822.

TROUBLE 7

CURSOR MOVING COMMANDS NOT OBEYED. (LETTERS DO NOT APPEAR IN RIGHT PLACE ON SCREEN.)

REPLACE L111698.
" L111702.
" L123275.*
" L122755.
" L100831.
" L106337* (J26 ON FIG. 12)
" L100825.
" L100826.
" L100830.
" L122753.

TROUBLE 8

CANNOT ERASE SCREEN, BUT LETTERS CAN BE WRITTEN.

REPLACE L100831.
" L122759.
" L111702.
" L111698.*
" ALL L106337'S AND L123275.*
" L122755.

TROUBLE 9

GRAPH CHARACTERS MISSING OR MISSHAPEN.

REPLACE L122661.
" L122663.
" L122659.

TROUBLE 10

NOT TRANSMITTING DISPLAYS TO THE COMPUTER CORRECTLY (NOT DUMPING CORRECTLY).

REPLACE L100832.
" L100833.
" L123275.*
" L123273.†
" L122665.
" L100826.
" L100830.
" L100759.
" L100831.

TROUBLE 11

SENDING A SINGLE LETTER FILLS THE SCREEN WITH THAT LETTER OR CONTENTS OF SCREEN APPEARS TO ROLL CONTINUOUSLY.

REPLACE L100825.
" L111698.
" L123273.†
" L111702.
" L100833.
" L123275.*
" L100829.

NOTE:
MOMENTARILY DEPRESS INITIALIZE BUTTON AFTER A CARD IS CHANGED.

* BEFORE REPLACING THIS CARD, READ PARAGRAPH 7.20.

† TURN OFF POWER BEFORE REPLACING THIS CARD.

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Fig. 24—Troubles 4 Through 11

