ELECTRONIC BLACKBOARD

DESCRIPTION, INSTALLATION, MAINTENANCE, AND TESTS

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1. GENERAL

1.01 The GEMINI* 100 Electronic Blackboard System (Fig. 1) provides for the transmission and display of hand-written information. Transmission is in real time over two-wire voice grade circuits. Either the switched network or private lines may be used.

1.02 This section is reissued to provide information on the:

(a) 330-type adapter when the graphics station is used behind a PBX (private branch exchange) or KTS (key telephone system)

(b) KS-21889-L3 digital memory unit.

Revision arrows are used to emphasize the more significant changes.

1.03 Transmission is half-duplex at 1300 bits per second; this allows nonsimultaneous two-way graphics communication between two locations, or several locations when ordinary voice conference facilities are used.

* Registered trademark of AT&T.

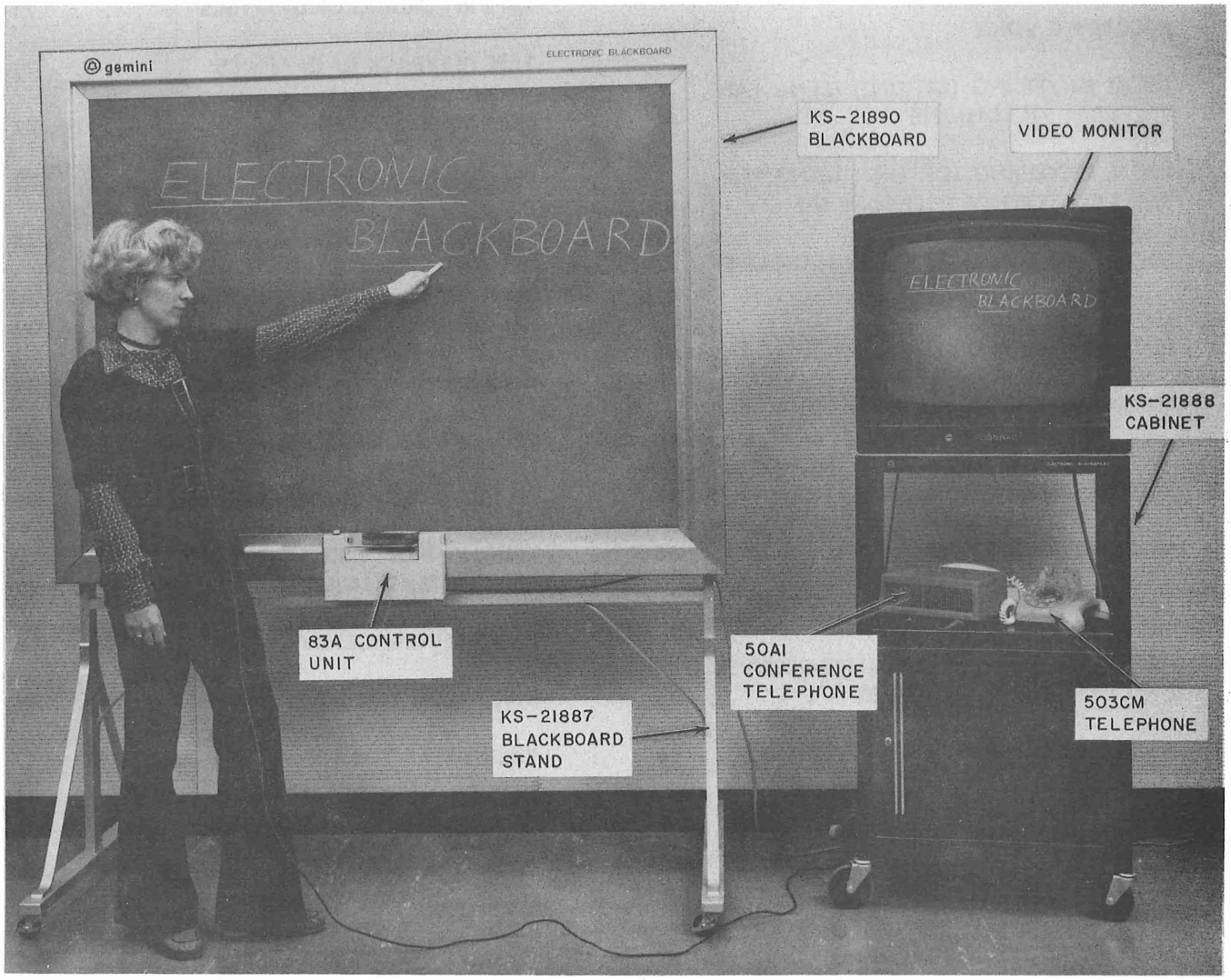


Fig. 1—Electronic Blackboard Station—Overall View

1.04 A telephone with an exclusion key, such as 502BM or 503CM (rotary dial) or 2502BM or 2503CM (TOUCH-TONE* dial) is required at each end for establishing a circuit for graphics use. Jacks with universal service order code (USOC) RJ41S or RJ36X shall be used on the switched network (see Fig. 19). Voice communication requires a separate telephone line for simultaneous use with the graphics circuit. A portable conference telephone with loudspeaker and microphones, such as the 50A1 (512-630-111), is recommended for voice communications for each configuration listed in Part 3.

1.05 Graphics and voice communication may be recorded on a stereo voice-grade cassette tape recorder for storage and replay.

1.06 The station will operate satisfactorily in an ambient temperature range of 40 to 110 °F, and a relative humidity range of 10 to 90 percent.

1.07 The electronic blackboard station described in this section meets FCC Part 68 requirements for registration. ▶The FCC registration number is AS593M-67767-OT-N. The "R" in the designation 1AR graphics transmitter-receiver indicates that the transmitter-receiver is registered with the FCC.◀

2. PHYSICAL DESCRIPTION OF STATION

GENERAL

2.01 Major components of the electronic blackboard station are as follows:

- KS-21890 Blackboard
- 83A Control Unit
- KS-21887 Blackboard Stand (optional)
- 1AR Graphics Transmitter-Receiver or 1AR Graphics Receiver
- KS-21889-L1 (MD) or -L3 Memory Unit
- KS-21888 Cabinet
- Video Monitor [customer owned and maintained (COAM)]
- 502BM or 503CM (rotary dial) or 2502BM or 2503CM (TOUCH-TONE dial) Telephone Set
- 50A1 Conference Telephone Set
- Stereo Tape Recorder (COAM).

KS-21890 BLACKBOARD (Fig. 1)

2.02 The electronic blackboard consists of two electrically conductive plastic sheets separated by a small air gap. The blackboard writing surface is a stretched flexible MYLAR† sheet, which is coated with blackboard paint. Writing on the blackboard is done with ordinary dustless chalk; the eraser is a conventional blackboard eraser.

2.03 The blackboard assembly measures 51 inches high by 65 inches wide by 3 inches thick, including the frame, and weighs about 70 pounds. An anodized aluminum decorative frame surrounds the 42-inch by 56-inch writing area and provides a mounting space for the control unit, as well as a chalk groove for storing chalk.

2.04 The blackboard is equipped with mounting hardware for wall mounting, or for mounting on an optional portable stand. The center portion of the chalk groove on the frame has a 6-inch strip of VELCRO‡ fastener to mate with a similar piece of VELCRO fastener on the control unit.

2.05 A Bell System logo, "GEMINI", and "ELECTRONIC BLACKBOARD" appear on the upper portion of the frame. The rear of the blackboard is coated with cream colored acrylic lacquer.

83A CONTROL UNIT (ERASER TRAY) (Fig. 2)

2.06 The control unit measures approximately 11 by 6 by 2 inches, and is contained in a steel housing, which is painted a cream color. The unit weighs about 4 pounds. The unit is secured to the blackboard by a contoured lip which mates with the chalk groove on the blackboard frame, and by a mating strip of VELCRO fastener which meshes with the VELCRO fastener on the chalk groove. In addition, a screw is provided on the blackboard for attaching a control unit mounting bracket to the bottom center of the blackboard frame.

2.07 A white pushbutton on the control unit is used to clear the memory and display ("electronic

* Trademark of AT&T.

† Registered trademark of E. I. duPont de Nemours & Co.

‡ Registered trademark of VELCRO U.S.A., Inc.

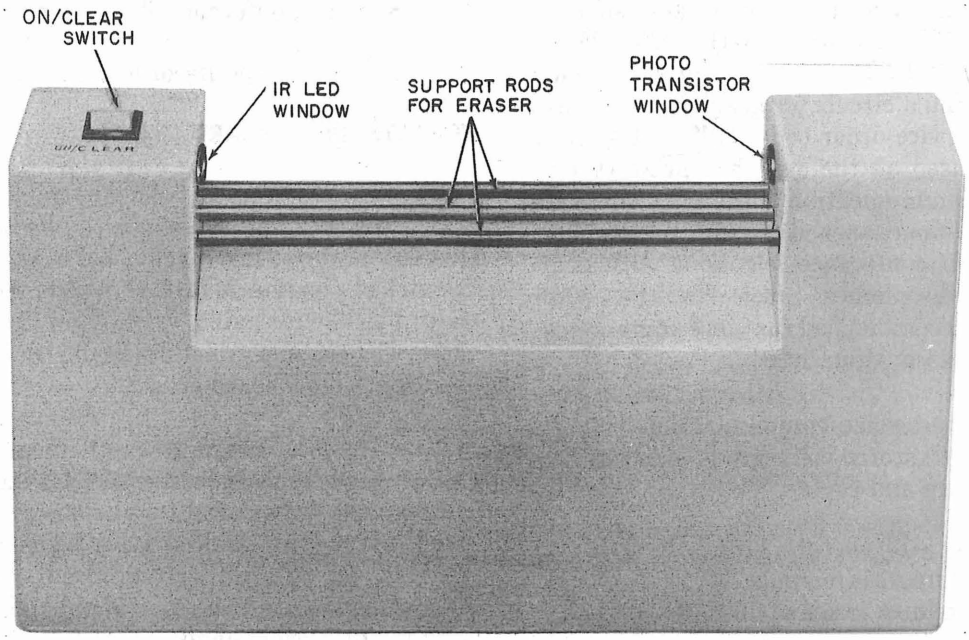


Fig. 2—83A Control Unit—Front View

erase") and to turn on the memory unit when first used ⧫(KS-21889-L1 only).⧫ The center of the control unit has three rods which provide a platform for storing an eraser. On either side of the control unit are located small "windows" through which infrared (IR) light passes from an IR LED (light-emitting diode) source to a receiving photo transistor ("electric eye"). This light switch provides the WRITE/ERASE switching function by detecting the presence (WRITE) or absence (ERASE) of the eraser.

2.08 The rear of the control unit contains three 25-pin connectors, labeled 1, 2, and 3, and a 5-pin blackboard connector. Connector 1 is male; connectors 2 and 3 are female. This arrangement of connectors automatically codes the blackboards to which they are connected as numbers 1, 2, and 3 in a multiple send-receive or multiple send configuration (see Part 3).

2.09 All components except the ON/CLEAR switch, IR LED, and photo transistor are mounted on a printed circuit board.

KS-21887 BLACKBOARD STAND (Fig. 1)

2.10 The optional blackboard stand is used in lieu of wall mounting. Overall dimensions of the blackboard stand are 78 inches high by 62 inches wide by 20 inches deep. The stand is made of aluminum and is finished in a clear anodized color. The stand has U-shaped cutouts on the top vertical members and two holes on the sides for mounting the blackboard. It is equipped with wheels, and weighs about 40 pounds. The front wheels are a lockable type.

1AR GRAPHICS TRANSMITTER-RECEIVER (Fig. 3)

2.11 The 1AR graphics transmitter-receiver (transceiver) consists of five circuit packs, a power supply, a printed circuit mother board, and a printed circuit connecting board. All of these components are mounted in an aluminum housing which measures 11 inches wide by 13 inches deep by 4 inches high, and weighs about 18 pounds fully equipped.

2.12 The mother board and connecting board are interconnected through a flat flexible cable which is connectorized at both ends. The five circuit packs plug into 40-pin connectors on the mother board which serves as a backplane. On the mother board, behind the removable rear plastic cover, are four test and option switches. Three of these are slide switches labeled GAIN, SEND, and DISP. The fourth switch is a push-to-operate, push-to-release switch labeled REC.

2.13 Following is a list of circuit packs that plug into the backplane.

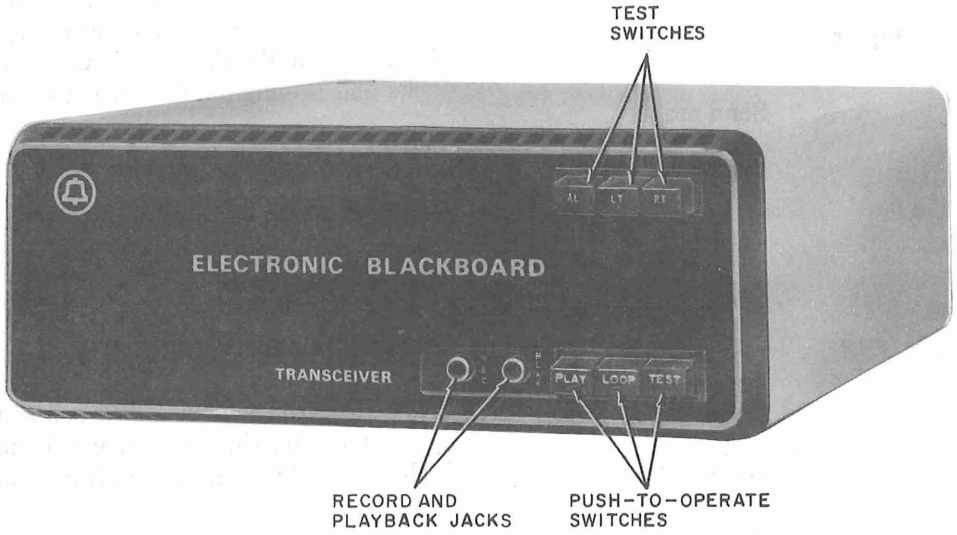


Fig. 3—1AR Graphics Transmitter-Receiver—Front View

- 202T Data Set
- TS1 Transmitter
- TS2 Transmitter
- TS3 Receiver
- TS4 Transmitter-Receiver.

The circuit packs are held in place by a removable locking bar.

2.14 The power supply is fastened into the housing with four screws on the bottom of the housing. A flexible cable connects the power supply to the backplane via a connector on the backplane. A fuse for the power supply is accessible when the front cover is removed. A spare fuse is located behind the rear cover.

2.15 A 25-pin connector is located on the connector board, which is used to connect the transmitter-receiver to the control unit via an M25-type cord. Three 9-pin female connectors are also located on the connector board which serve for connecting up to three memory units to the transmitter-receiver.

2.16 A three-terminal telephone connector is located near the connector board. The connector provides a connecting point for attaching a telephone line mounting cord.

2.17 Three push-to-operate switches are located on circuit pack (CP) TS4; they are labeled PLAY, LOOP, and TEST, and are accessible on the faceplate. The TEST switch is nonlocking; the PLAY and LOOP switches are push-to-operate, push-to-release.

2.18 Four indicator LEDs are located on CP TS1 and six are located on CP TS3. The LEDs illuminate "drop out" graphics on the front cover. When illuminated, the graphics provide for the appearance of two-letter abbreviations on the front cover. When the LEDs are extinguished, the front cover appears as a continuous black opaque surface. LED designations on the faceplate for data set (DS) 202T are (from left to right) ON, MR, RS, CS, CO, and TM. LED designations for CP TS1 (from left to right) are SE, S1, S2, and S3. LED designations for CP TS3 (from left to right) are ON, RD, RE, R1, R2, and R3. Definitions of these designations are as follows:

DESIGNATION	MEANING
DS 202T	
ON	Power on
MR	Modem ready
RS	Request to send
CS	Clear to send
CO	Carrier on
TM	Test mode

DESIGNATION	MEANING
CP TS1	
SE	Send erase
S1	Send 1
S2	Send 2
S3	Send 3
CP TS3	
ON	DC on
RD	Receive data
RE	Receive erase
R1	Receive 1
R2	Receive 2
R3	Receive 3

2.19 Two phonojacks are located on CP TS4 for tape recording and playback of graphics. These jacks are accessible through the front cover. Designations PLAY and REC are adjacent to the jacks and are visible through the front cover.

1AR GRAPHICS RECEIVER (Fig. 3)

2.20 The 1AR graphics receiver is identical to the 1AR graphics transmitter-receiver with CPs TS1 and TS2 removed.

KS-21889-L1 MEMORY UNIT (Fig. 4)

2.21 The -L1 memory unit is contained in an aluminum housing measuring 11 inches wide by 13 inches deep by 4 inches high and weighs about 22 pounds.

2.22 The memory unit is equipped with three push-to-operate nonlocking test switches labeled WRITE, CLEAR, and VIDEO; these are accessible through the plastic front cover. A potentiometer which is used to adjust the video output level from the memory unit is located to the right of the test

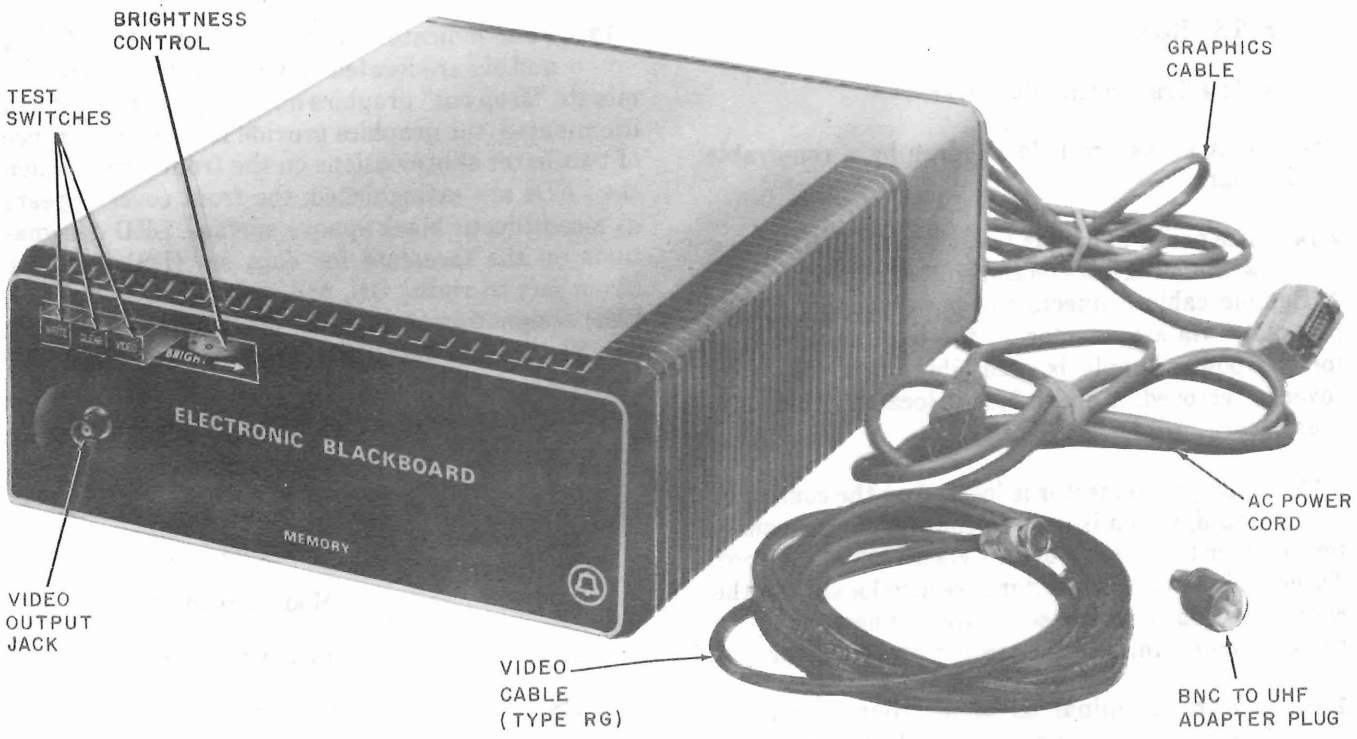


Fig. 4—KS-21889-L1 Analog Memory Unit—Front View With Associated Cables

switches, with the designation BRIGHT located under the potentiometer knob. The front cover may be removed by depressing at the top, then pulling forward.

2.23 Drop-out graphics appear on the front cover faceplate; they are illuminated from behind by six LEDs. Designations and meanings of these graphics are as follows:

DESIGNATION	MEANING
PO	Power on
ON	DC on
WR	Write
ER	Erase
CL	Clear
FF	Fan fail

2.24 Behind the front cover on the upper circuit pack is a slide switch labeled TEST-NORMAL. On the rear of the -L1 memory unit is an ac power cord and an input graphics cable terminated in a 9-pin male connector. A BNC connector is accessible through a cutout in the front cover, for connecting video to the monitor.

2.25 The -L1 memory unit is equipped with a cooling fan which draws outside air through a circular cutout in the rear plastic cover. Failure of the fan will cause the FF (fan fail) lamp to flash ***on*** and ***off.***

◗KS-21889-L3 MEMORY UNIT (Fig. 5 and 6)

2.26 The -L3 memory unit is contained in an aluminum housing measuring 15-1/2 inches wide by 16 inches deep by 4 inches high and weighs about 17 pounds.

> ***Note:*** The -L2 and -L4 memory units are identical to the -L1 and -L3 memory units, respectively, except that they do not have the Bell System logo; they are for non-Bell System use.

2.27 The -L3 memory unit is equipped with two push-to-operate nonlocking test switches labeled WRITE and CLEAR; these are accessible through the metal front cover. The front cover may be removed by removing two screws.

2.28 Five indicator LEDs appear on the front cover faceplate. Their designations and meanings are as follows:

DESIGNATION	MEANING
PO	Power on
WR	Write
ER	Erase
CL	Clear
FF	Fan fail

2.29 On the rear of the -L3 memory unit is an ac power cord and an input graphics cable terminated in a 9-pin male connector. A BNC connector is also accessible through the rear cover, for connecting video to the monitor.

2.30 A cooling fan is provided on the -L3 memory unit, which draws outside air through a cutout in the rear metal cover. Failure of the fan will cause the FF (fan fail) lamp on the front panel to turn ***on.***◖

KS-21888 CABINET (Fig. 7 and 8)

2.31 The cabinet measures 24 inches wide by 18 inches deep by 42 inches high, and weighs about 40 pounds. The cabinet has a black finish. Caster wheels are provided on the bottom of the cabinet for mobility. Three shelves are provided and a compartment with front and rear access doors. Ventilating holes are provided in the bottom of the compartment, and in the rear door.

2.32 A multioutlet ac power strip is attached to the bottom of the compartment; it is equipped with a 15-foot-long power cord. The power strip has an on-off switch, a power indicator lamp, and a resettable delay-type circuit breaker. One cutout for feeding the power cord and other cords is located on the rear bottom of the compartment, and two cutouts are located on the rear top of the compartment.