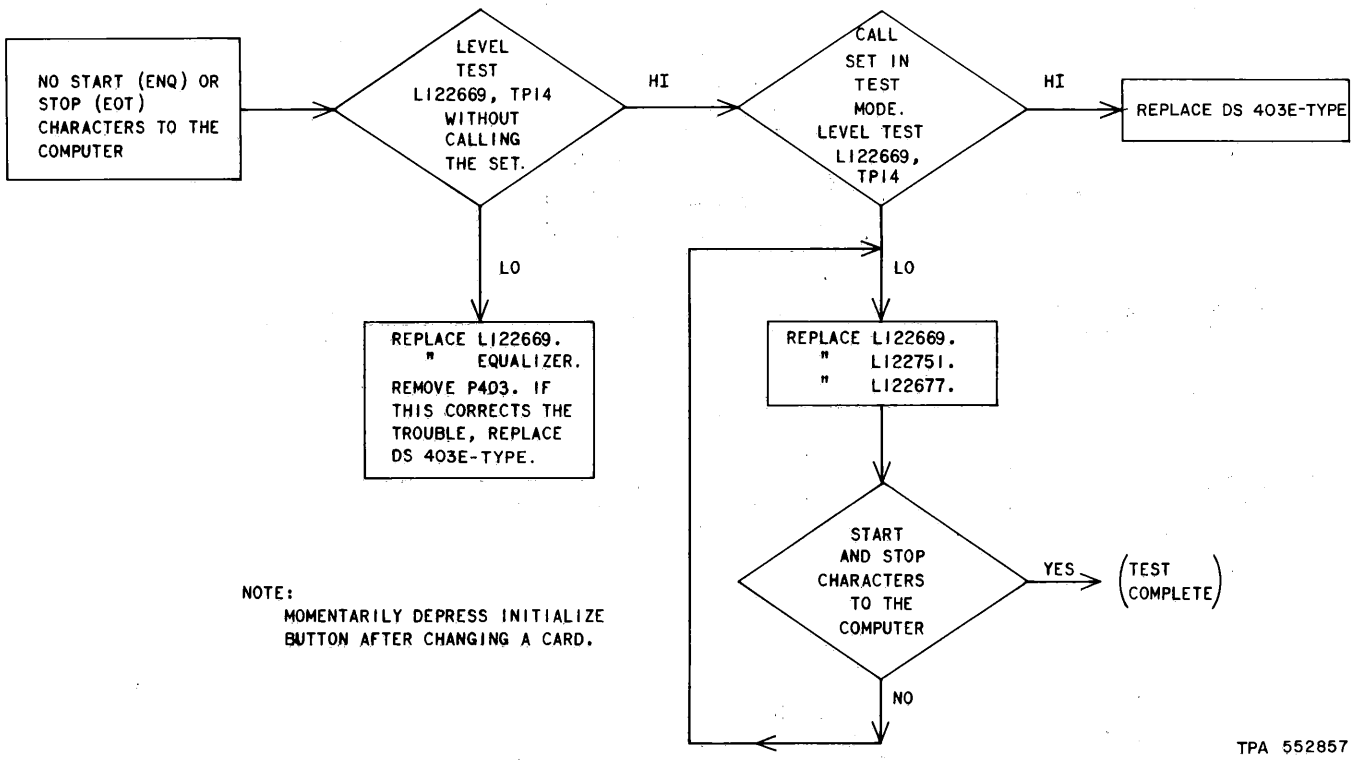

Fig. 25—Trouble 12—No Start (ENQ) or Stop (EOT) Characters to the Computer

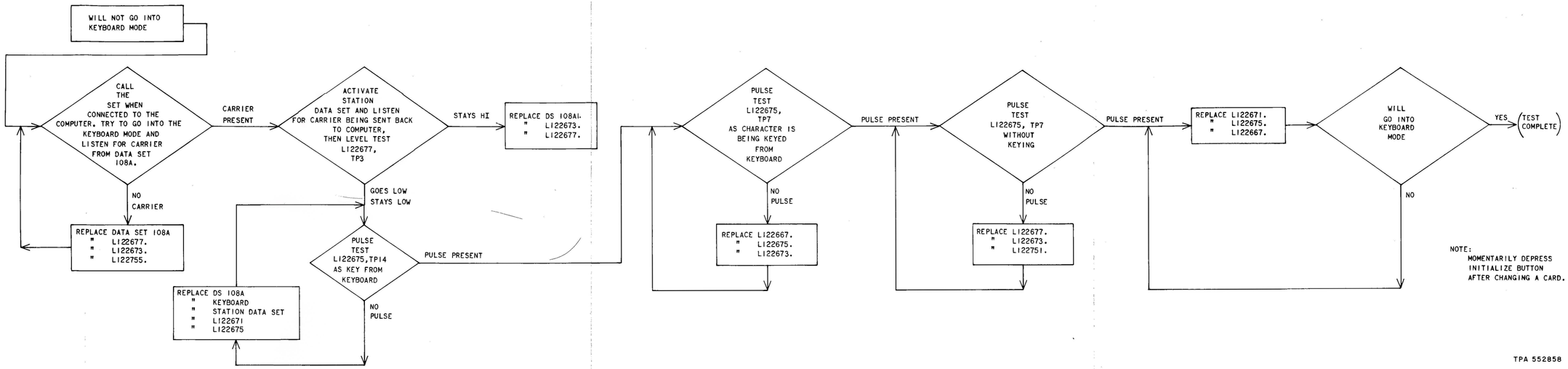

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Fig. 26—Trouble 13—Will Not Go Into Keyboard Mode