VIDEO MONITOR (Fig. 1)

2.33 Any baseband video monitor conforming with EIA (Electronic Industries Association) Stan-

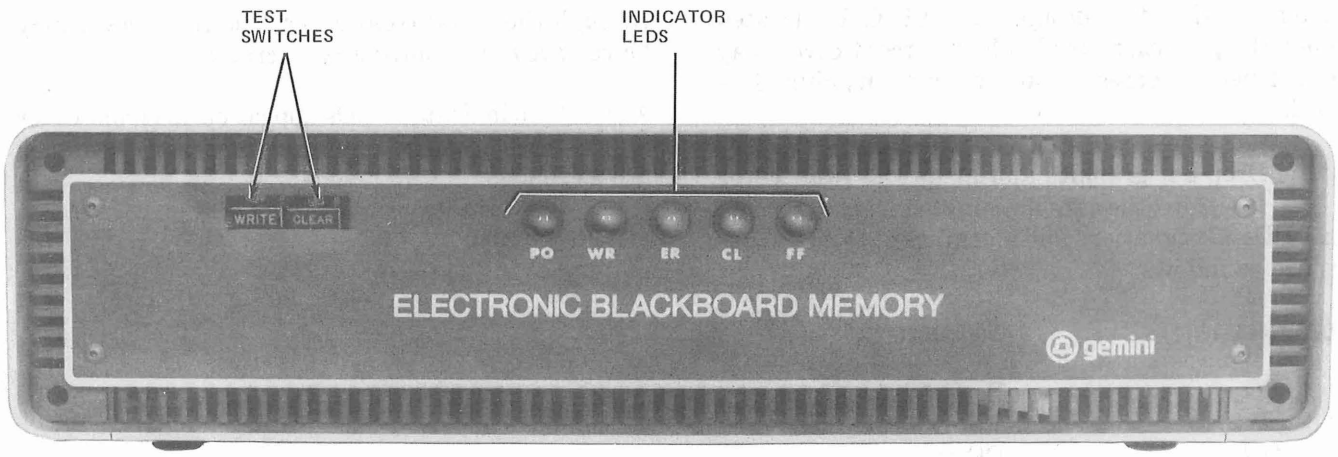


Fig. 5—KS-21889-L3 Digital Memory Unit—Front View

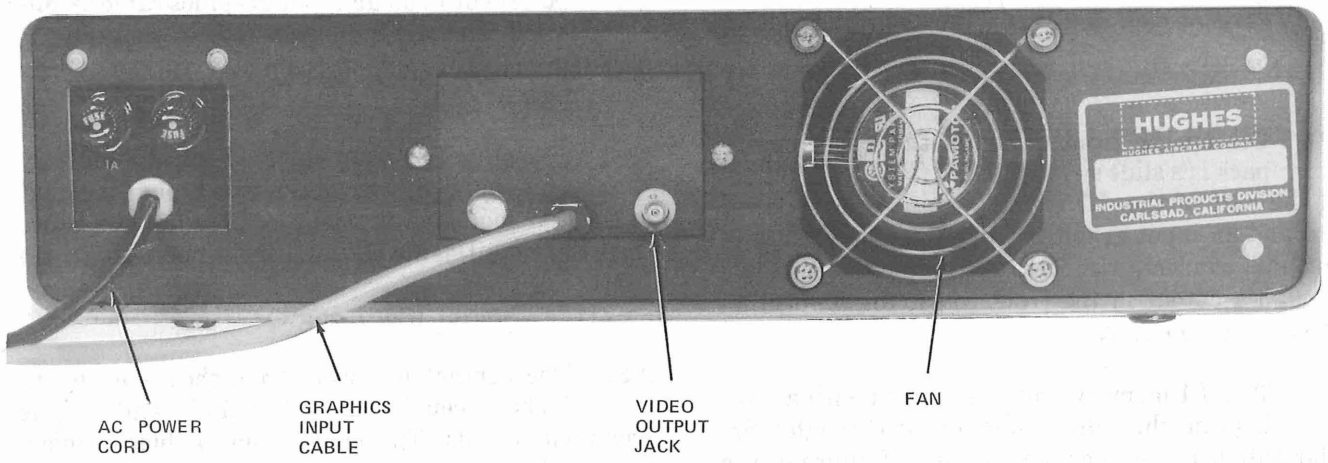


Fig. 6—KS-21889-L3 Digital Memory Unit—Rear View

dard RS-170, such as a CONRAC* SNA23/C may be used; however, a 23-inch monitor is recommended. For a good quality display, inexpensive monitors should be avoided. The monitor is customer owned and maintained (COAM). The use of television receivers with up converters is discouraged because of poor resolution which results in a poor quality video display.

TELEPHONE SET (Fig. 1)

2.34 Each of the four recommended telephones is provided with an exclusion key, to permit transfer from voice to graphics. For details on the 502BM (rotary dial), 2502BM (TOUCH-TONE dial), 503CM (rotary dial), and 2503CM (TOUCH-TONE dial) telephone sets, refer to Sections 502-531-401, 502-533-401, 502-501-120, and 502-503-120, respectively.

Note: The telephone sets must be rewired to provide line control in the talk mode (handset off-hook) data control with the exclusion key operated, (and monitoring deactivated on 503CM and 2503CM sets).

* Registered trademark of Conrac Corporation.

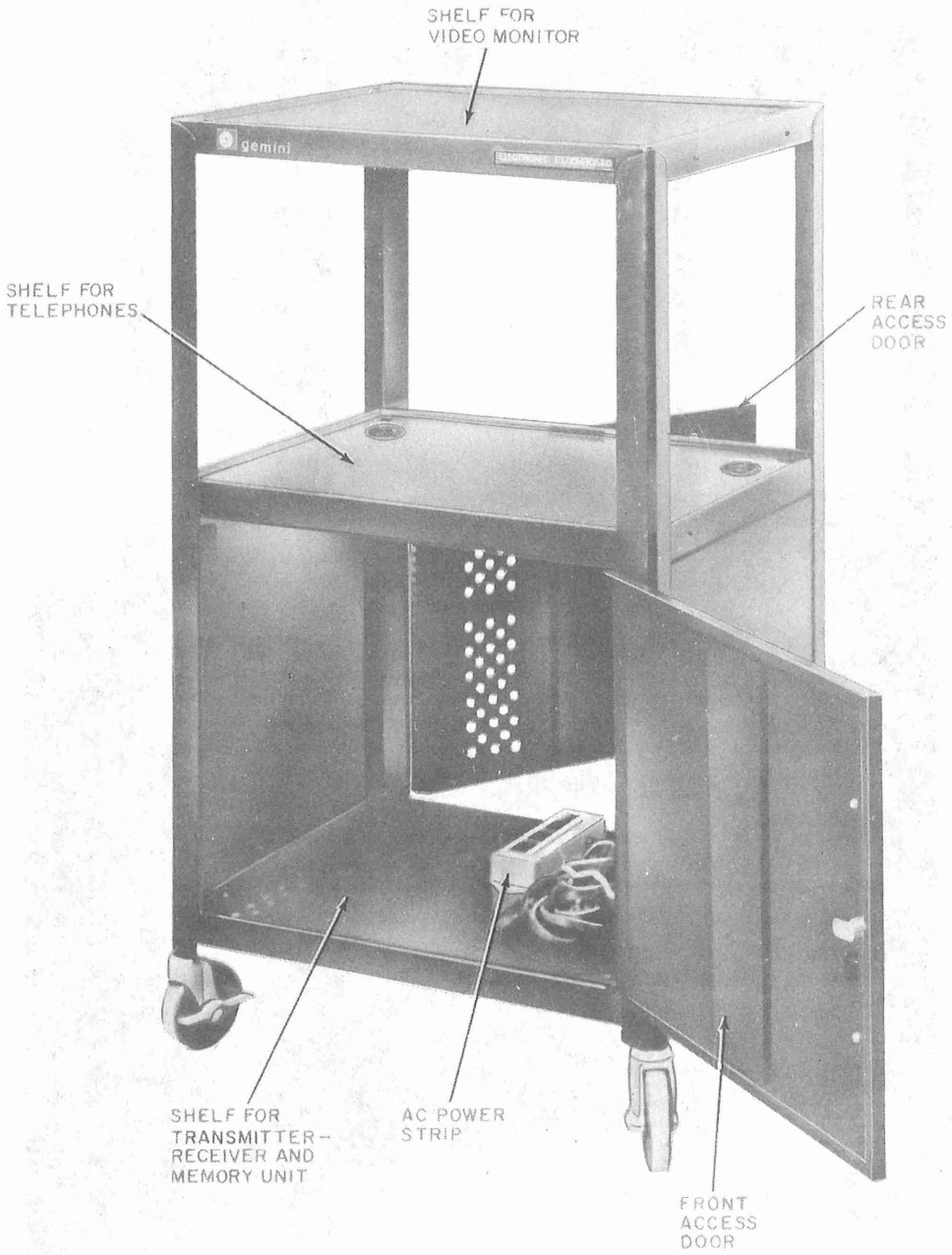


Fig. 7—KS-21888 Cabinet Arranged for KS-21889-L1 Memory Unit—Front View

50A1 CONFERENCE TELEPHONE SET

2.35 The 50A1 conference telephone set (Fig. 1) provides a built-in loudspeaker, a built-in microphone and two portable microphones with 20-foot cords. The portable microphones may be used with lavaliere assemblies (neck band) to provide voice pickup while writing at the blackboard. For further details, refer to Section 512-630-111.

STEREO CASSETTE TAPE RECORDER

2.36 A stereo cassette tape recorder may be used for recording both graphics and audio (voice) simultaneously, either at the originating location or

Fig. 8—KS-21888 Cabinet Arranged for KS-21889-L3 Memory Unit—Front View

from a remote location, for playback at a later time. A good-quality commercially available two-channel voice-grade cassette recorder (such as SUPERSCOPE* CD 320) may be used. The tape recorder is customer owned and maintained.

Note: For error-free operation, the tape recorder must have a speed accuracy better than ±3 percent.

* Registered trademark of Superscope, Inc.

3. STATION CONFIGURATIONS

3.01 The electronic blackboard station is modular in design, permitting various configurations to suit the requirements of the customer. These configurations are as follows:

SINGLE SEND-RECEIVE STATION (Fig. 9)

3.02 For originating and receiving graphics, the following equipment is required at one location:

- KS-21890 Blackboard
- KS-21887 Blackboard Stand (if wall mounting is not used)
- 83A Control Unit
- 1AR Graphics Transmitter-Receiver
- Video Monitor (COAM) (CONRAC SNA23/C or equivalent)
- KS-21889 Memory Unit
- KS-21888 Cabinet
- 50A1 Conference Telephone Set (optional)
- Stereo Cassette Tape Recorder (optional) (COAM)
- M25A-25' Blackboard Cord.

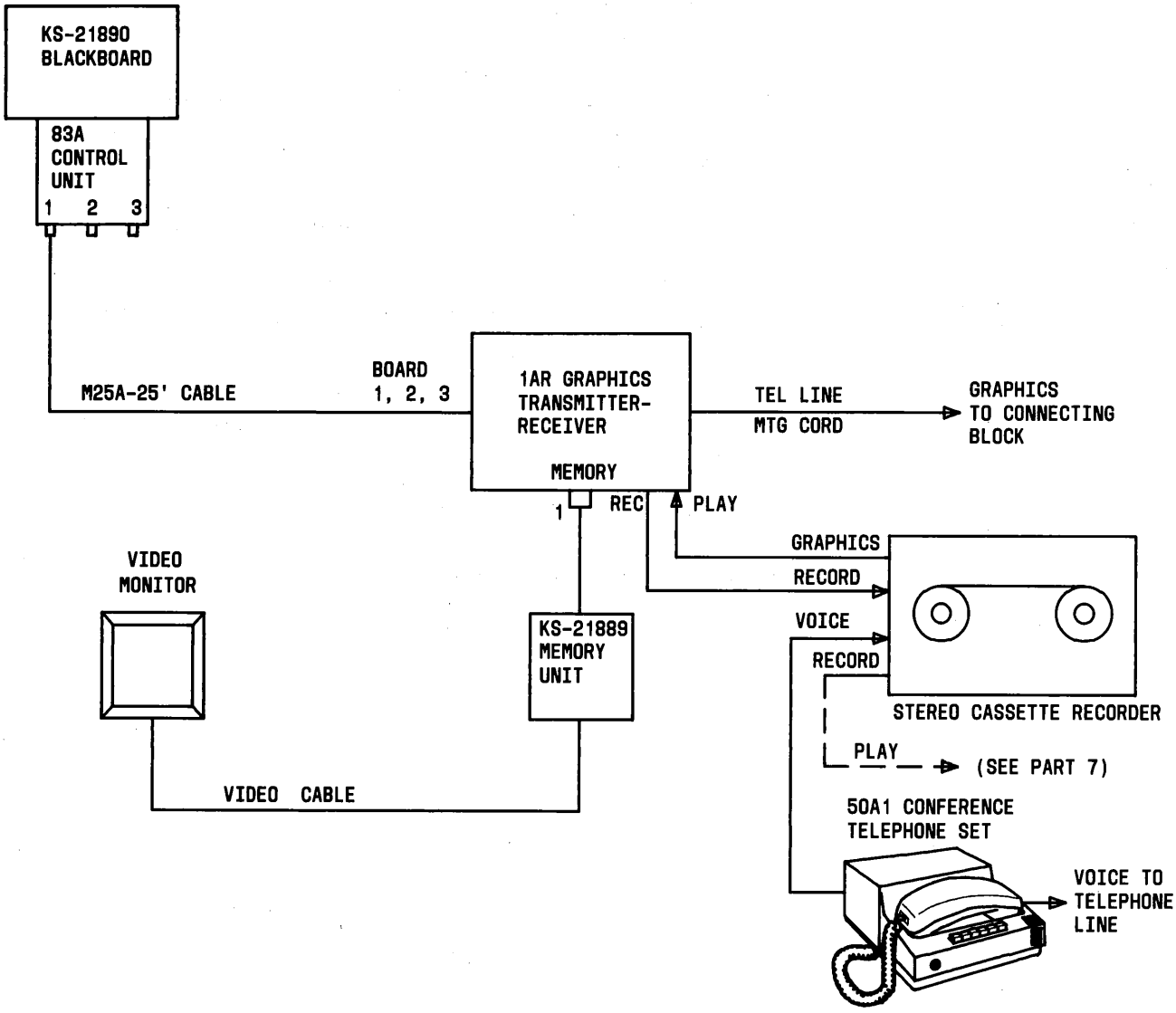


Fig. 9—Single Send-Receive Station

SINGLE RECEIVE-ONLY STATION (Fig. 10)

3.03 For receiving graphics only, the following equipment is required at one location:

- 1AR Graphics Receiver (1AR graphics transmitter-receiver can also be used)
- KS-21889 Memory Unit
- KS-21888 Cabinet
- Video Monitor (COAM) (CONRAC SNA23/C or equivalent)
- 50A1 Conference Telephone Set (optional)
- Stereo Cassette Tape Recorder (optional) (COAM).

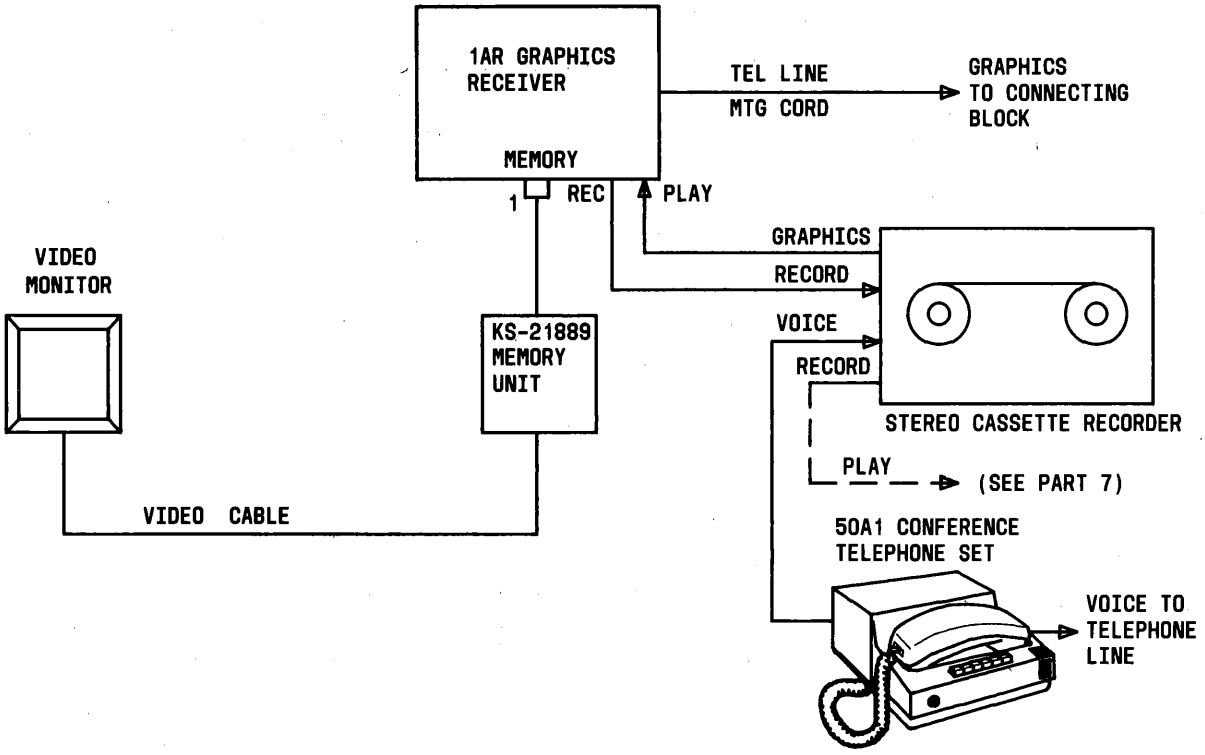


Fig. 10—Single Receive-Only Station

SINGLE SEND-ONLY STATION (Fig. 11)

3.04 For transmitting graphics only, the following equipment is required at one location:

- KS-21890 Blackboard
- KS-21887 Blackboard Stand (if wall mounting is not used)
- 83A Control Unit
- 1AR Graphics Transmitter-Receiver
- KS-21888 Cabinet
- 50A1 Conference Telephone Set (optional)
- Stereo Cassette Tape Recorder (optional) (COAM)
- M25A-25' Blackboard Cord.

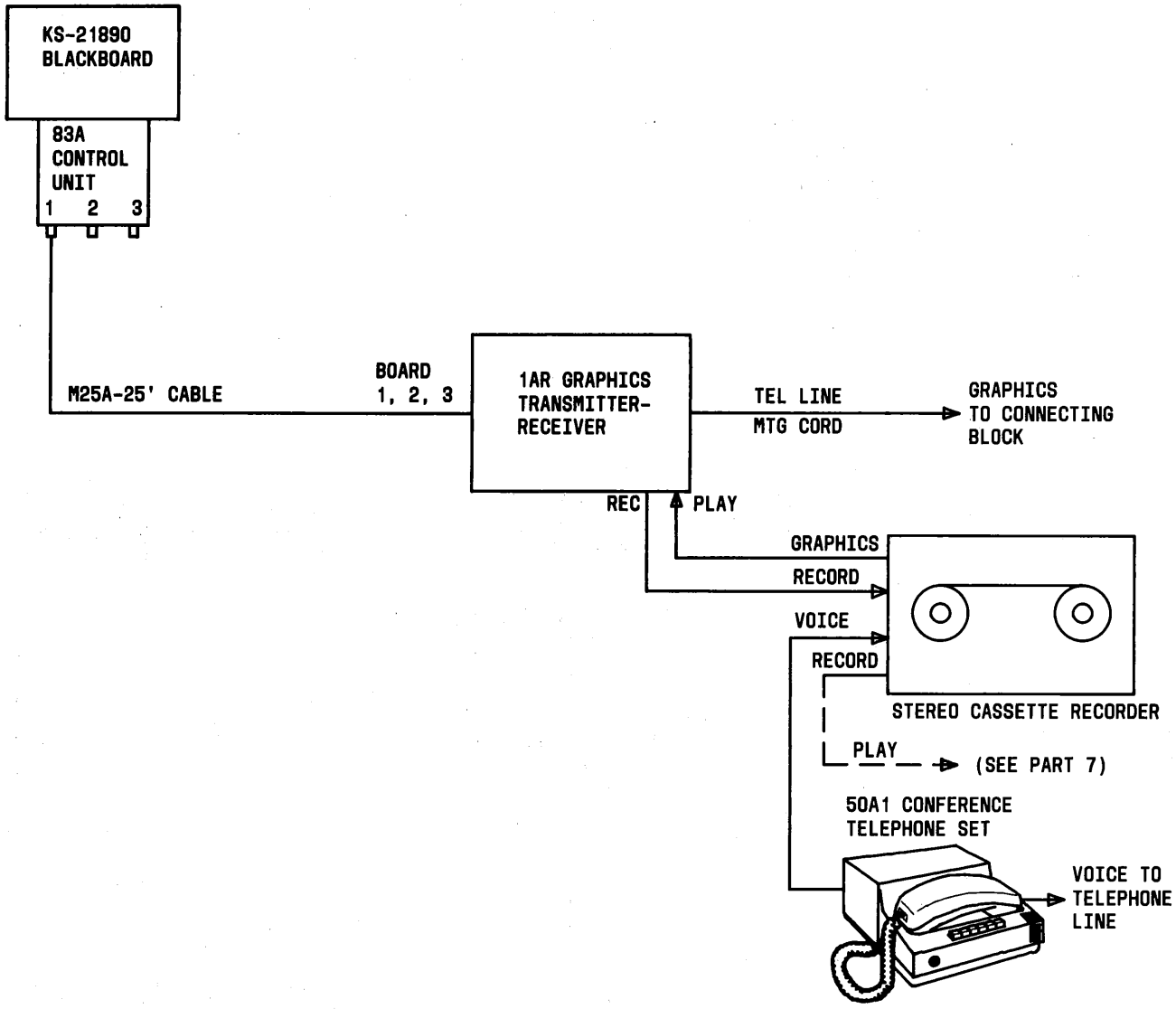


Fig. 11—Single Transmit-Only Station

MULTIPLE SEND-RECEIVE STATION

3.05 Where more than one display and/or blackboard is required, the number of either or both may be increased to two or three. Only one transmitter-receiver is required in any of these cases.

DUAL SEND-RECEIVE STATION (Fig. 12)

3.06 The following equipment is required for a dual send-receive station:

- 2 KS-21890 Blackboards
- 2 KS-21887 Blackboard Stands (if wall mounting is not used)
- 2 83A Control Units
- 1 1AR Graphics Transmitter-Receiver
- 2 KS-21889 Memory Units
- 2 KS-21888 Cabinets
- 2 Video Monitors (COAM) (CONRAC SNA23/C or equivalent)
- 2 Blackboard Cords; 1 M25A-25', 1 M25A-9'
- 1 50A1 Conference Telephone Set (optional)
- 1 Stereo Cassette Tape Recorder (optional) (COAM).

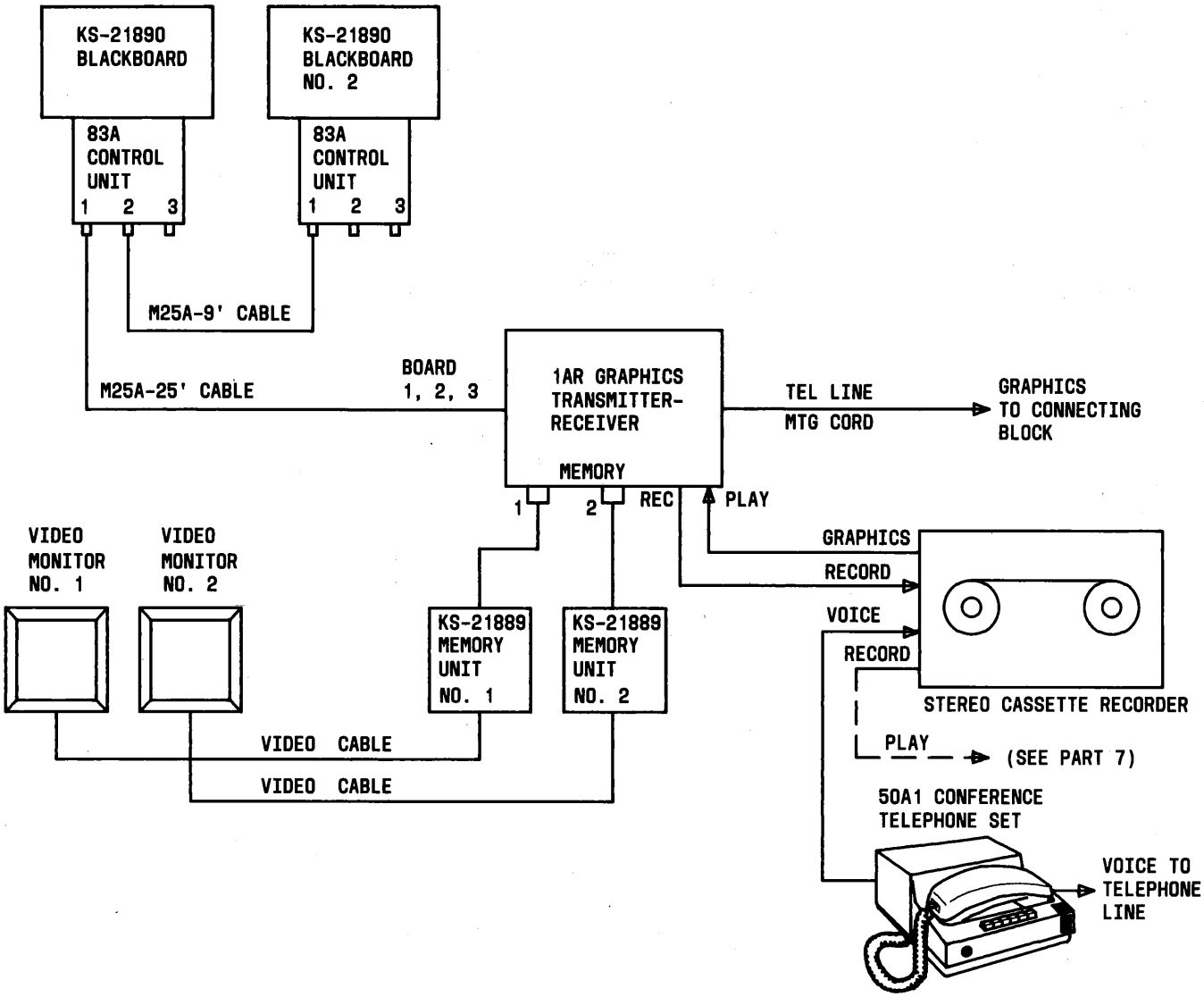


Fig. 12—Dual Send-Receive Station

TRIPLE SEND-RECEIVE STATION (Fig. 13)

3.07 The following equipment is required for a triple send-receive station:

- 3 KS-21890 Blackboards
- 3 KS-21887 Blackboard Stands (if wall mounting is not used)
- 3 83A Control Units
- 1 1AR Graphics Transmitter-Receiver
- 3 KS-21889 Memory Units
- 3 KS-21888 Cabinets
- 3 Video Monitors (COAM) (CONRAC SNA23/C or equivalent)
- 3 Blackboard Cords; 1 M25A-25', 2 M25A-9'
- 1 50A1 Conference Telephone Set (optional)
- 1 Stereo Cassette Tape Recorder (optional) (COAM).

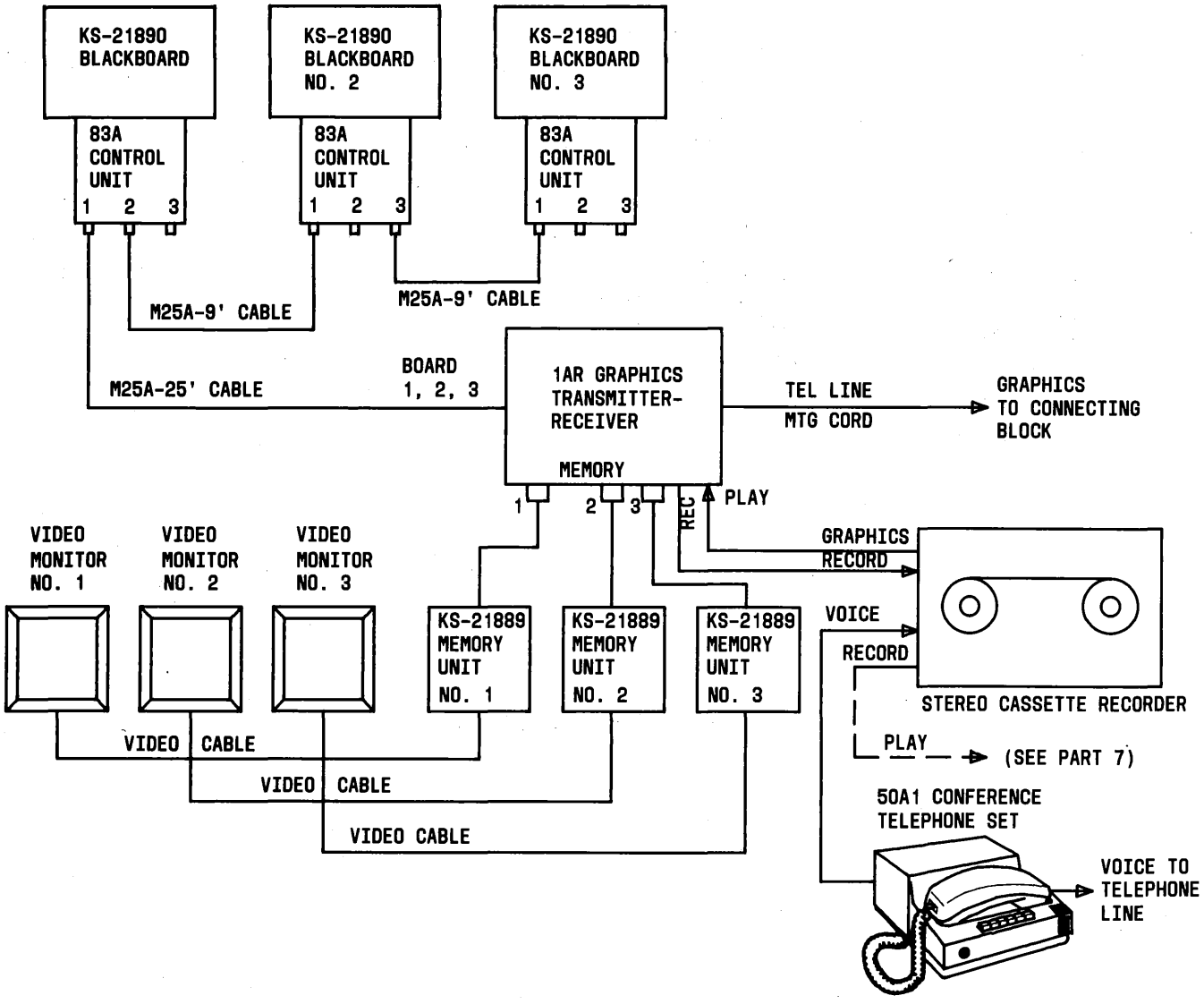


Fig. 13—Triple Send-Receive Station

DUAL RECEIVE-ONLY STATION (Fig. 14)

3.08 The following equipment is required for a dual receive-only station:

- 1 1AR Graphics Receiver (1AR graphics transmitter-receiver can also be used)
- 2 KS-21889 Memory Units
- 2 KS-21888 Cabinets
- 2 Video Monitors (COAM) (CONRAC SNA23/C or equivalent)
- 1 50A1 Conference Telephone Set (optional)
- 1 Stereo Cassette Tape Recorder (optional) (COAM).

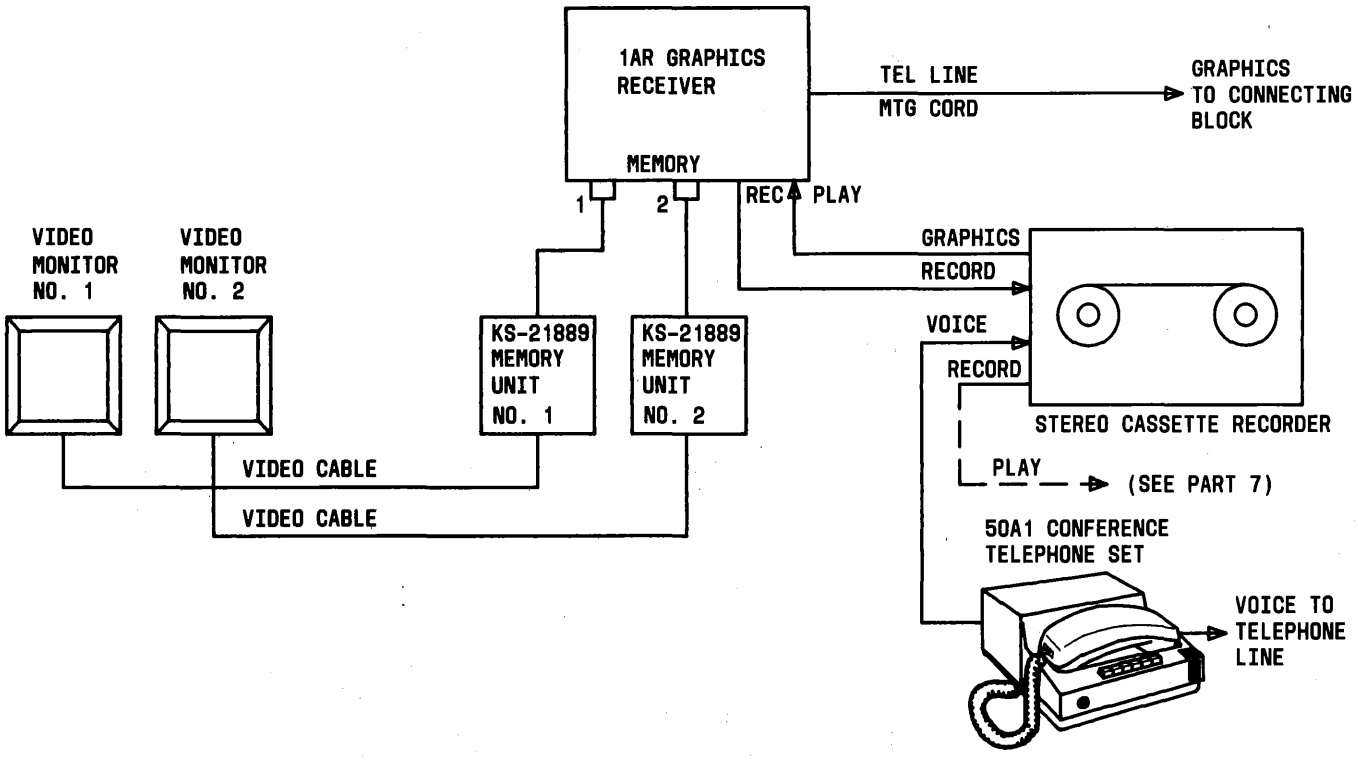


Fig. 14—Dual Receive-Only Station

TRIPLE RECEIVE-ONLY STATION (Fig. 15)

3.09 The following equipment is required for a triple receive-only station:

- 1 1AR Graphics Receiver (1AR graphics transmitter-receiver can also be used)
- 3 KS-21889 Memory Units
- 3 KS-21888 Cabinets
- 3 Video Monitors (COAM) (CONRAC SNA23/C or equivalent)
- 1 50A1 Conference Telephone Set (optional)
- 1 Stereo Cassette Tape Recorder (optional) (COAM).

MIXED MULTIPLE STATION

3.10 Where desired, the number of blackboards may be different than the number of displays. Mixing in any combination is permissible. A typical mixed multiple station is given in paragraph 3.11.

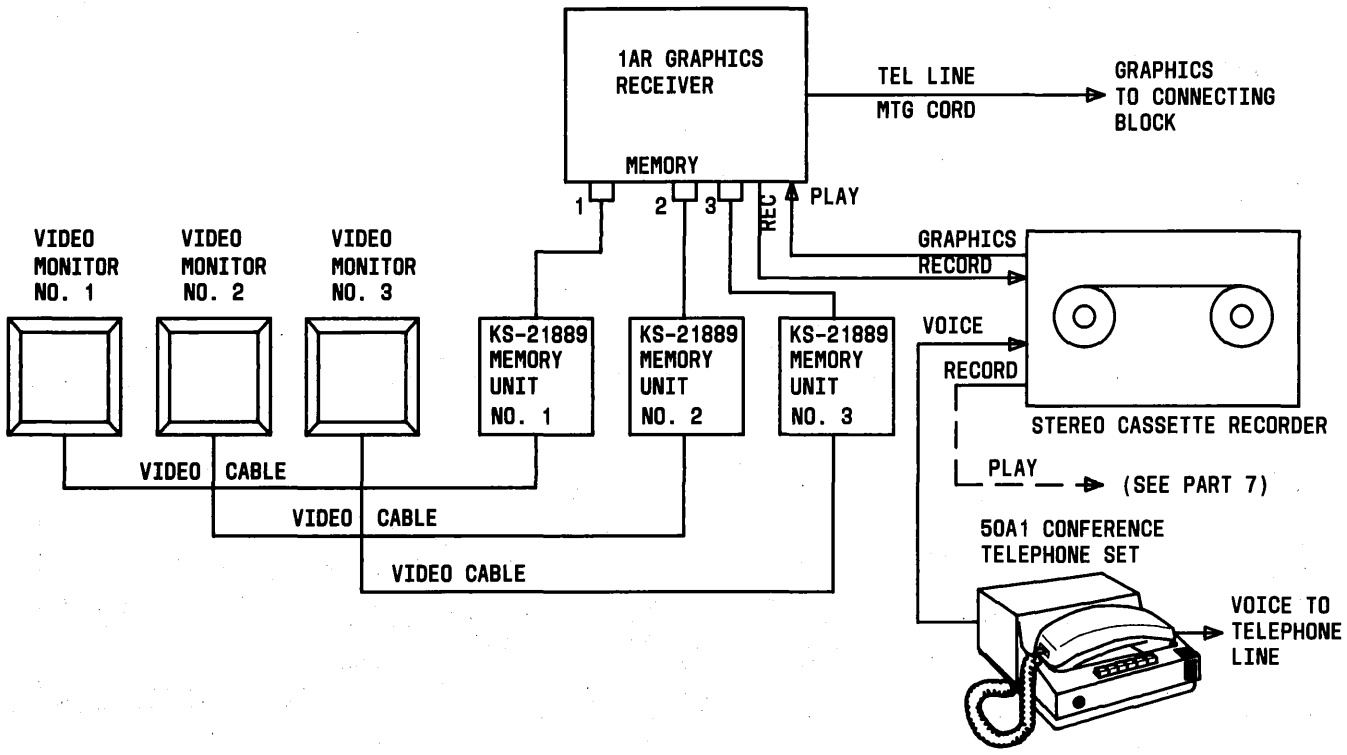


Fig. 15—Triple Receive-Only Station

SINGLE SEND-TRIPLE RECEIVE STATION (Fig. 16)

3.11 The following equipment is required for a single send-triple receive station:

- 1 KS-21890 Blackboard
- 1 KS-21887 Blackboard Stand (if wall mounting is not used)
- 1 83A Control Unit
- 1 1AR Graphics Transmitter-Receiver
- 3 KS-21889 Memory Units
- 3 KS-21888 Cabinets
- 3 Video Monitors (COAM) (CONRAC SNA23/C or equivalent)
- 1 Blackboard Cord M25A-25'
- 1 50A1 Conference Telephone Set (optional)
- 1 Stereo Cassette Tape Recorder (optional) (COAM).

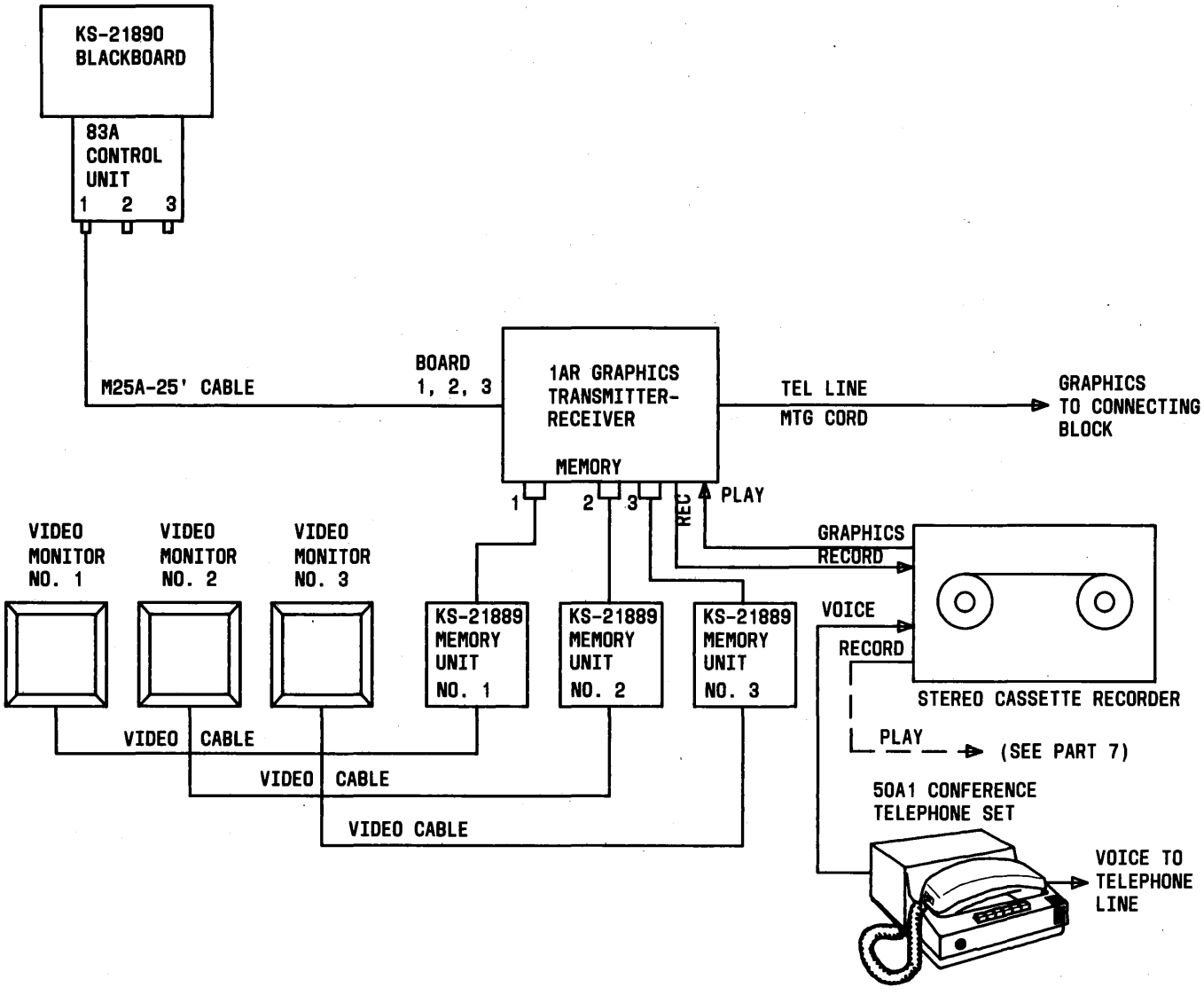


Fig. 16—Single Send-Triple Receive Station

DUAL SEND-ONLY STATION (Fig. 17)

3.12 The following equipment is required for a dual send-only station:

- 2 KS-21890 Blackboards
- 2 KS-21887 Blackboard Stands (if wall mounting is not used)
- 2 83A Control Units
- 1 1AR Graphics Transmitter-Receiver
- 1 Blackboard Cord M25A-25′
- 1 Blackboard Cord M25A-9′
- 1 50A1 Conference Telephone Set (optional)
- 1 Stereo Cassette Tape Recorder (optional) (COAM).

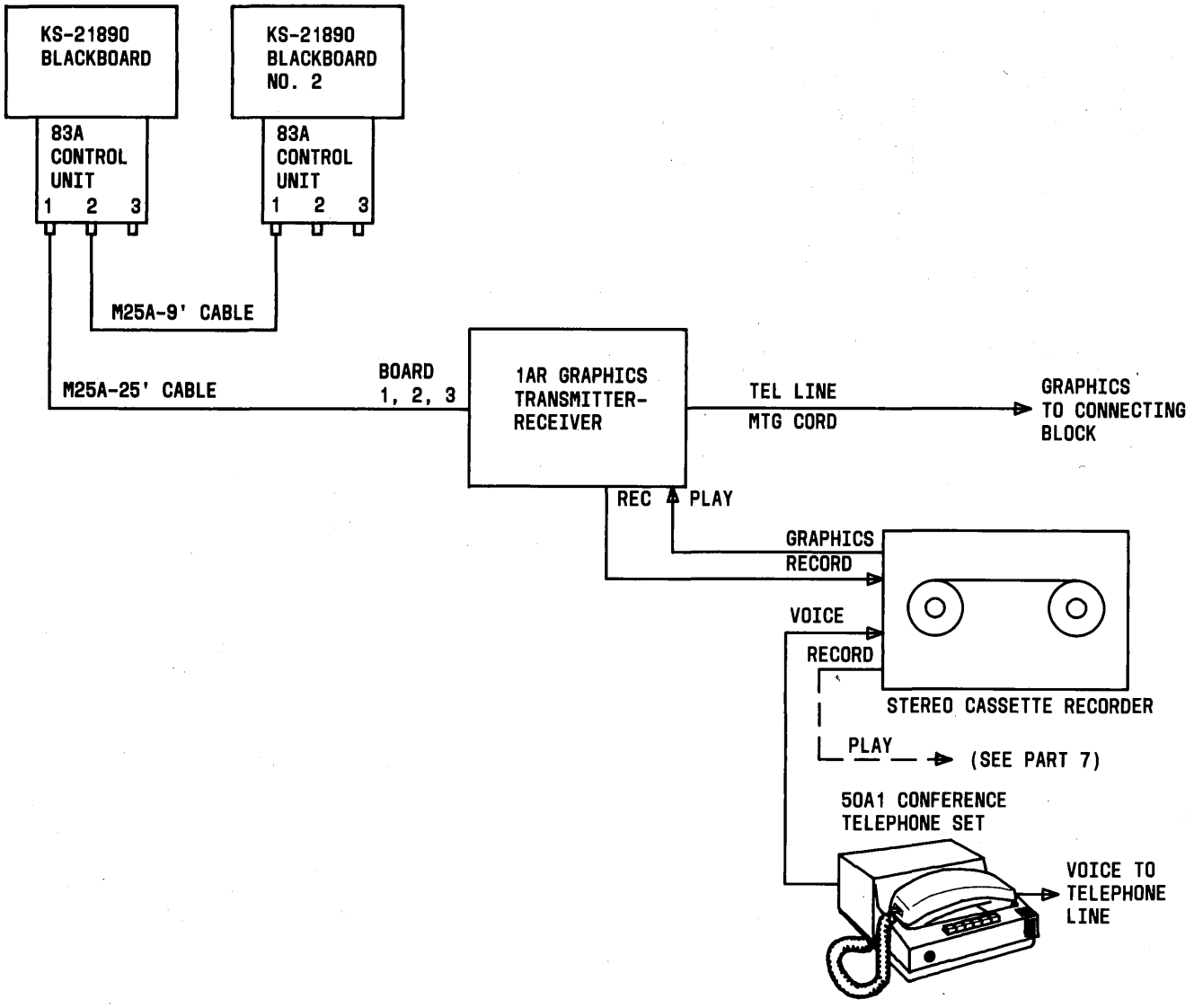


Fig. 17—Dual Send-Only Station

TRIPLE SEND-ONLY STATION (Fig. 18)

3.13 The following equipment is required for a triple send-only station:

- 3 KS-21890 Blackboards
- 3 KS-21887 Blackboard Stands (if wall mounting is not used)
- 3 83A Control Units
- 1 1AR Graphics Transmitter-Receiver
- 1 Blackboard Cord M25A-25'
- 2 Blackboard Cords M25A-9'
- 1 50A1 Conference Telephone Set (optional)
- 1 Stereo Cassette Tape Recorder (optional) (COAM).

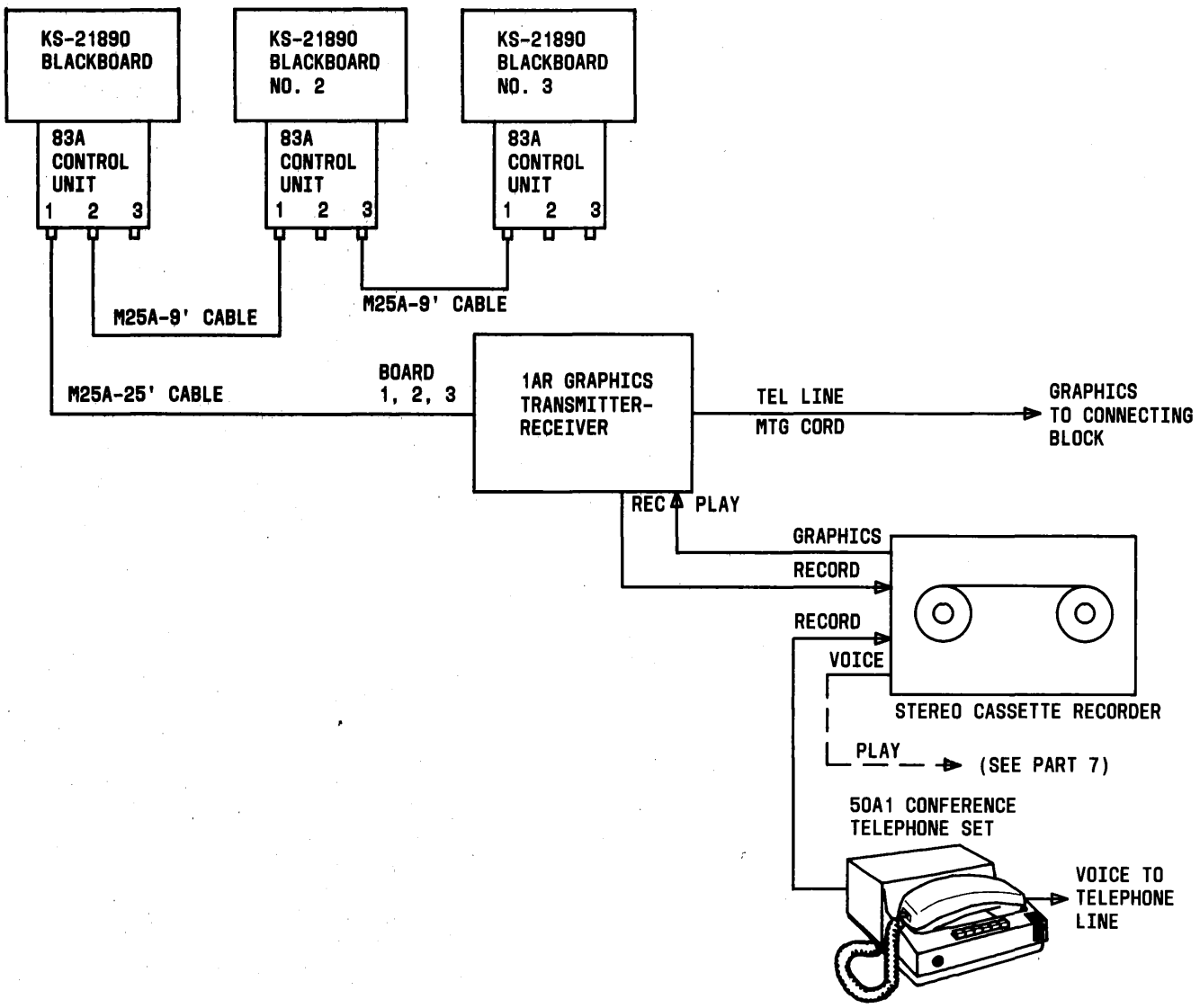


Fig. 18—Triple Send-Only Station

SWITCHED NETWORK TELEPHONE CONNECTION (Fig. 19)

3.14 For connecting to the switched network the following equipment is required:

- M4AU Telephone Mounting Cord
- 97A Connecting Block
- 635B Connecting Block
- 502BM, 2502BM, 503CM,* or 2503CM* Telephone Set.