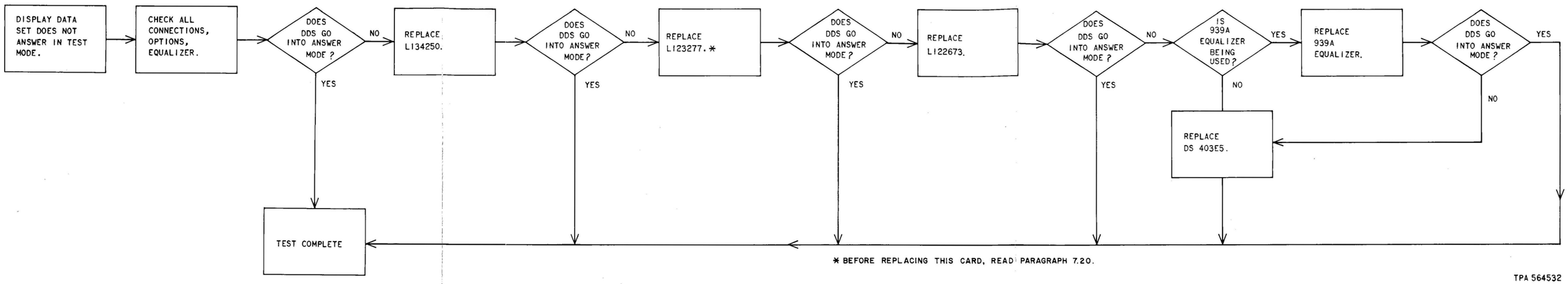

Fig. 27—Trouble 17—Display Data Set Does Not Answer in Test Mode

TYPE AND LENGTH OF CABLES WHICH CAN BE FOUND BETWEEN THE KTS CABLE EQUALIZER AND THE "PICTUREPHONE" DISPLAY DATA SET AND THE CORRESPONDING NETWORKS TO BE USED.			
NETWORK TO BE USED	D-TYPE INSIDE WIRE 24 GAUGE	D-TYPE WIRE 22 GAUGE	252A SWITCHBOARD CABLE 24 GAUGE
877A, NETWORK A	UP TO 110 FEET	UP TO 150 FEET	UP TO 140 FEET
877B, NETWORK B	111 TO 190 FEET	151 TO 260 FEET	141 TO 260 FEET
877A, NETWORK C	191 TO 280 FEET	261 TO 380 FEET	261 TO 380 FEET
877B, NETWORK D	281 TO 370 FEET	381 TO 500 FEET	381 TO 500 FEET
939B	371 TO 6300 FEET	501 TO 8000 FEET	501 TO 6700 FEET
939A	FOR THE TYPE AND LENGTH OF CABLES WHICH CAN BE FOUND BETWEEN THE DDS AND THE "PICTUREPHONE" SWITCH REFER TO TABLE A.		