*Recommended sets.

Note: The 502BM and 2502BM sets require a D-180810 kit of parts (ordered separately) for use with an M4AU telephone mounting cord.

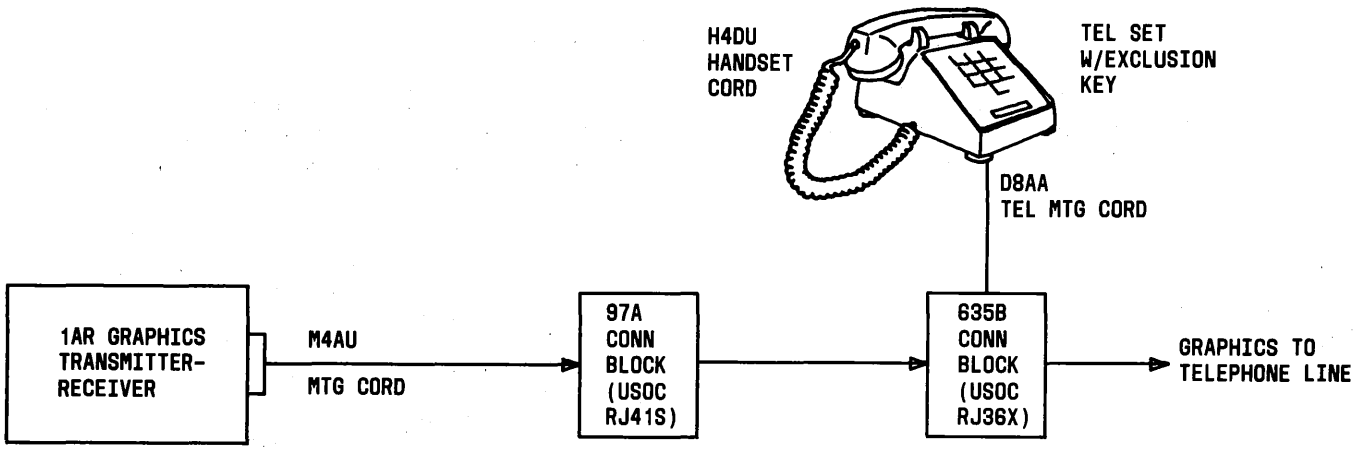


Fig. 19—Connecting to the Switched Network

SWITCHED NETWORK TELEPHONE CONNECTION BEHIND A PBX (Fig. 20)

3.15 For connecting to the switched network behind a PBX the following equipment is required:

- M4AU Telephone Mounting Cord
- 330-Type Adapter (comcode 103 259 891)
- 625A Voice Jack
- 635B Connecting Block
- 502BM, 2502BM, 503CM,* or 2503CM* Telephone Set

*Recommended sets.

Note: The 502BM and 2502BM sets require a D-180810 kit of parts (ordered separately) for use with an M4AU telephone mounting cord.

PRIVATE LINE TELEPHONE CONNECTION (Fig. 21)

3.16 For connecting to a private line the following equipment is required:

- D6AA-87 Telephone Mounting Cord
- 42A or 635B Connecting Block
- 502BM, 2502BM, 503CM,* or 2503CM* Telephone Set.

*Recommended sets.

Note: The telephone set is optional and is only required if the customer requests voice service on the graphics line.

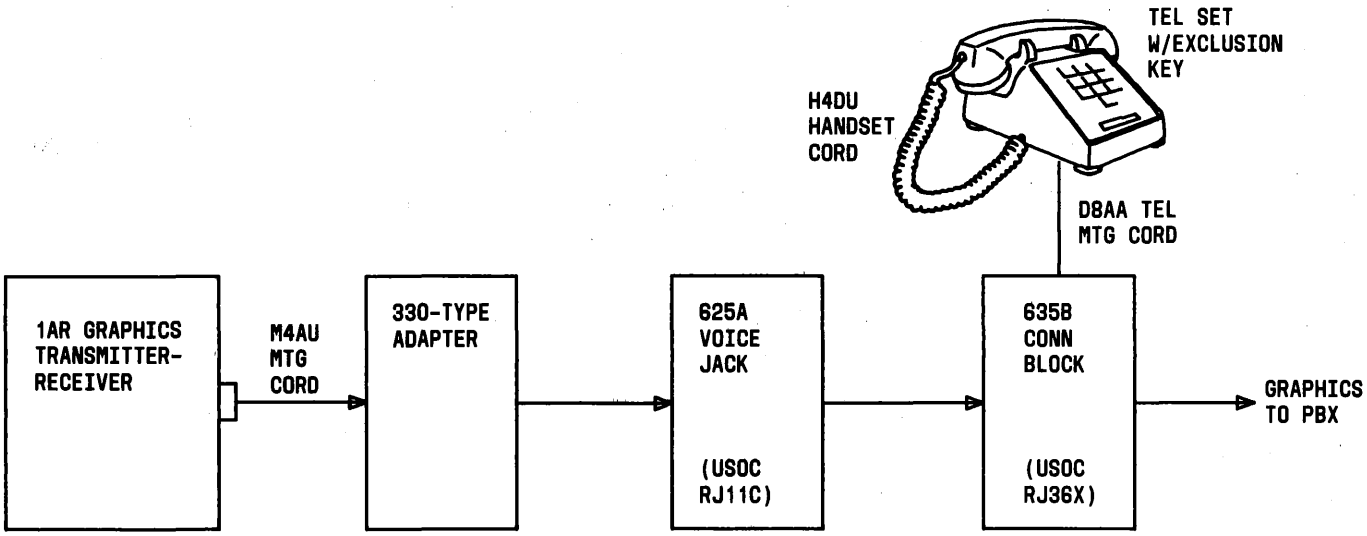


Fig. 20—Connecting to the Switched Network Behind a PBX

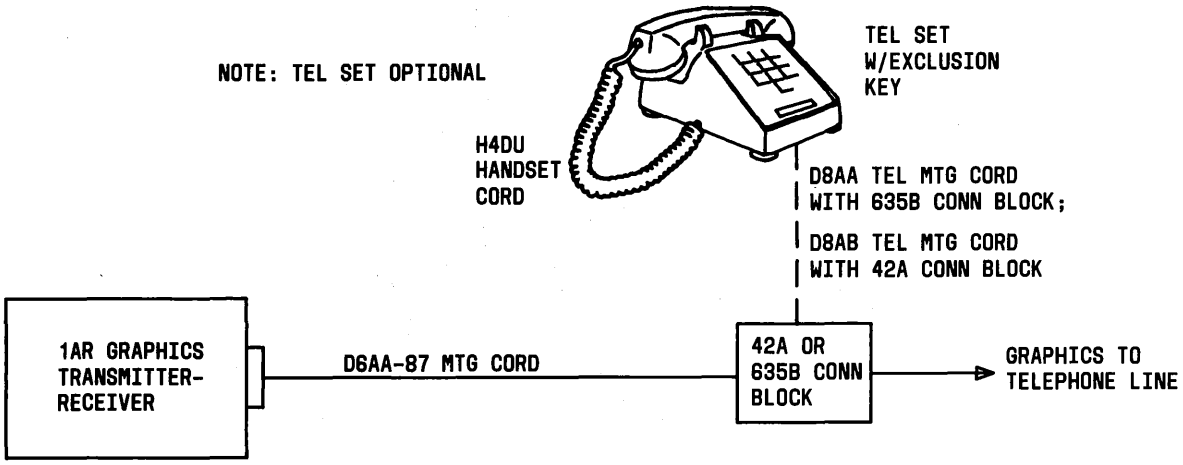


Fig. 21—Connecting to a Private Line

3.17 The telephone sets have to be ordered as follows:

502BM or 2502CM

D-180810 Kit of Parts

D8AA Telephone Mounting Cord (for 635 Connecting Block)

D8AB Telephone Mounting Cord (for 42A Connecting Block)

503CM* or 2503CM*

H4DU Handset Cord

D8AA Telephone Mounting Cord (for 635 Connecting Block)

D8AB Telephone Mounting Cord (for 42A Connecting Block).

*Recommended sets.

4. FUNCTIONAL DESCRIPTION OF STATION

4.01 The station described in this part is a single send-receive station, as shown in Fig. 22. Other stations operate in essentially the same manner as the single send-receive station; details of multiple stations will not be discussed in this part.

KS-21890-L1 BLACKBOARD

4.02 The blackboard consists of two large MYLAR sheets coated on one side with electrically conductive material, and separated by a small air gap. A voltage is alternately applied to the horizontal axis (X axis) and vertical axis (Y axis). When chalk touches the board, the front sheet of plastic deflects to make contact with the rear sheet, and an electrical analog voltage proportional to position of the chalk is developed for each axis. ***For proper operation of the blackboard, only one point at a time can be touched with either the chalk or any other object.***

4.03 The writing surface of the blackboard is painted with a flat black paint which provides a writing surface similar to an ordinary blackboard. A conventional blackboard eraser is used to erase the board.

83A CONTROL UNIT

4.04 Analog X and Y position signals from the blackboard pass through the control unit,

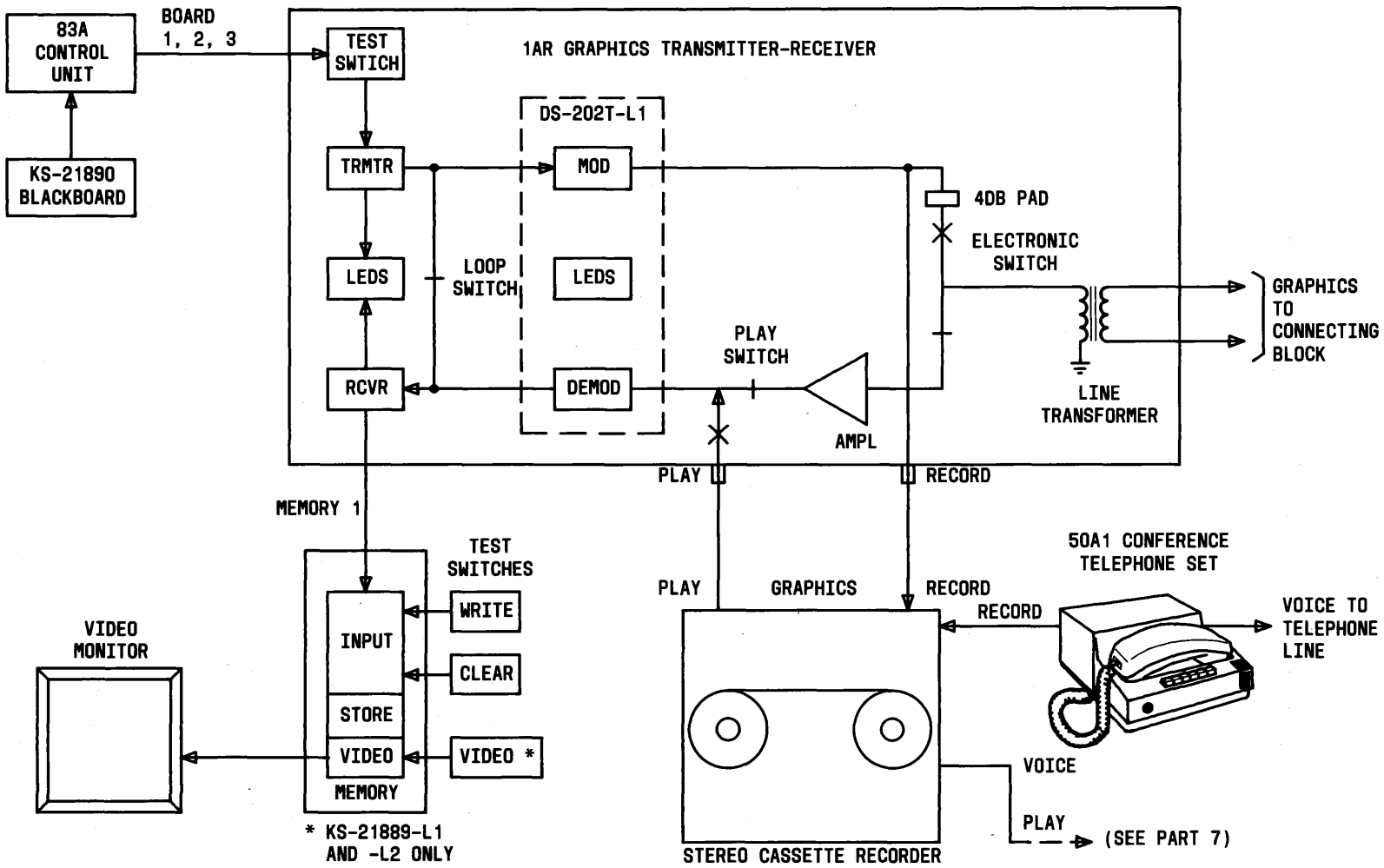


Fig. 22—Single Send-Receive Station—Functional Block Diagram

which also provides a connection point with the transmitter-receiver and with other blackboards.

4.05 A pushbutton provided on the control unit is used to clear the stored display in the memory at both local and remote stations and to turn on the memory unit from standby. ⏵There is no standby on the -L3 memory unit.⏴

4.06 An IR light switch (described in paragraph 2.07) detects the presence of the eraser on the control unit, which switches to erase mode when the eraser is lifted from the control unit. ***Writing on the blackboard when the eraser is removed from the control unit will result in erasure of corresponding points on the display.***

4.07 When the eraser touches a small portion of the blackboard, a corresponding small portion of the stored display in the memory is automatically erased.

1AR GRAPHICS TRANSMITTER-RECEIVER (TRANSCEIVER)

4.08 Analog signals are fed from the blackboard via the control unit to the transmitter portion of the transmitter-receiver (Fig. 22), where the signal is converted to digital form. Clear and erase signals are also processed and incorporated into the digital data stream. Which one of up to three blackboards is also encoded and sent to the modulator portion of DS 202T.

4.09 The transmitter-receiver is always in the receive mode except when chalk or eraser touches the blackboard. Touching the board "chalk-switches" from receive to transmit mode. Transmission is prohibited by lockout circuitry when an incoming signal is present.

4.10 Data set 202T is operated in the 4-wire mode as described in Section 592-031-200. Refer to Table D for setting of option switches. A line transformer and associated circuitry in the transmitter-receiver provide an interface suitable for operating over 2-wire private lines or the switched network. Interface to the customer-provided tape recorder for recording and playback of graphics is also provided.

4.11 Transmission of the data stream from DS 202T is a nonsynchronous frequency shift keyed (FSK) signal at 1300 bits per second (bps).

4.12 "Chalk-switched" operation permits half-duplex operation; that is, two-way graphics is accomplished using only one 2-wire line. More than one remote graphics station may be bridged for multipoint conferencing using any existing 2-wire voice-grade bridging facilities. The number of remote stations is limited only by the limits of the bridging facilities. In such an arrangement, transmission may originate at any one of the stations and be received by all other stations on the bridge.

> ***Note:*** For voice and graphics conferencing, two bridges are required.

4.13 Impedance of the transmitter-receiver is 600 ohms, as seen from the telephone line. The transmit level is fixed at −4 dBm into a 600-ohm line. The receiver will operate with an input between 0 and −42 dBm. ⏵The low-end cutoff is determined by the DS 202T. There are presently DS 202T-L1s and DS 202T-L1As in use in the 1AR graphics transmitter-receiver. The -L1 has a clamp disable option which will make this low-end cutoff somewhat variable (−40 dBm to −50 dBm). However, the -L1A does not have a clamp disable option and the low-end cutoff will be higher (about −38 dBm).⏴ For switched network service, the access loop shall meet Type II conditioning requirements.

4.14 The receiver portion of DS 202T demodulates the signal before passing it to the RCVR (receiver) portion of the transmitter-receiver. The receiver further processes the incoming graphics signal, converting it from digital to analog form before passing the signal to the memory unit. The receiver also decodes which one of up to three blackboards is being used, and directs the signal to the associated memory unit. The RCVR also decodes CLEAR and ERASE commands and passes them to the appropriate memory unit.

KS-21889-L1 MEMORY UNIT

4.15 Analog signals from the receiver portion of the transmitter-receiver are applied to the input of the memory unit. This signal is passed to the storage part of the memory unit, which will retain the signal in electronic storage for a period of up to 1 hour. After 1 hour from the last received signal a timer times out, turning the memory to standby. While the unit is on, gradual degradation of the stored signal may cause poor quality graphics after 45 minutes storage; thus the customer is not penalized by the time-out.

4.16 Signals are continuously sent to the video section of the memory unit, then passed to the

video monitor. The video section of the memory unit terminates in a BNC male connector. A 75-ohm, 6-foot-long coaxial cable is supplied with the memory unit for connecting to the video monitor. The cable is terminated at each end with a BNC female connector. A BNC to UHF adapter is supplied with the memory unit for connecting to video monitors with UHF terminations. The signal format is such that video monitors meeting EIA Standard RS-170 will be able to receive and display stored graphics information.

Note: On initial turnon, for the first few seconds the memory shows a test pattern (Fig. 47). During this time, writing will not be stored or displayed. This turnon procedure occurs every time the system has been inoperative for approximately 60 minutes.

▶KS-21889-L3 MEMORY UNIT

4.17 The KS-21889-L3 memory unit has a digital memory. Information in the -L3 memory will be retained indefinitely as long as there is no power interruption. There is no standby operational mode for KS-21889-L3. The KS-21889-L3 is a direct replacement for KS-21889-L1.◀

VIDEO MONITOR

4.18 A CONRAC model SNA23/C or equivalent commercial video monitor is recommended, although any video monitor meeting the requirements of EIA Standard RS-170 should be satisfactory. The manufacturer's booklet supplied with the monitor selected should be helpful in setting up the monitor.

4.19 The video monitor provides for local viewing of outgoing graphics. It also provides a visual receiver for viewing graphics from a remote station.

STEREO CASSETTE TAPE RECORDER

4.20 A commercially available stereo cassette tape recorder (described in paragraph 2.36) provides for recording and playback of voice and graphics. The recorder is customer owned and maintained. The customer must supply all interconnecting cables.

4.21 The manufacturer's booklet will provide additional information on the recorder.

SYSTEM OPERATION

4.22 To establish a call, first place a call to the desired remote station on the 50A1 conference telephone set. After initial contact has been made using the conference telephone set, make another call (on a separate line) using the telephone set with an exclusion key, as listed in paragraph 2.34. The remote station will answer on a similar telephone. By mutual agreement, parties at both ends should go to graphics mode by lifting the exclusion key and placing the handset beside the telephone. Writing on the blackboard can now take place.

4.23 After all graphics communications has been completed, verbally agree to place handsets on-hook at both ends, then turn off the 50A1 conference telephone set.

5. STATION INSTALLATION

GENERAL

5.01 For send-receive stations or send-only stations, the blackboard(s) and 83A control unit(s) should be mounted first. ***The writing surface may have been pressed against the rear conductive surface in the shipping container producing a short circuit.*** Mounting the blackboard first will allow time for the writing surface to return to normal position before testing of the system begins. The order of mounting of other components is not of particular significance.

Note: Part of the installation is a two-person task.

5.02 The blackboard shipping carton contains the following items:

- Blackboard with protective cover
- 1 Top wall mounting bracket (Fig. 23)
- 2 Bottom wall mounting brackets (Fig. 23)
- 1 Eraser
- 1 Box of chalk
- Hardware accessories.

STAND-MOUNTED BLACKBOARD(S)

Caution: It is essential that the blackboard be electrically insulated from all conductive surfaces. Contact between

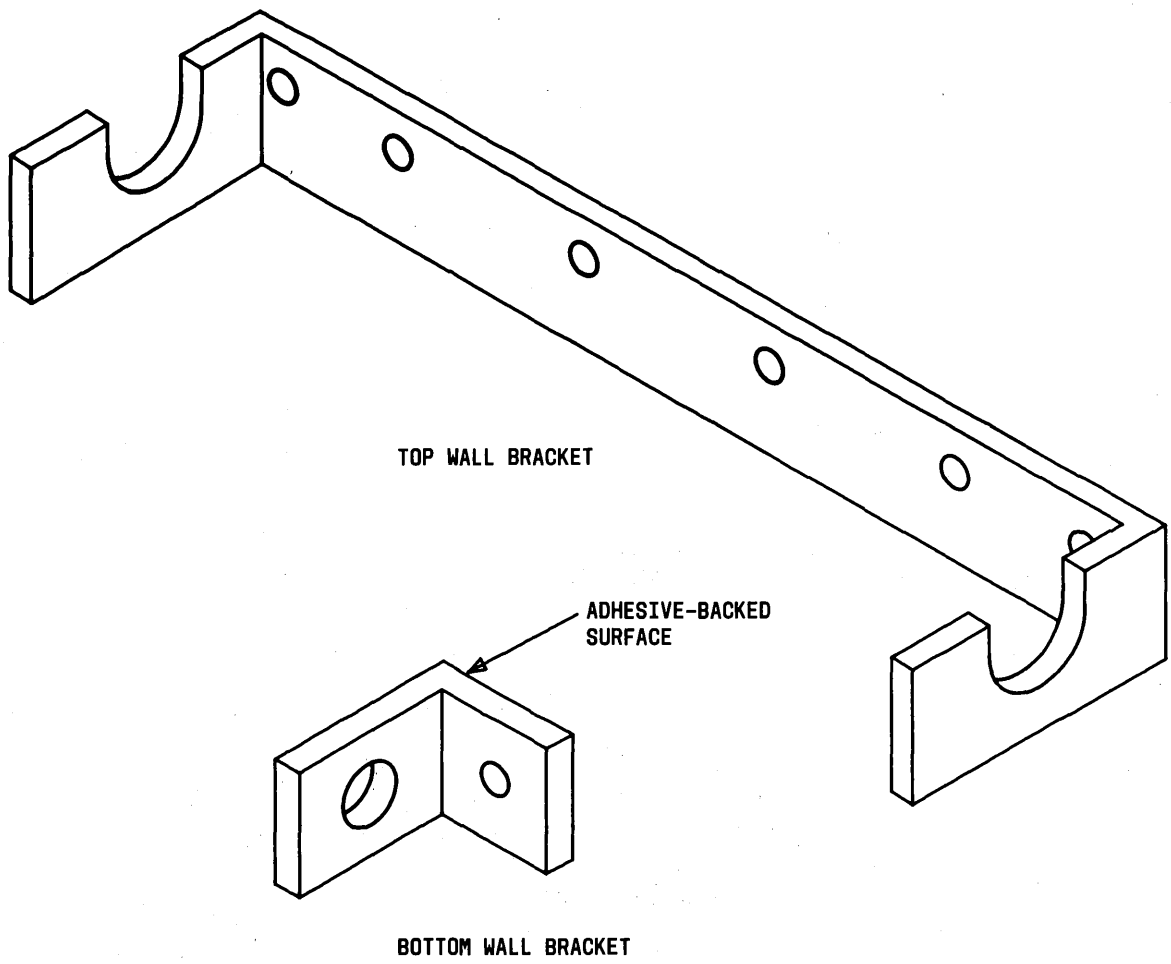


Fig. 23—Wall Brackets

blackboard and mounting surface should be by means of the blackboard mounting bars only.

Note: If blackboard is to be wall-mounted, go directly to paragraph 5.14.

5.03 Remove portable stand components from shipping carton. The carton contains the following items:

- Two vertical posts (about 78 inches high) with casters and braces attached
- One top cross member (about 60 inches long)
- One bottom cross member (about 60 inches long) (bottom side has a hole located 12 inches from each end)
- Two braces
- Assembly hardware: four 1-3/4 inch long pan-head machine screws (attached to cross member) and four 1/2-inch long round-head machine screws (attached to vertical posts and bottom cross member).

5.04 Assemble the portable stand as follows:

(1) Remove screws from bottom cross member.

(2) Attach bottom cross member to vertical posts using two 1-3/4 inch long pan-head machine screws and tighten (Fig. 24).

Note: Be sure that bottom cross member with holes faces down so that braces can be attached.

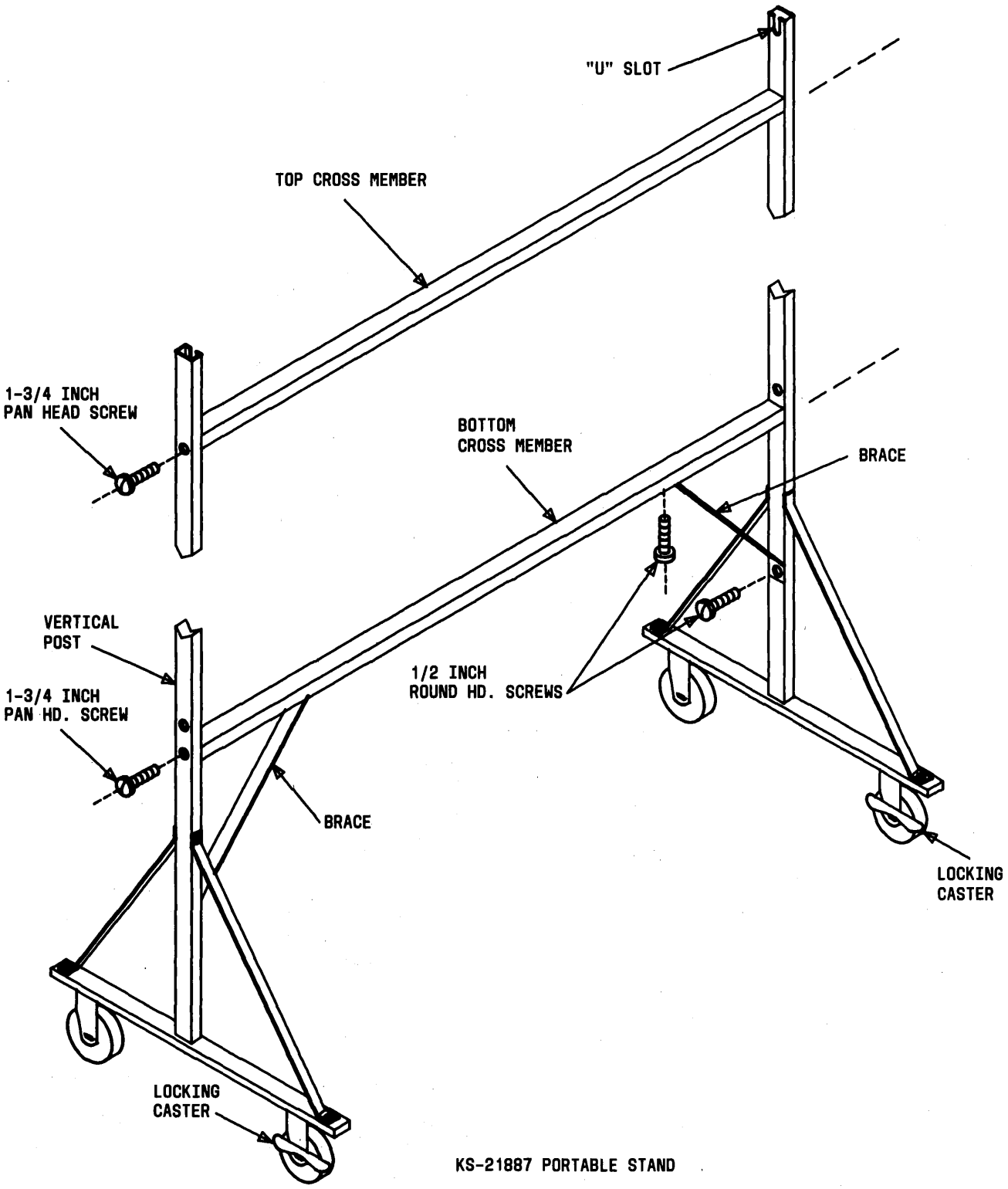


Fig. 24—Assembly of Portable Stand

(3) Attach braces to vertical posts and bottom cross member using four 1/2-inch round-head screws supplied.

(4) Attach top cross member to vertical posts using two 1-3/4 inch long pan-head machine screws and tighten screws. The stand is now ready for installation of the blackboard.

5.05 Remove blackboard from shipping carton. (This is a two-person task.) Do not remove protective cover at this time. The protective cover will prevent damage to the blackboard during mounting.

5.06 Mount blackboard on ***front*** of portable stand. The front of the stand has locking casters (Fig. 25).

5.07 Slip the top mounting bolts of the blackboard into the U-shaped cutouts in the top of the stand (Fig. 26).

> ***Note:*** The bolts in the upper mounting bar of the blackboard are properly installed for mounting. DO NOT READJUST.

5.08 Secure the bottom of the blackboard to the stand with two 2-3/4 inch hexagon-head bolts through holes in the stand (Fig. 27). The lower mounting bars have guides for capturing nuts. Tighten lower nuts until fingertight, then turn 1/2 turn with a suitable wrench.

> ***Caution: Do not overtighten mounting nuts. To do so may warp the board.***

5.09 After installation is complete, remove protective cover from blackboard, and peel off release paper from frame.

5.10 If one or two additional blackboards are to be mounted on a portable stand, mount them to the right of the first blackboard in accordance with paragraphs 5.03 through 5.09.

MOUNTING 83A CONTROL UNIT

5.11 Mount the 83A control unit at the bottom center of the blackboard. Line up the control unit mounting bracket with the hole on the underside of the blackboard frame and place the contoured lip of the control unit (Fig. 28) so that is mates with the chalk groove on the blackboard. If holes are not aligned, remove control unit from blackboard and reposition. The VELCRO fastener on the control unit will then mate with the VELCRO fastener on the blackboard.

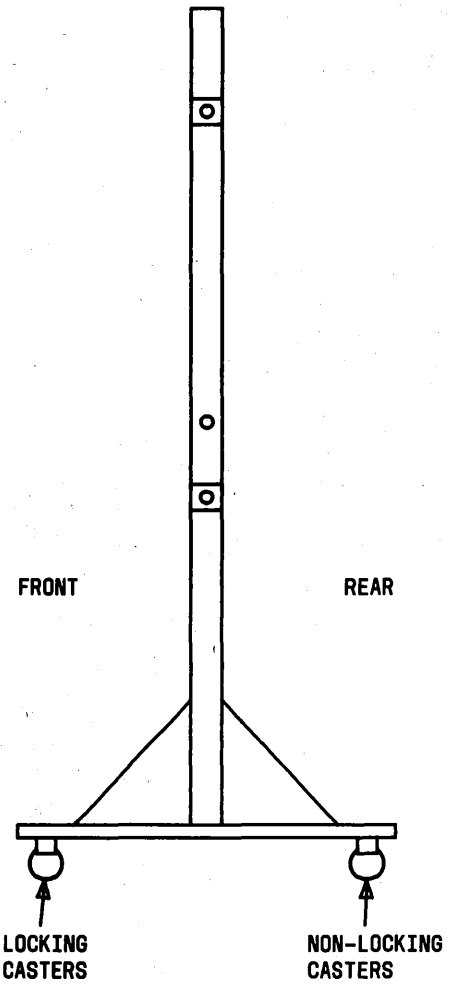


Fig. 25—Portable Stand—Side View

5.12 Remove lockwasher and control unit mounting screw from blackboard. Place screw through the hole in the mounting bracket on the rear of the control unit and screw into underside of blackboard frame. Tighten screw securely to ensure electrical connection.

> ***Caution: Be sure this screw is not shorting to the blackboard frame in any way.***

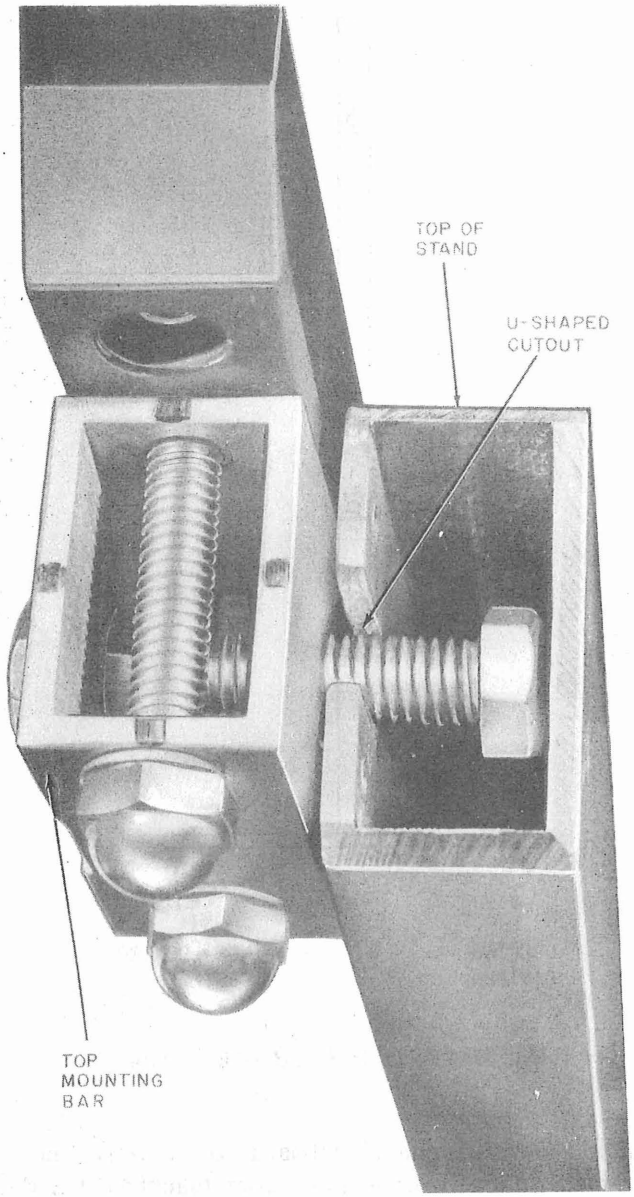


Fig. 26—Top Blackboard Mounting Detail

5.13 Connect blackboard cable to control unit as shown in Fig. 32.

WALL-MOUNTED BLACKBOARD

Caution: Proper mounting of the electronic blackboard is extremely important to ensure adequate performance of the system. These instructions must be followed as closely as possible.

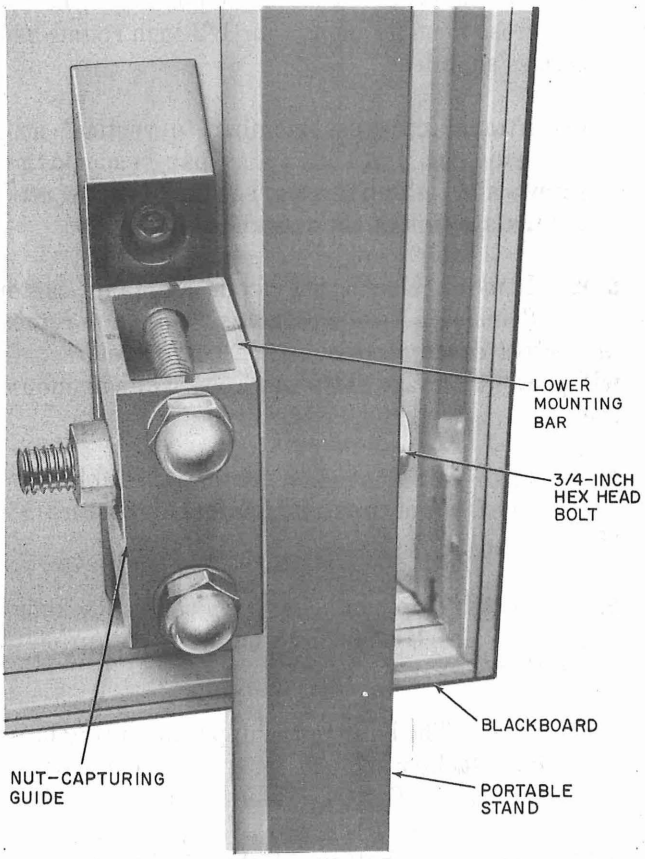


Fig. 27—Bottom Blackboard Mounting Detail

5.14 Before starting installation, examine the wall on which the blackboard is to be mounted and determine type of wall—brick, plaster, wood, metal, etc. The surface of the wall should be generally smooth and even.

> ***Note:*** If wall is not suitable for mounting of brackets with holes provided (studs do not line up with bracket holes), use furring strips nominally 60-3/4 inches by 1 inch by 3 inches.

5.15 If multiple blackboards are to be mounted, install brackets (and furring strips, if required) as shown in Fig. 29. Use chalk line and mark a straight level line on the wall at the specified height.

5.16 Lift the blackboard sufficiently to remove the package of accessories described in paragraph 5.02. Return blackboard to shipping carton.

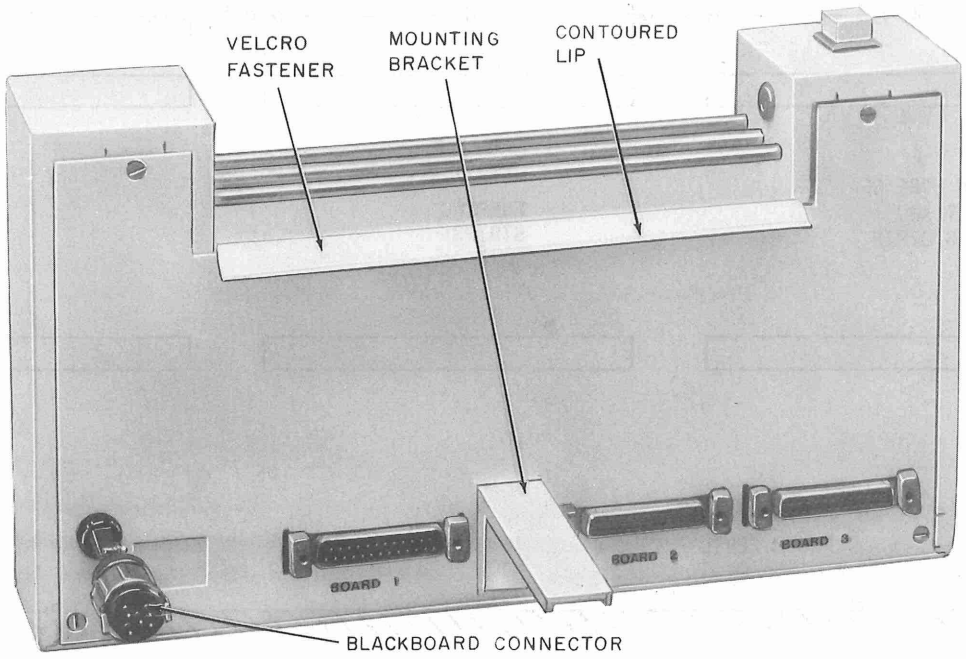


Fig. 28—Control Unit—Rear View

5.17 Place the bottom edge of the top mounting bracket 84 inches above floor level (Fig. 30). Hold the bracket parallel to floor and mark with a pencil as follows:

(1) For soft wall (wood, plaster, etc) having studs on 16-inch centers mark holes labeled "A".

(2) For other walls mark holes labeled "B".

Note: Holding the top mounting bracket and marking the holes is a two-person task.

5.18 Remove bracket from wall. Drill wall where marked and mount top mounting bracket according to Table A. Make sure that top mounting bracket is securely mounted on the wall.

5.19 Remove blackboard from shipping carton. (This is a two-person task.) ***Do not remove protective cardboard covering from front of blackboard until mounting is complete. The protective cover will minimize the chance of damage to the writing surface during mounting.***

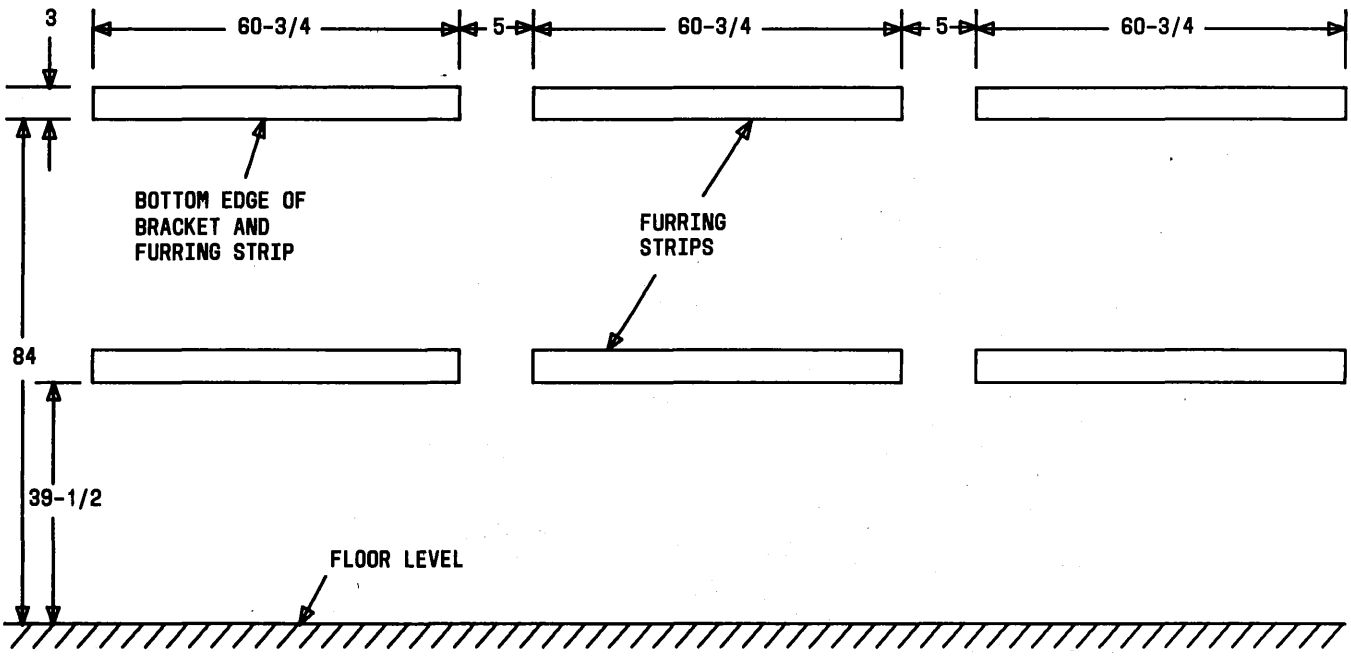
5.20 Carefully place the top mounting bolts of the blackboard into the U-shaped opening of the mounting bracket (Fig. 26 and 31).

Note: The bolts in the upper mounting bar of the blackboard are properly installed for mounting. DO NOT READJUST.

5.21 Using a dry clean cloth, wipe the surface area of the wall on which the bottom wall brackets are to be mounted, so that the adhesive-backed brackets will stick to the wall.

5.22 Remove the lower mounting bolts from the lower mounting bars of the blackboard. Swing the blackboard away from the wall, place the bottom wall bracket (Fig. 23) next to the outside of the lower mounting bar, and insert bolt through the mounting bar and bracket (Fig. 31). Center (approximately) the bolts in the oval cutouts and tighten them fingertight so that the wall brackets are approximately at right angles to the mounting bar. A guide for capturing the nuts is provided on the lower mounting bars.

Note: The following procedure must be followed exactly to ensure that the blackboard is not distorted due to an uneven mounting sur-



NOTES:
1. DIMENSIONS ARE SHOWN IN INCHES.
2. FURRING STRIPS ARE NOMINAL 1 X 3 X 60-3/4 LONG.

Fig. 29—Mounting Furring Strips for Dual or Triple Blackboard Systems

face. Such distortion could cause improper operation of the blackboard.

5.23 Peel off the narrow paper (1/4-inch by 4 inches) from the center of the lower wall brackets. This adhesive strip is to hold the brackets to the walls temporarily. Gently but firmly push the blackboard against the wall so that the lower wall brackets are temporarily attached to the wall.

5.24 Loosen both lower mounting bolts and allow the blackboard to seek its own final rest position with respect to brackets. Proceed to next step for metal and wood walls. Proceed to paragraph 5.27 for nonmetal or nonwood walls.

A. Metal and Wood Walls

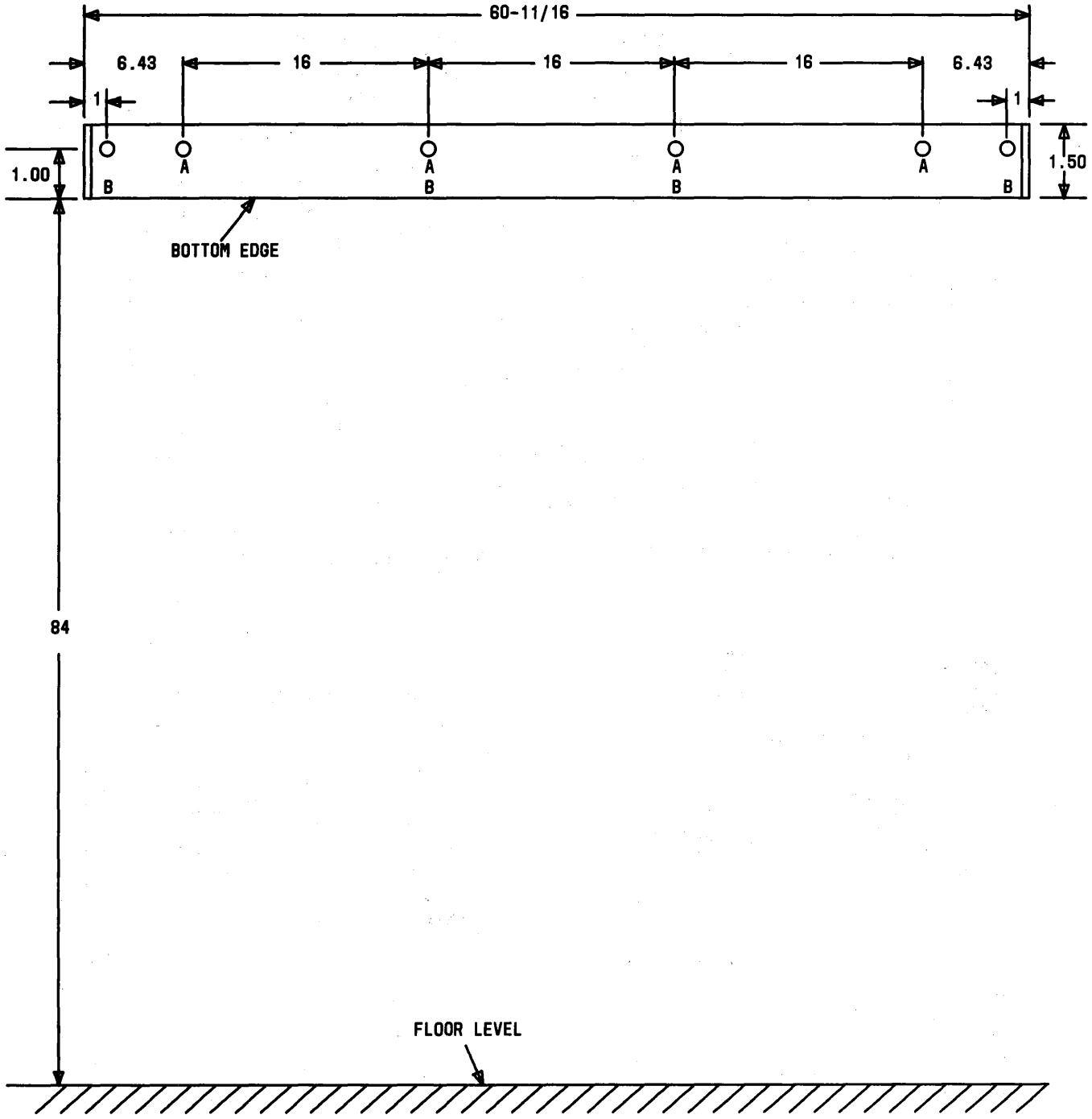
5.25 Tighten the lower mounting bolts firmly, using an appropriate wrench. ***Do not overtighten the mounting nuts.*** Pull the blackboard (with lower mounting brackets attached) away from wall.

5.26 Peel off the entire sheet of paper from the back surface of the brackets, and again gently but firmly push the blackboard frame against the wall. Installation is now complete; remove cardboard protective cover from blackboard.

B. Nonmetal and Nonwood Walls

5.27 Mark the exact location of the two holes in each lower mounting bracket on the wall. Loosen nuts and remove lower mounting brackets from blackboard. Lift up blackboard and set aside.

5.28 Drill wall where it has been marked and mount lower mounting brackets according to Table A. Make sure that lower mounting brackets are securely mounted on wall and that they are approximately at right angles to the wall.



NOTES:
1. DIMENSIONS SHOWN IN INCHES.
2. "A" HOLES FOR STUD MOUNTING
3. "B" HOLES FOR NON-STUD MOUNTING

Fig. 30—Dimensions for Mounting Top Wall Bracket

TABLE A

DRILLING HOLES FOR WALL-MOUNTED BLACKBOARD

MOUNTING SURFACE	HOLE SIZE REQD (IN.)	FASTENERS		
		SIZE AND TYPE	NO. REQUIRED	
			TOP BRACKET	BOTTOM BRACKET
Wood and soft wall; ie, sheetrock, plaster, paneling, etc, with studs on 16-in. centers	1/8	1/4 by 2 in. RH wood screw	4	4*
Plaster, cinder block, hollow tile, metal, plasterboard	3/4	1/4 by 2 in. RH toggle bolt	4	4*
Masonry (concrete, brick)	1/2	1/4 by 1-1/2 in. machine screw anchor	4	4

*No fasteners required for bottom brackets for wood and metal walls.