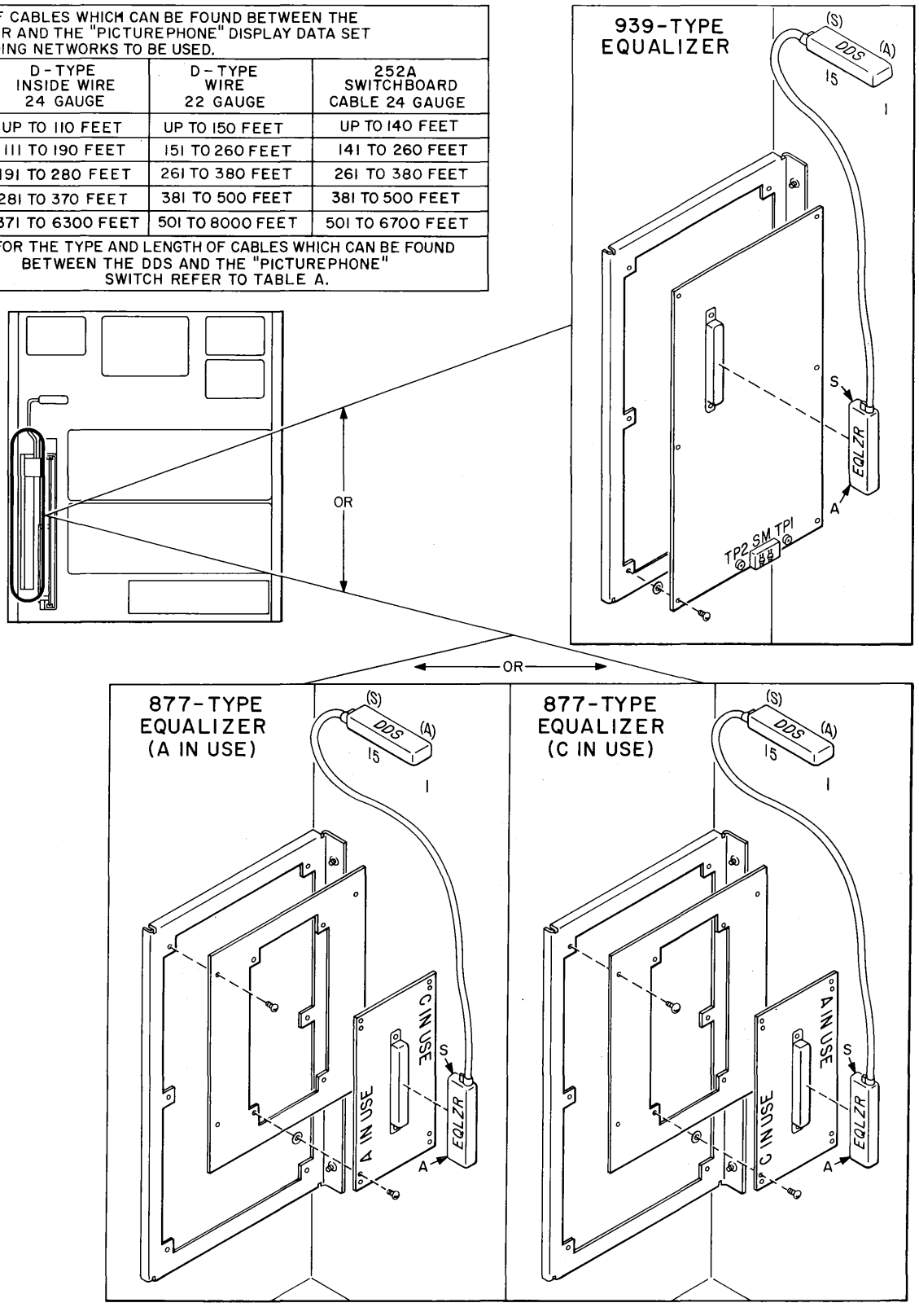

Fig. 28—Equalizer Configuration

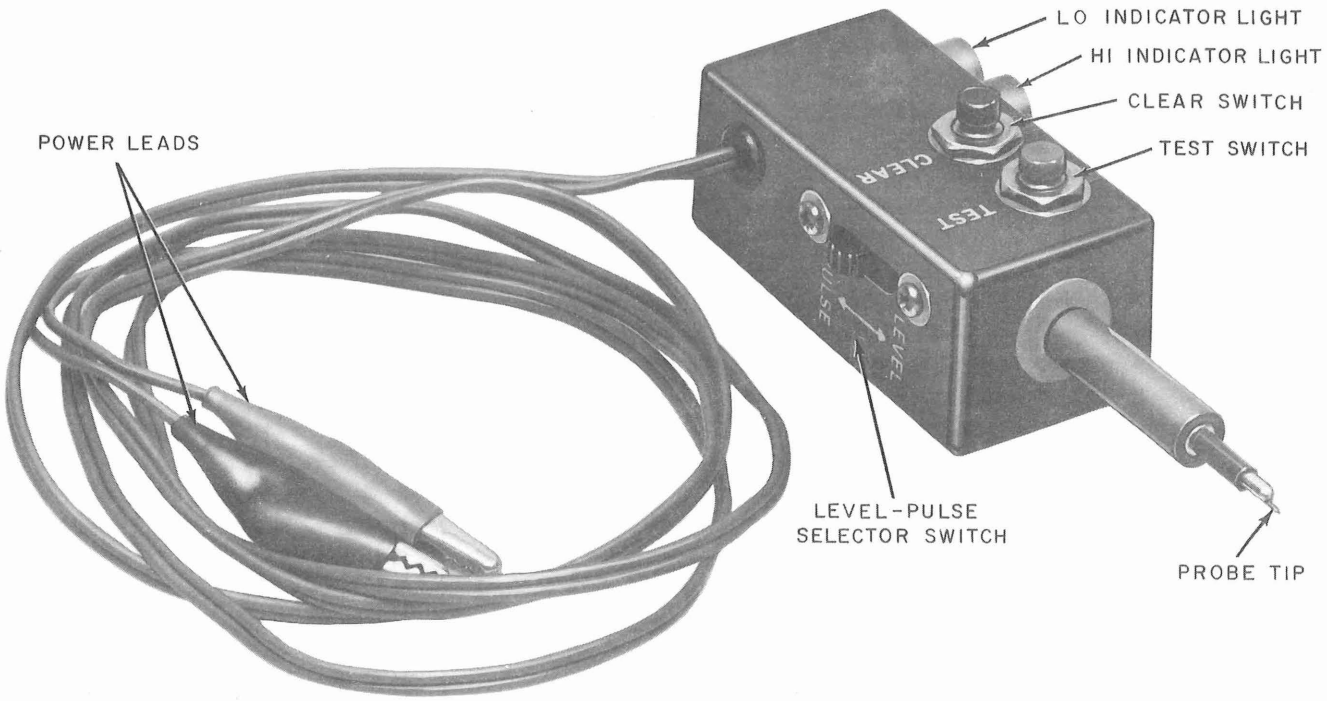

Fig. 29—DIGI-PROBE Model 1210—Left Front Oblique View

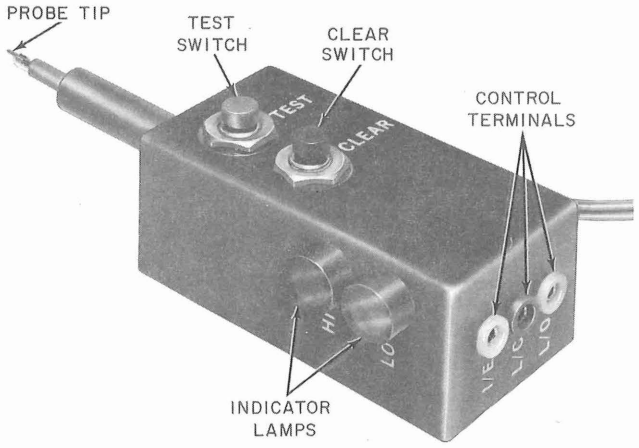

Fig. 30—DIGI-PROBE Model 1210—Right Rear Oblique View