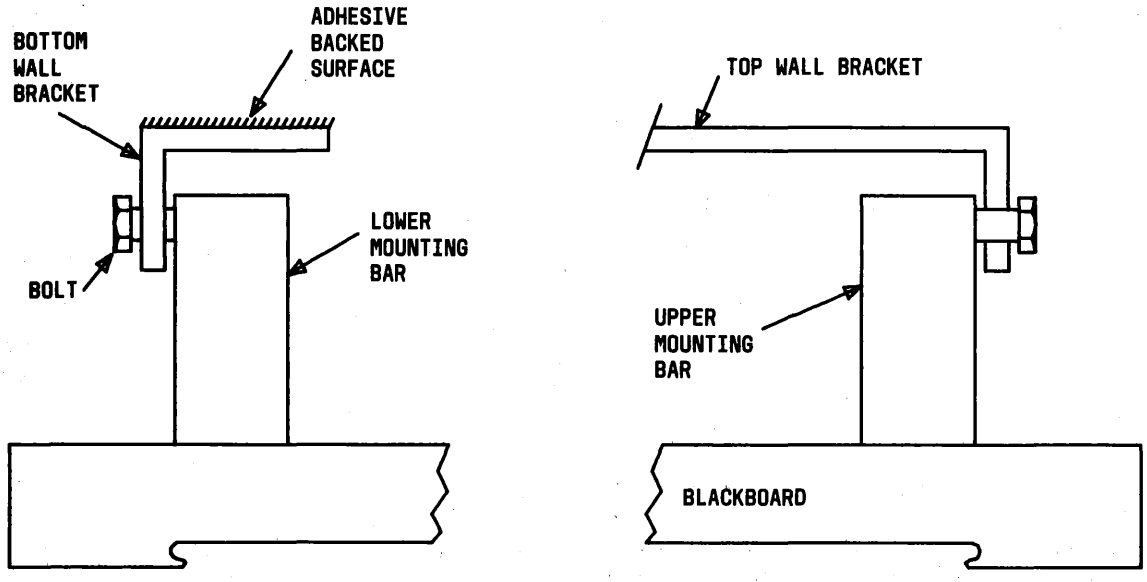


Fig. 31—Wall Mounting—Top View

5.29 Lift the blackboard and carefully place the top mounting bolts of the blackboard into the U-shaped opening of the mounting bracket (Fig. 31).

5.30 Allow the blackboard to seek its own final rest position with respect to the brackets. Insert the bolts in the oval cutouts and tighten them fingertight. Now tighten the mounting bolts firmly using an appropriate wrench. ***Do not overtighten the mounting nuts.***

5.31 Remove cardboard protective cover after installation is complete.

MOUNTING 83A CONTROL UNIT

Note: It is difficult to connect the M25A cable and the blackboard cable to the 83A control unit after it is secured to a wall-mounted blackboard. Connect M25A cable(s) to control unit(s) per paragraph 5.53 (1), (3), and (4) prior to mounting blackboard. Also, connect blackboard cable (Fig. 32) prior to mounting the control unit.

5.32 Mount the 83A control unit as described in paragraphs 5.11 and 5.12.

5.33 If one or two additional blackboards are to be wall mounted, mount them to the right of the first blackboard in accordance with paragraphs 5.14 through 5.31. Mount 83A control units as described in paragraphs 5.11 and 5.12.

KS-21888 CABINET ASSEMBLY

5.34 Assemble the KS-21888 cabinet (Fig. 33 and 34) as follows:

(1) Remove cabinet from shipping container.

(2) Remove box attached to bottom shelf containing casters.

(3) Attach casters with brakes to front legs and casters without brakes to rear legs.

Note: The front of the cabinet has the Bell System logo, "GEMINI", and "ELECTRONIC BLACKBOARD" designations.

(4) Place rubber mat on top shelf, embossed side up.

(5) Open cabinet.

(6) Pass power strip cord through rectangular cutout in bottom shelf. ***Do not connect to source of power at this time.***

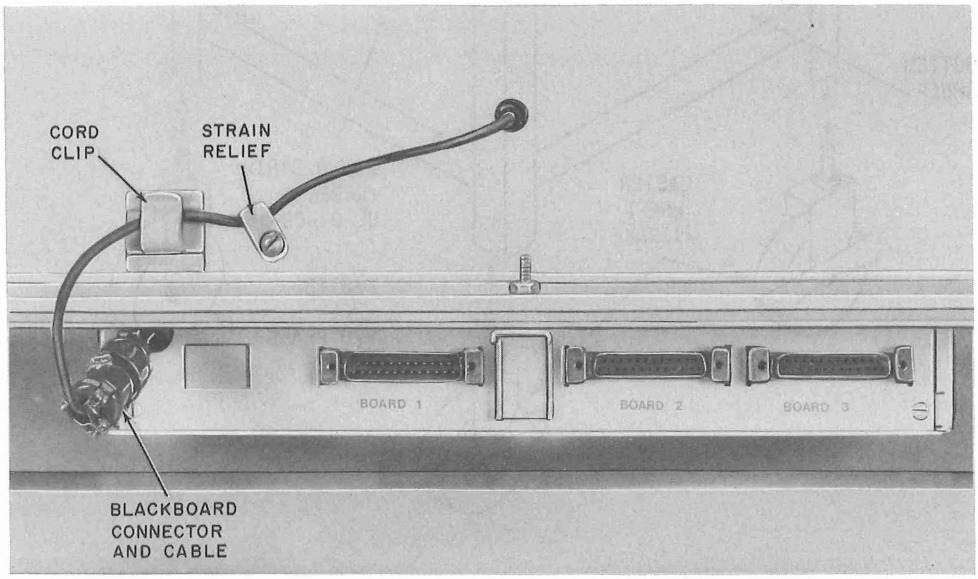


Fig. 32—Control Unit Installed—Rear View

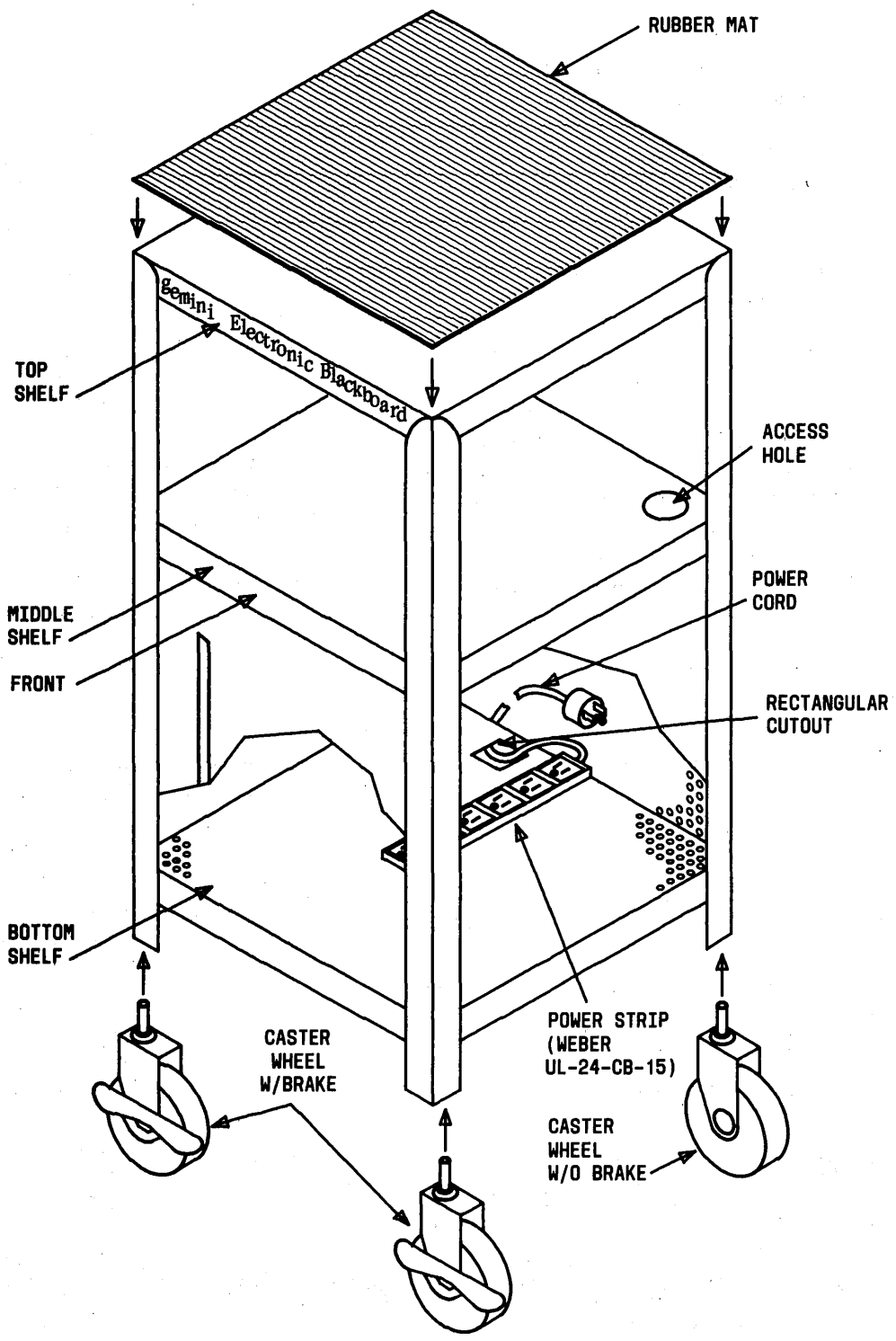


Fig. 33—KS-21888 Cabinet Assembly Arranged for KS-21889-L1 Memory Unit

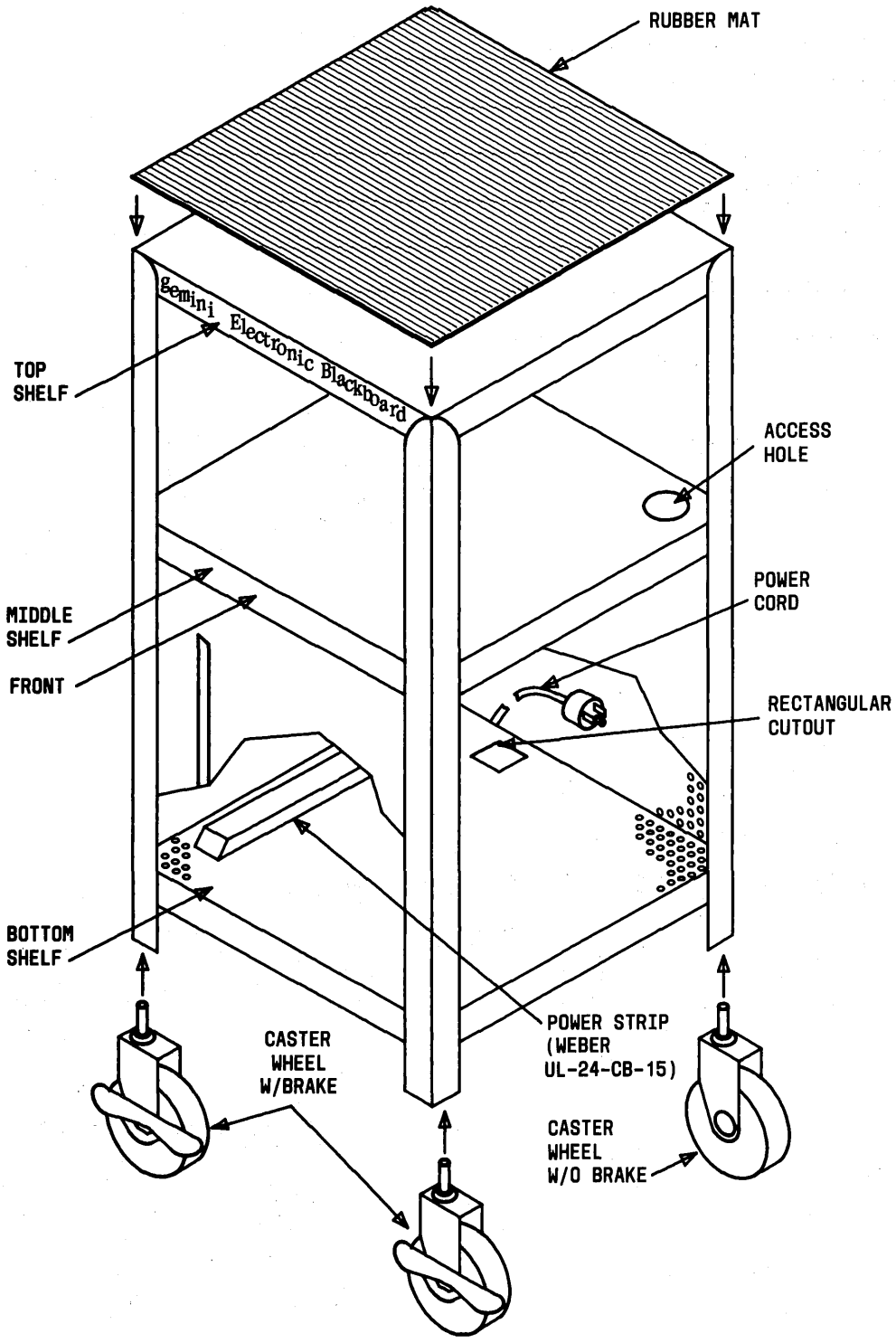


Fig. 34—KS-21888 Cabinet Assembly Arranged for KS-21889-L3 Memory Unit

(7) The cabinet is now ready for installation of video monitor, memory unit, and transmitter-receiver.

Note 1: The holes in the middle shelf are for passing cords from monitor and other accessories into the cabinet.

Note 2: In multiple display installations, the ac power cords of the second (and third) cabinet may be connected to the power strip of the first cabinet.

MOUNTING TRANSMITTER-RECEIVER OR RECEIVER

5.35 Remove rear cover from 1AR graphics transmitter-receiver or receiver (Fig. 35). Set option switches as follows:

SWITCH	POSITION
GAIN	DDD
REC	ON
DISP	ONE (unless multiple receive station)

5.36 Connect the telephone line mounting cord to the telephone line connector on the rear of the transmitter-receiver per Fig. 35 and 36. Secure the mounting cord to the transmitter-receiver by placing the strain relief loop of the mounting cord under the strain relief screw on the transmitter-receiver and tighten the screw.

5.37 Route ac power cord and telephone line mounting cord through large cutout in rear cover of transmitter-receiver. Replace rear cover. When using a KS-21889-L1 memory unit, place 1AR graphics transmitter-receiver or receiver unit in the left bottom portion of the cabinet (Fig. 41). ▶When using a KS-21889-L3 memory unit, place memory unit in bottom center of cabinet. Place 1AR graphics

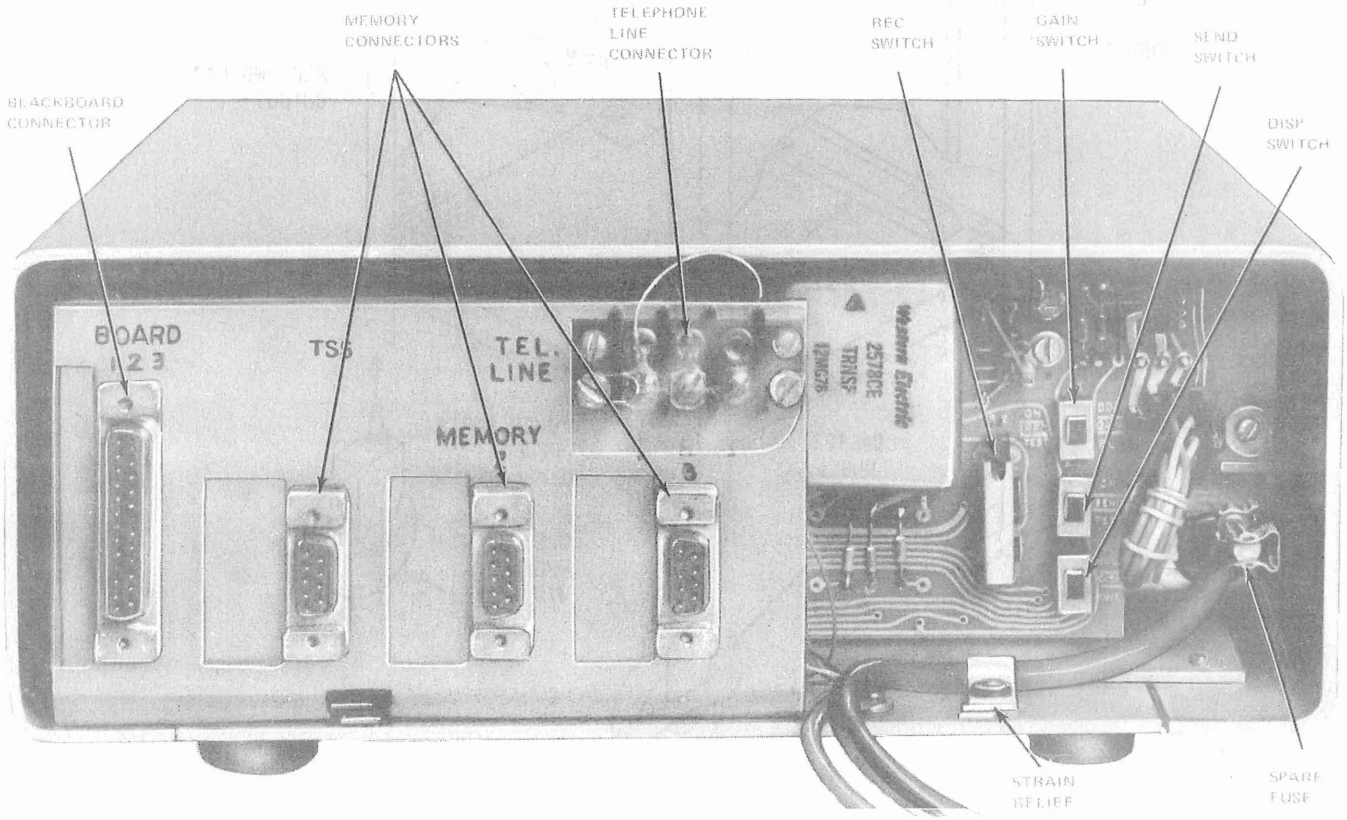


Fig. 35—Rear of Transmitter-Receiver

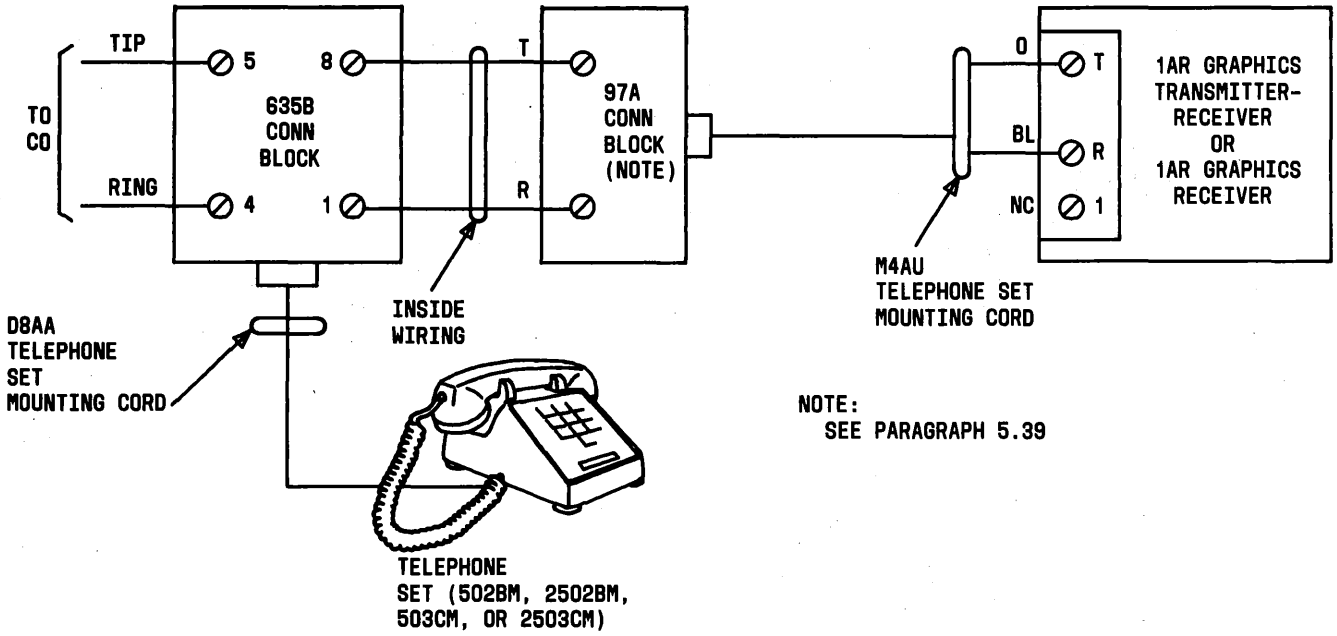


Fig. 36—Switched Network Graphics Telephone Set Connections

transmitter-receiver on top of the -L3 memory unit.◀ Connect ac power cord to power strip.

5.38 Route telephone line mounting cord through rectangular cutout of bottom shelf.

CONNECTING TELEPHONE SET AND TELEPHONE LINE

Note: Telephone sets must be rewired to provide line control in the talk mode with handset off-hook, data control with exclusion key operated, and monitoring deactivated on 503CM and 2503CM sets.

5.39 Place telephone set with exclusion key on middle shelf of cabinet (Fig. 1) or other convenient location. Connect telephone set mounting cord to 635B connecting block (42A on private line). On the switched network, also connect a 97A connecting block as shown in Fig. 36. Select the ***appropriate*** 97A connecting block. The choice is determined by the central office loop loss. (See Section 590-101-103.) Note that the character "X" in 97AX does not designate "X" dB of attenuation, but rather (10−X) dB of attentuation. ▶On the switched network behind a PBX, omit the 97A connecting block and connect a 625A voice jack and 330-type adapter as shown in Fig. 37.◀

5.40 Wire selected telephone set to provide normal voice communication with the exclusion key ***not operated*** and the monitoring feature disabled.

5.41 Rewire 502BM and 2502BM telephone sets as follows (Sections 502-531-401 and 502-533-401, respectively):

(1) Obtain a D-180810 kit of parts (641D jack and mounting bracket).

(2) Install the jack and mounting bracket in the telephone set. Connect the jack to the following terminals:

COLOR	TERM. STRIP NO.
BL-W	1
W-BL	2
O-W	6
W-O	5
G-W	3
W-G	4

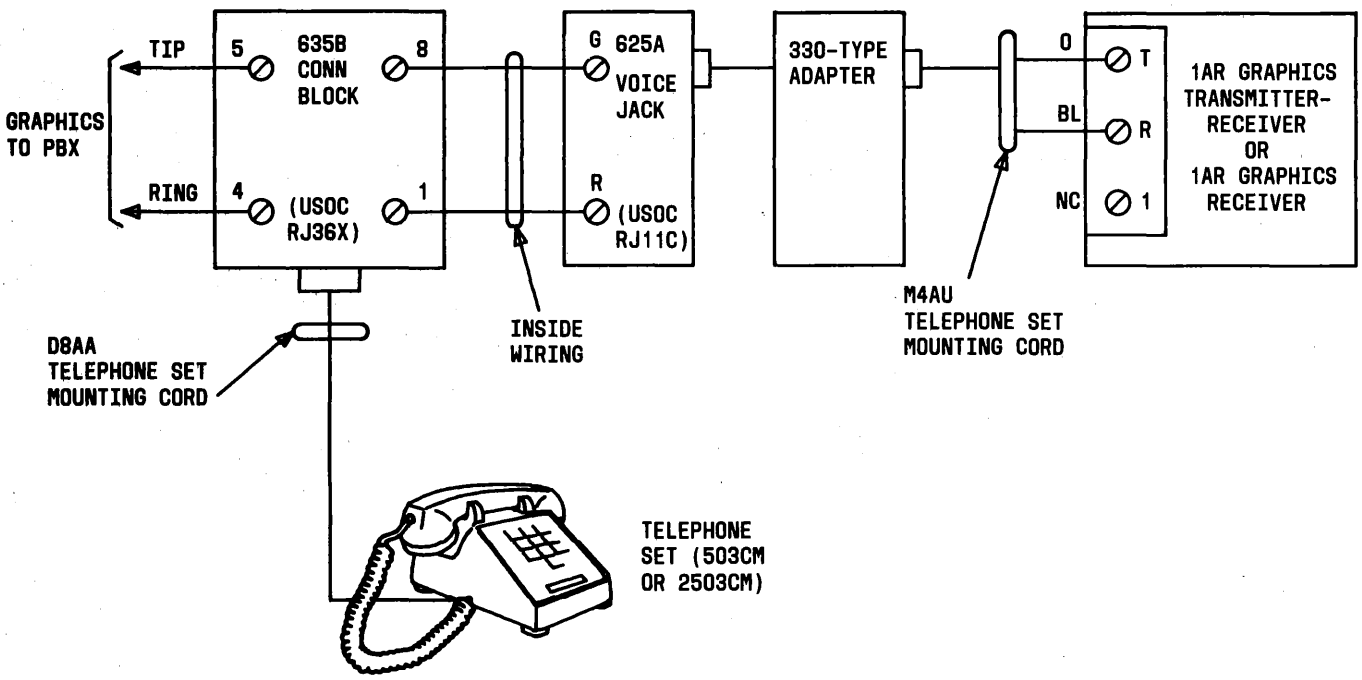


Fig. 37—Switched Network Graphics Telephone Set Connections Behind a PBX

COLOR	TERM. STRIP NO.
BR-W	E1
W-BR	E2

(3) Rewire the exclusion key per Table B.

5.42 Rewire 503CM and 2503CM telephone sets per Table C. This provides exclusion of the graphics transmitter-receiver with the exclusion key down (voice mode) and exclusion of the telephone set with the exclusion key up (graphics mode).

TABLE B

EXCLUSION KEY WIRING FOR 502BM AND 2502BM TELEPHONE SETS

LEAD	COLOR	REMOVE FROM		CONNECT TO	
		TERM. STRIP	NETWORK	TERM. STRIP	NETWORK
	G	2*	L1*	E1 to 1*	
NET. (F)	G	2			L1
RINGER	BK	2			L1
EXC KEY	W	E2		2	
EXC KEY	BL	E1		E2	
EXC KEY	Y		L2	E2	

*Move strap

TABLE C

EXCLUSION KEY WIRING FOR 503CM AND 2503CM TELEPHONE SETS

LEAD	COLOR	REMOVE FROM		CONNECT TO	
		TERM. STRIP	NETWORK	TERM. STRIP	NETWORK
EXC KEY	R		L2	E2	
EXC KEY	S	E2			L2
EXC KEY	O		GN(R)†	1	
EXC KEY	BR	1			GN(R)†
TRANS & CAP. ASSY*	R		L2		G

* This rewiring disables the monitoring feature.

† Designations in parentheses are for 2503CM Tel Set.

5.43 At private line stations without a telephone set, connect the transmitter-receiver to the line in accordance with Fig. 38.

5.44 At private line stations with a telephone set and using a 42A connecting block, connect the telephone set and transmitter-receiver per Fig. 39 and Table D.

5.45 At private line stations with a telephone and using a 635B connecting block, connect the telephone set and transmitter-receiver as shown in Fig. 40.

MOUNTING KS-21889-L1 MEMORY UNIT

5.46 Place the memory unit in the right bottom portion of the cabinet (Fig. 41). Connect ac power cord into power strip.

5.47 If one or two additional memory units are required, place them in the right bottom portion

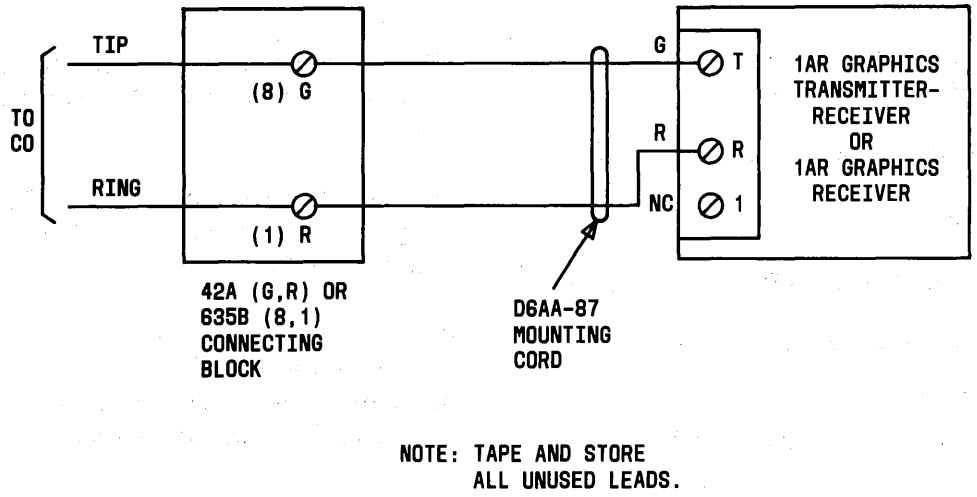
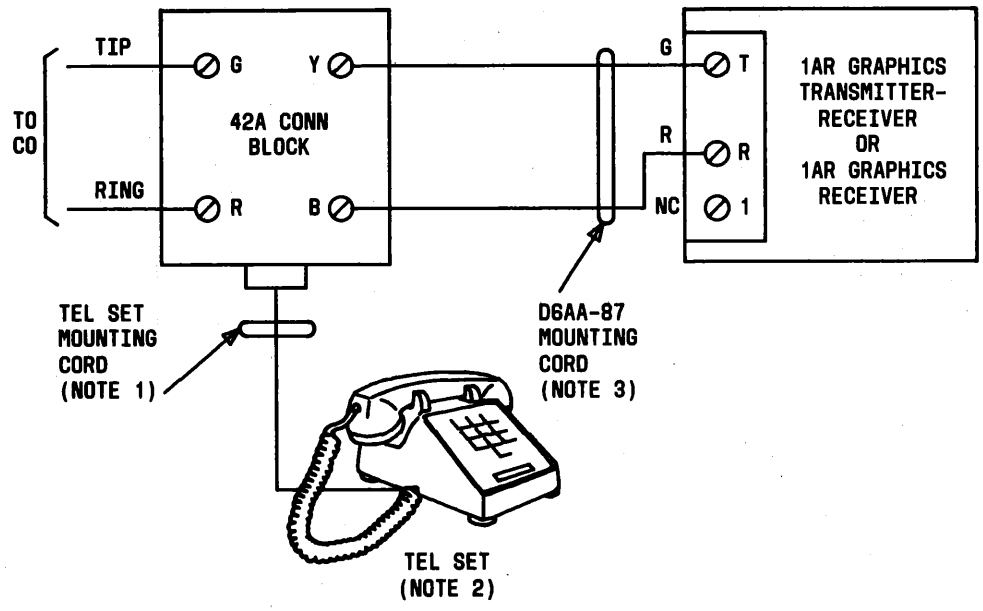


Fig. 38—Private Line Connections Without a Telephone Set



NOTE 1: IF A 42A CONNECTING BLOCK IS USED, USE A D8AB TELEPHONE SET MOUNTING CORD AND CONNECT TO THE 42A BLOCK AS FOLLOWS:

D8AB COLOR	CONNECT TO 42A BLOCK	SIGNAL
BR	B	DR
G	R	CO RING
R	G	CO TIP
SL	Y	DT

NOTE 2: WIRE TELEPHONE SET IN ACCORDANCE WITH 5.41 OR 5.42.

NOTE 3: TAPE AND STORE ALL UNUSED WIRES.

Fig. 39— Private Line Connections With a Telephone Set Using a 42A Connecting Block

of cabinets 2 and 3. Connect ac power cord of memory unit(s) into respective power strip(s).

▶MOUNTING KS-21889-L3 MEMORY UNIT

A. Relocating Power Strip

5.48 Relocate power strip as follows:

(1) Disconnect ac power cord from commercial power.

(2) Remove KS-21889-L1 memory unit from cabinet.

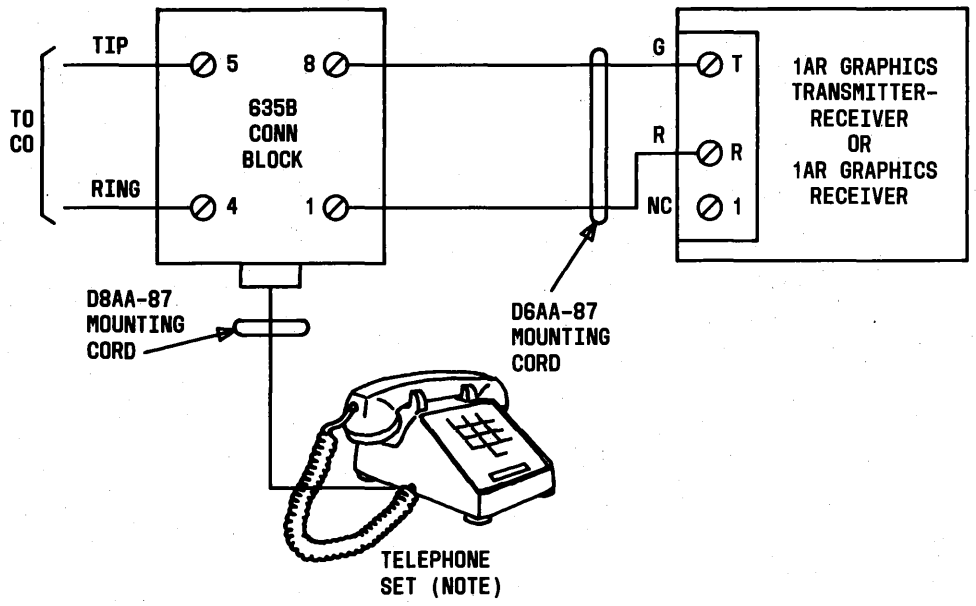
(3) Remove 1AR graphics transmitter-receiver (transceiver) from cabinet.

(4) Remove two bolts holding the power strip in place, and the two cable clamps. Save hardware.

(5) Relocate power strip to left side of cabinet, placing light and on-off switch toward front of cabinet (Fig. 8).

(6) Align power strip mounting holes with two of the vent holes in bottom of cabinet. Use original mounting bolts to secure power strip to bottom of cabinet. Place washers on bolts on underside of cabinet.

(7) Position power cord of power strip along side of cabinet to rear exit hole.



NOTE: WIRE TELEPHONE SET IN ACCORDANCE WITH 5.41 OR 5.42

Fig. 40—Private Line Connections With a Telephone Set Using a 635B Connecting Block

B. Placing KS-21889-L3 Memory Unit

5.49 Place KS-21889-L3 memory unit on the bottom shelf of the cabinet (Fig. 42).

(1) Plug memory unit ac power cord into power strip.

(2) Connect video cable to video jack on back of memory unit and up through appropriate cable hole and connect to VIDEO IN jack of monitor.

(3) Place 1AR graphics transmitter-receiver (transceiver) on top of KS-21889-L3 memory unit.

(4) Connect 1AR graphics power cord to power strip.

(5) Reconnect blackboard cable to 1AR graphics transmitter-receiver BOARD 1, 2, 3.

(6) Connect KS-21889-L3 memory unit to the 1AR graphics transmitter-receiver MEMORY 1.

(7) Reconnect cabinet power cord to commercial power. Operate on-off switch on power strip to ON.

(8) Cable clamps and associated hardware may be used at the discretion of craft person.

If additional cabinets are to be equipped with KS-21889-L3 memory units, repeat steps in paragraphs 5.48 and 5.49, except in 5.49 (6), connect to MEMORY 2 and MEMORY 3 for cabinets 2 and 3, respectively.

PLACING VIDEO MONITOR

5.50 Place the customer-owned video monitor on top of cabinet (Fig. 1).

Caution: This is a two-person task.

Route monitor ac power cord through the access hole in the middle shelf of the cabinet and connect to power strip.

Note: If more than one monitor is used, cabinets should be placed side-by-side as close as possible.

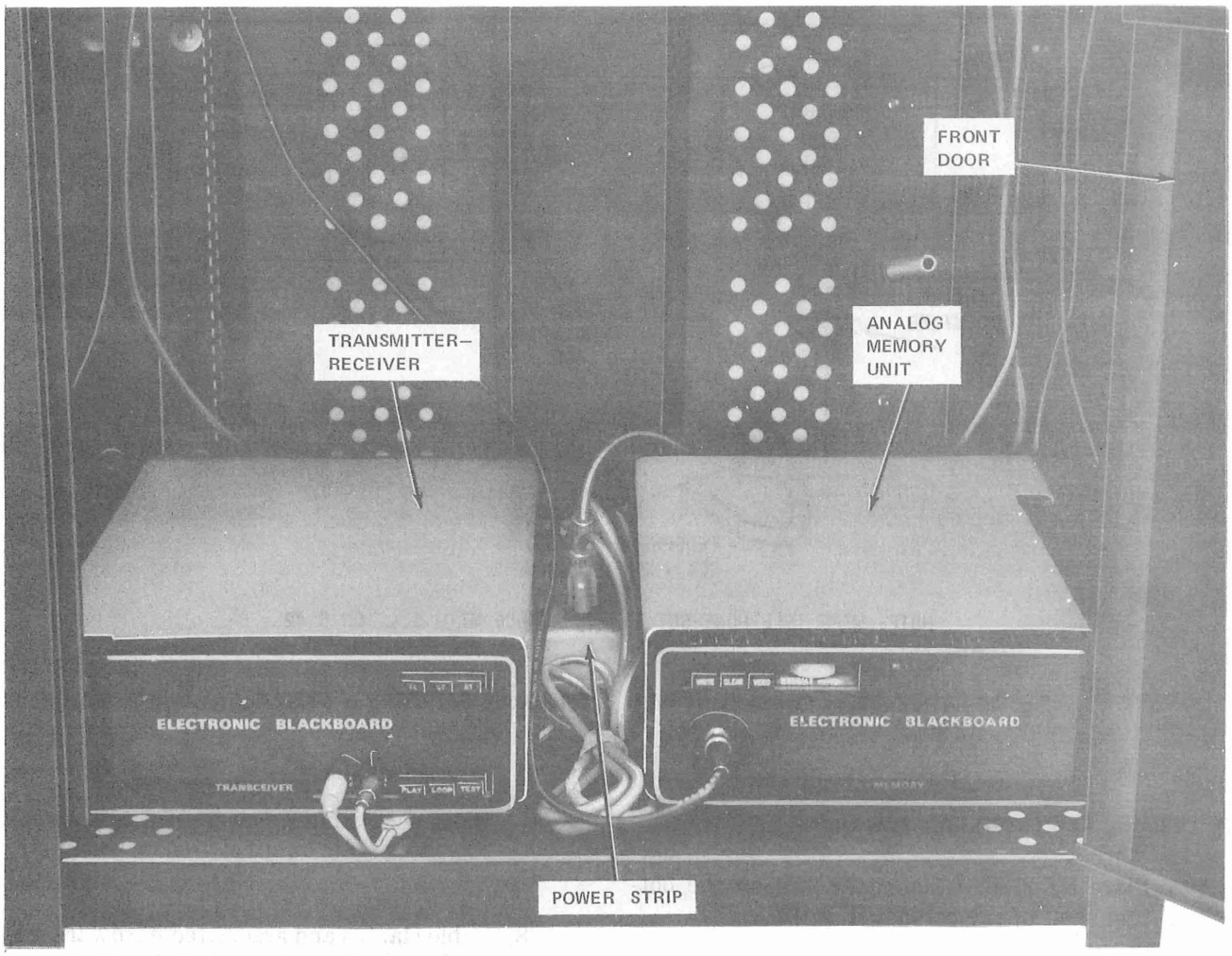


Fig. 41—Bottom Front View of Cabinet With KS-21889-L1 Memory Unit

5.51 If one or two additional monitors are required, place them on top of cabinets 2 and 3, respectively. Connect ac power cord(s) into respective ac power strip(s).

A. Placing Stereo Cassette Tape Recorder

5.52 Place stereo cassette tape recorder (if used) (COAM) on middle shelf of cabinet or other convenient location. Route ac power cord from tape recorder through access hole in the middle shelf of the cabinet and connect to ac power strip.

Note: The bottom portion of the cabinet is for the transmitter-receiver and memory unit only. No other equipment—either powered or unpowered—shall be placed inside the cabinet.

INTERCONNECTING UNITS

5.53 After all units have been placed in their proper location (Fig. 1) and power cords have been connected into the ac power strip, make interconnections in accordance with applicable Fig. 9 through 18 and the following:

Note: Tighten all screws.

(1) Connect M25A25 foot cord from 83A control unit on blackboard No. 1 (Fig. 32) to black-

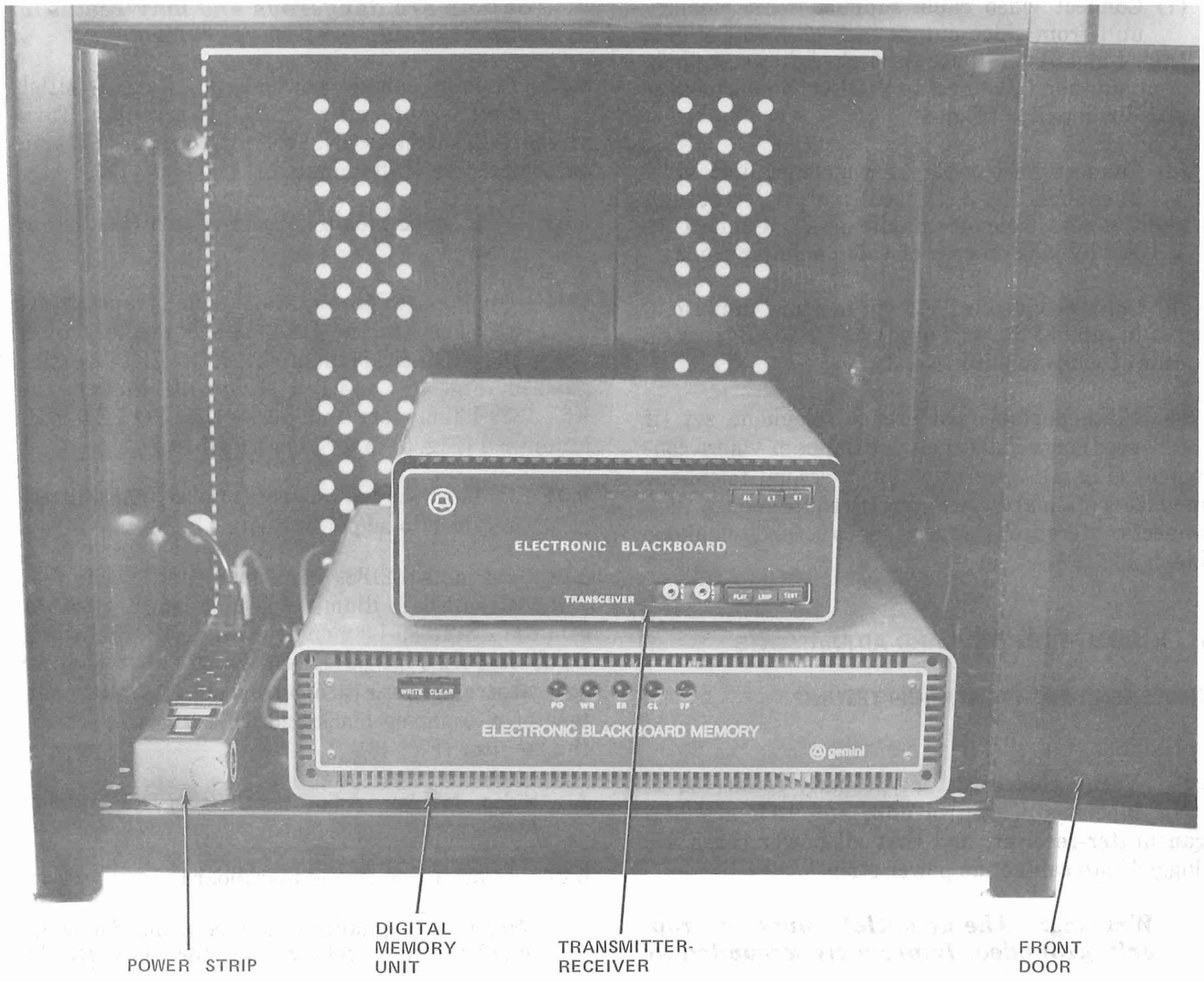


Fig. 42—Bottom Front View of Cabinet With KS-21889-L3 Memory Unit

board connector (labeled BOARD 123) on rear of transmitter-receiver (Fig. 35).

Caution: The M25A cable connecting the control unit to the transmitter-receiver is 25 feet long. DO NOT EXTEND UNDER ANY CIRCUMSTANCES.

(2) Connect cable from memory unit No. 1 in first cabinet to transmitter-receiver MEMORY 1 connector (Fig. 35).

(3) Connect 83A control unit connector 1 of blackboard No. 2 (if used) to connector No. 2 of control unit on blackboard No. 1, using an M25A 9-foot cord.

(4) Connect 83A control unit connector 1 of blackboard No. 3 (if used) to connector No. 3 of control unit on blackboard No. 2, using an M25A 9-foot cord.

(5) Connect cable from memory unit No. 2 in second cabinet (if used) to transmitter-receiver MEMORY 2 connector (Fig. 35).

(6) Connect cable from memory unit No. 3 in third cabinet (if used) to transmitter-receiver MEMORY 3 connector (Fig. 35).

(7) Connect video cable supplied with memory unit from video output jack on memory unit (Fig. 4 and 6) and route through right access hole of middle shelf. Connect to VIDEO IN jack on rear of video monitor (Fig. 43).

(8) Connect video cable from memory unit No. 2 in cabinet No. 2 (if used) and route through right access hole of middle shelf. Connect to VIDEO IN jack on rear of video monitor No. 2.

(9) Connect video cable from memory unit No. 3 in cabinet No. 3 (if used) to VIDEO IN jack on rear of video monitor No. 3.

5.54 Place portable conference telephone set (if used) on middle shelf of cabinet or where convenient (Fig. 1). Ascertain that a second telephone line meets standard voice-circuit requirements, then connect conference telephone set to second telephone line.

6. INSTALLATION TESTS AND ADJUSTMENTS

SINGLE SEND-RECEIVE STATION TESTING

6.01 Verify that cords are properly connected at blackboard, control unit, and 1AR graphics transmitter-receiver, and that all power cords are plugged into cabinet ac power strip.

Warning: The ac outlets must be properly grounded. Improperly grounded ac outlets are dangerous and may result in unacceptable system operation.

6.02 Connect cabinet power cord to an ac outlet that is not under control of a switch. Turn power strip switch to ON. Verify that power ON lamp on power strip is illuminated.

6.03 Turn video monitor power switch (Fig. 44) to ON.

6.04 Unplug ac power cord from transmitter-receiver. On the KS-21889-L1 memory unit, verify that PO LED is illuminated, ON LED is extinguished (Fig. 45), and fan is ***inaudible.*** ▶On the KS-21889-L3 memory unit, verify that PO LED is illuminated (Fig. 5) and fan is ***audible.***◀

6.05 Connect ac power cord from transmitter-receiver to ac power strip.

6.06 On the KS-21889-L1 memory unit, verify that ON LED is illuminated and fan is ***audible.*** ▶On the KS-21889-L3 memory unit verify that fan is ***audible.***◀ Also on the KS-21889-L1, verify that for several seconds after turnon from standby, a test pattern of alternating black and white lines appear on the monitor (Fig. 46).

A. Video Monitor Adjustment Using KS-21889-L1 Memory Unit

6.07 Draw a line on the blackboard.

Note: Designations and controls for video monitor that follow are for a CONRAC

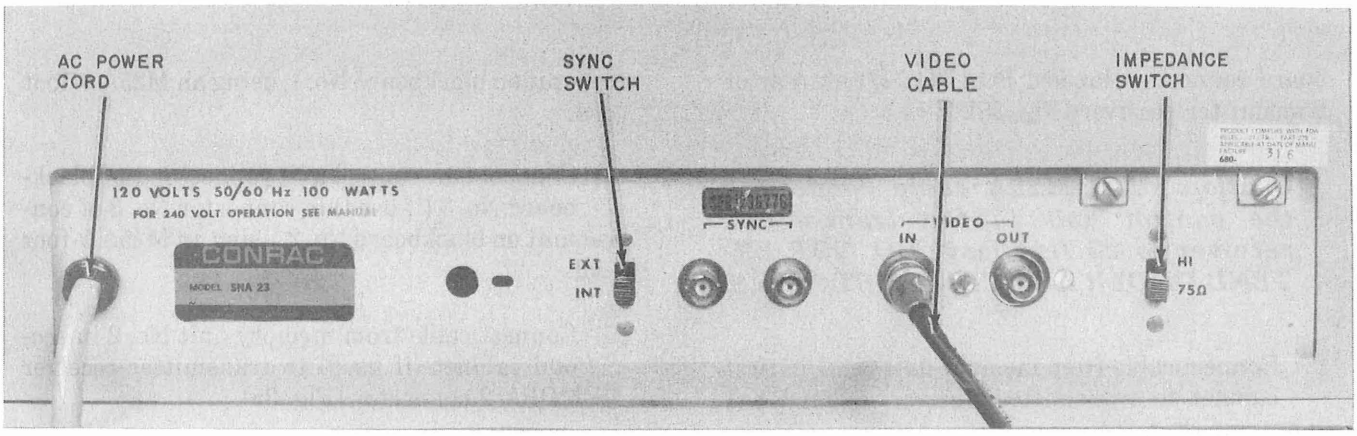


Fig. 43—Typical Video Monitor Controls—Rear

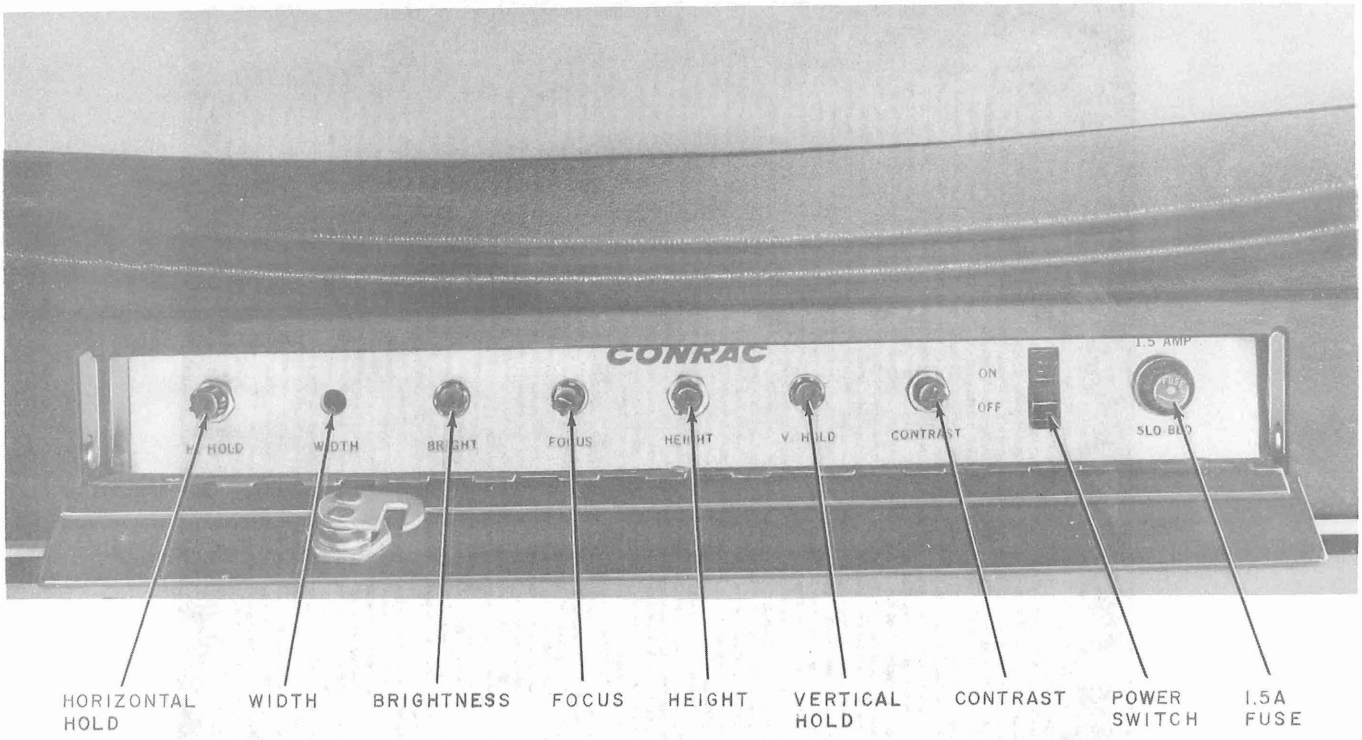


Fig. 44—Typical Video Monitor Controls—Front

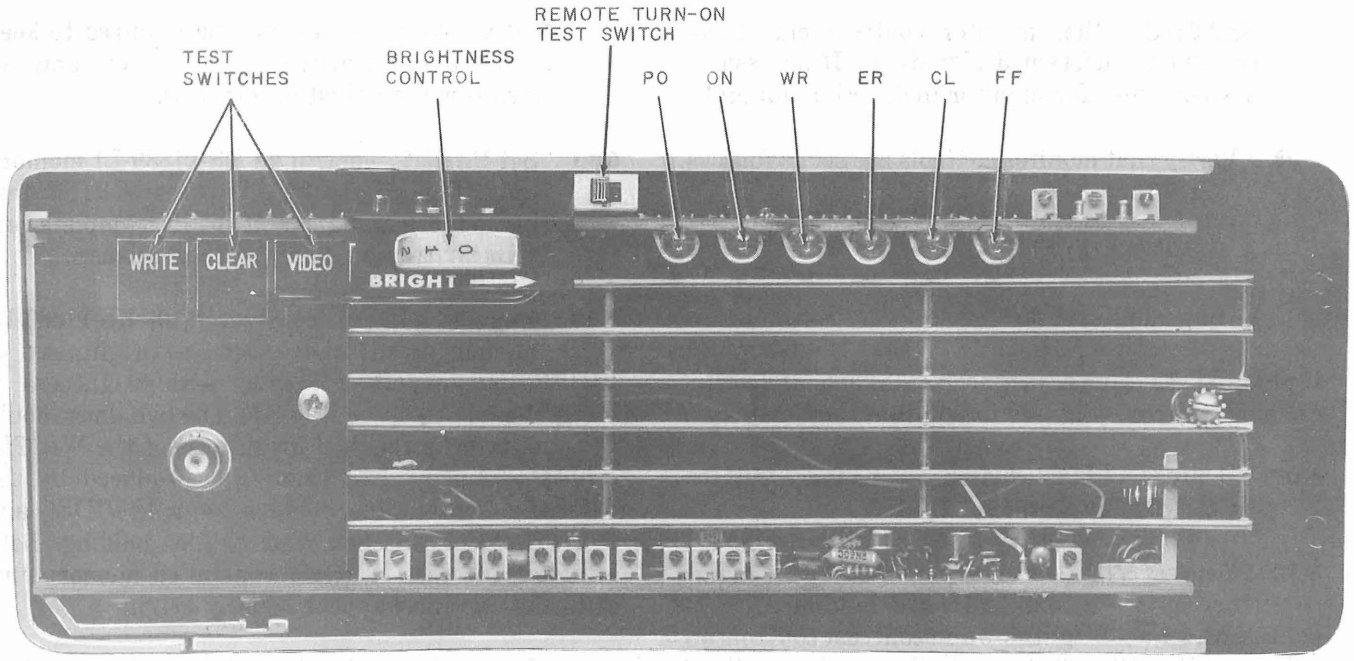


Fig. 45—LED Identification on KS-21889-L1 Memory Unit

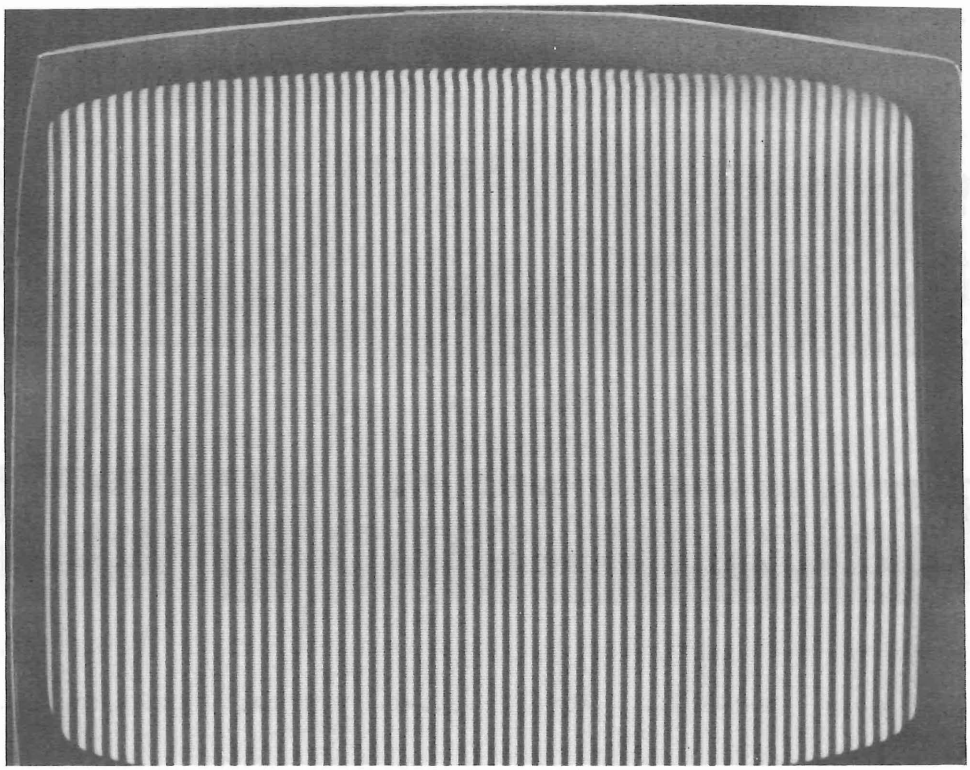


Fig. 46—KS-21889-L1 Memory Unit Test Pattern

SNA23/C. Other monitor controls may have somewhat different designations. If necessary, ask customer for monitor instruction manual.

6.08 Verify that monitor controls are set as follows (Fig. 43):

- SYNC set to INT
- Impedance set to 75 Ω.

If picture breaks up, adjust horizontal hold and vertical hold controls (Fig. 44) to obtain steady display.

6.09 Depress CLEAR switch on memory unit to clear display on monitor.

6.10 Depress VIDEO switch on KS-21889-L1 memory unit (Fig. 45), and while holding VIDEO depressed, adjust brightness and contrast controls on video monitor (Fig. 44) until background scan lines are barely visible and the video line is bright but not blooming (excessively wide line) (Fig. 47). Release VIDEO test switch.

Note: An assistant may be required to keep the VIDEO test switch on the memory unit depressed while adjusting monitor.

6.11 Set BRIGHT control on KS-21889-L1 memory unit (Fig. 45) to "0". Depress WRITE test switch on memory unit and hold until a complete vertical line is written on monitor, then release.

6.12 Depress VIDEO test switch on KS-21889-L1 memory unit and compare brightness of VIDEO line on left of display with brightness of WRITE-generated line (Fig. 47). The two lines should be equal in brightness. If brightness of the WRITE-generated line is less than that produced by the VIDEO-generated line, depress and hold VIDEO and WRITE test switches and while holding both switches, increase BRIGHT control on memory unit until the two lines appear equally bright.

Note: On initial installation, the nominal BRIGHT control setting should be at or near zero. The purpose of this control is for user adjustment of the memory output as the unit ages.

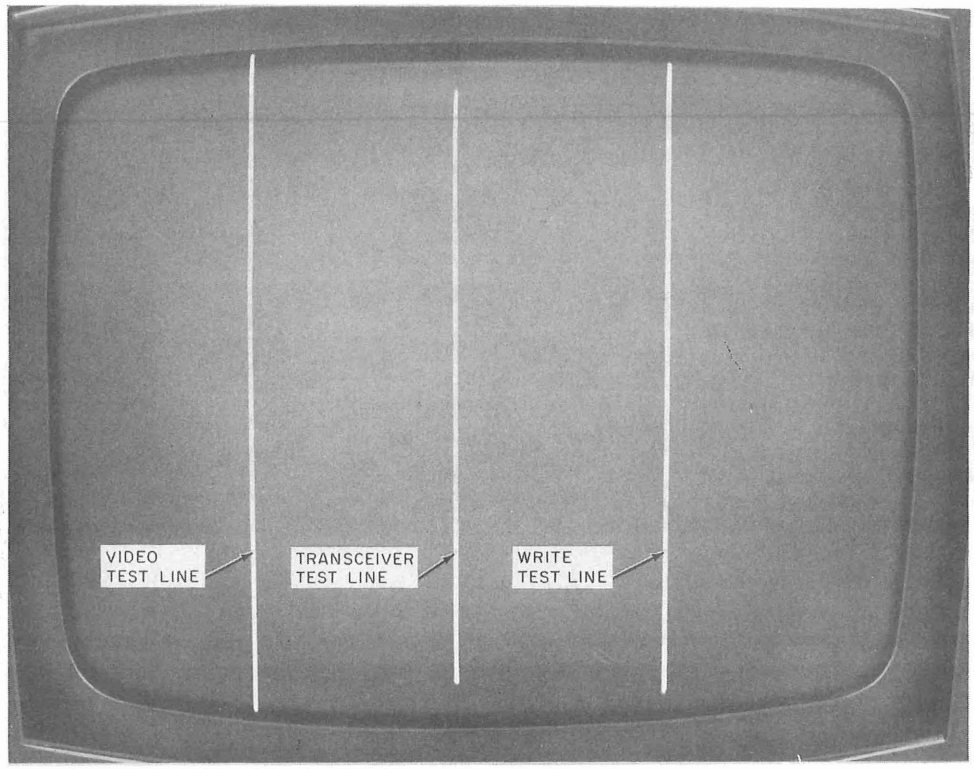


Fig. 47—Video Test Lines

6.13 Depress TEST switch on the 1AR graphics transmitter-receiver (Fig. 48). Display should clear, followed by a vertical line alternately written and erased (Fig. 47). Release TEST switch when line is fully written.

> ***Note:*** The eraser must be on the eraser tray of the control unit for all subsequent tests.

6.14 Trace the entire perimeter of the blackboard with finger, exerting sufficient pressure to cause an unbroken outline to be displayed on the monitor.

6.15 If left or right side of perimeter "writing" is not visible (Fig. 49), adjust horizontal hold control on video monitor (Fig. 44) until both sides are visible.

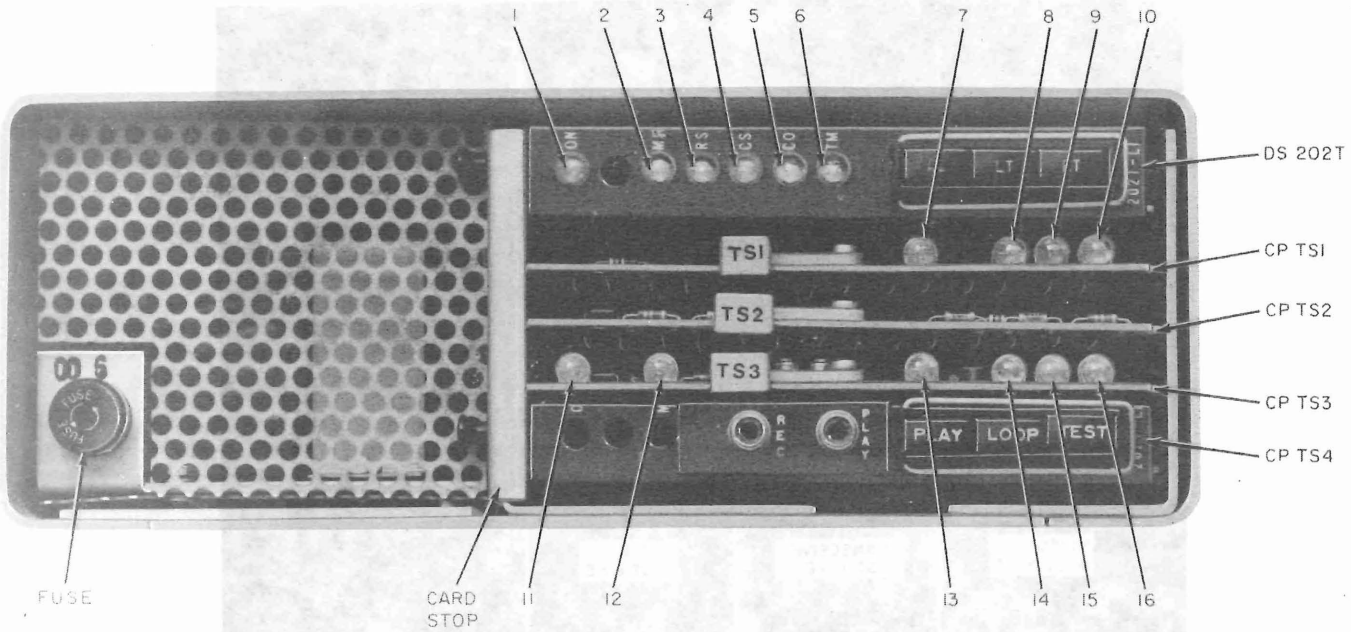
6.16 Turn video monitor power switch ***off*** and ***on***. If picture breaks up, indicating horizontal hold control is not adjusted properly, readjust horizontal hold control and repeatedly turn power switch ***off*** and ***on*** while adjusting horizontal hold control until picture remains steady when power is turned ***off*** and ***on.*** If left or right side of perimeter "writing" is not visible after this procedure, adjust WIDTH control of monitor. If this does not bring both sides of the "writing" into view, internal adjustments are required. ***Do not attempt to adjust customer video monitor internally.*** Refer the problem to the customer.

6.17 Adjust HEIGHT control on video monitor until perimeter "writing" at top and bottom are visible. This concludes monitor adjustment.

▶B. Video Monitor Adjustment Using KS-21889-L3 Memory Unit

6.18 Perform steps given in paragraphs 6.07 through 6.09.

6.19 Depress TEST switch on 1AR graphics transmitter-receiver (Fig. 48) and generate a vertical line (Fig. 50). Adjust brightness and contrast controls on video monitor (Fig. 44) until background scan lines are barely visible and the vertical test line



LEGEND

KEY	DESIGNATION	KEY	DESIGNATION
DS 202T		CP TS3	
1	ON	11	ON
2	MR	12	RD
3	RS	13	RE
4	CS	14	RI
5	CO	15	R2
6	TM	16	R3
CP TSI			
7	SE		
8	SI		
9	S2		
10	S3		

Fig. 48—LED Identification on Transmitter-Receiver

is bright but not blooming (excessively wide line). Release TEST switch.

Note: An assistant may be required to keep the TEST switch on the transmitter-receiver depressed while adjusting monitor.

6.20 Perform steps given in paragraphs 6.13 through 6.17.

C. KS-21889-L1 Memory Unit Testing

6.21 Depress CLEAR test switch and release, then depress WRITE test switch (Fig. 45) and verify that a test line is alternately written and erased as long as switch is depressed. Verify that PO and ON LEDs are illuminated and that WR and ER LEDs are alternately illuminated and extinguished.

6.22 Depress CLEAR test switch and verify that CL LED illuminates momentarily when test switch is depressed, and that monitor display is cleared.

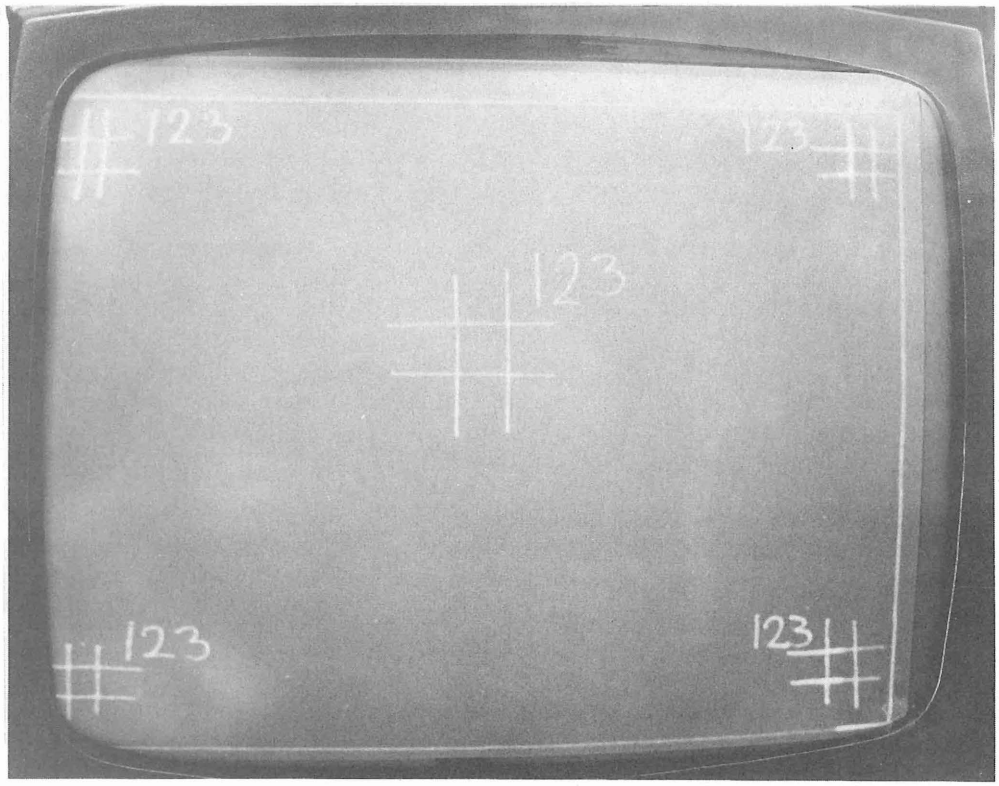


Fig. 49—Left Edge Not Visible on Video Monitor

⧫D. KS-21889-L3 Memory Unit Testing

6.23 Depress CLEAR test switch and release, then depress WRITE test switch (Fig. 5) and verify that a diagonal test line is alternately written and erased as long as switch is depressed (Fig. 50). Verify that PO LED is illuminated and that WR and ER LEDs are alternately illuminated and extinguished.

6.24 Depress CLEAR test switch and verify that CL LED illuminates momentarily when test switch is depressed, and that monitor display becomes fully white and then is cleared.⧫

E. 1AR Graphics Transmitter-Receiver Testing

6.25 Verify that only ON and MR LEDs on DS 202T and ON LED on CP TS3 are illuminated (Fig. 48).

6.26 Depress LT test switch on 1AR graphics transmitter-receiver and verify that ON, MR, RS, CS, and TM LEDs on DS 202T illuminate. Release LT switch.

6.27 Depress TEST switch on 1AR graphics transmitter-receiver. Verify that RS, CS, S1, RD, and R1 LEDs illuminate, and RE LED flashes ***on*** and ***off.***

6.28 Verify that CL LED on memory unit illuminates momentarily when TEST switch is first depressed, followed by WR and ER LEDs alternately illuminating and extinguishing (Fig. 45 and 5).

6.29 On 1AR graphics transmitter-receiver, depress locking LOOP switch. Depress TEST switch and verify that RD LED ***does not*** illuminate (Fig. 48).

6.30 Depress locking AL test switch. Depress TEST switch and verify that RD LED illuminates and the video monitor shows a test line being written. Release AL switch.

6.31 Depress PLAY switch. Verify that LOOP switch remains depressed. Depress TEST switch and verify that RD LED ***does not*** illuminate.

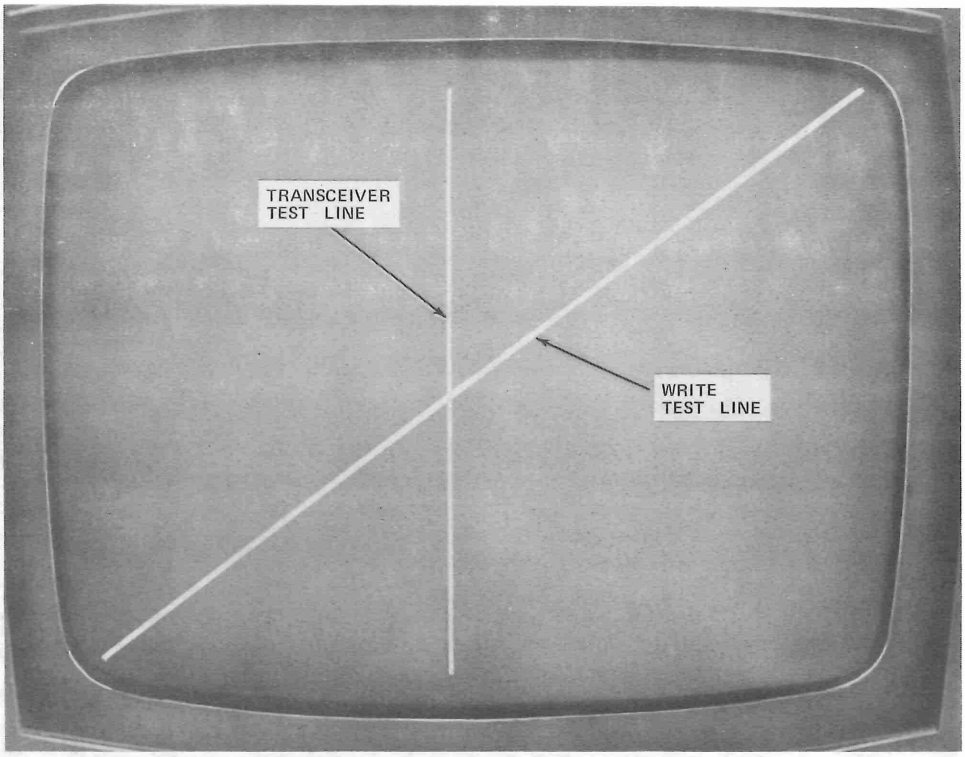


Fig. 50—Test Lines With Digital Memory

6.32 Connect test cable supplied with the 1AR graphics transmitter-receiver between REC and PLAY jacks (Fig. 51). Depress TEST switch and verify that RD LED illuminates (Fig. 48) and video monitor shows a test line being written.

6.33 Release LOOP and PLAY switches. Remove test cable and store in plastic bag attached to inside of cabinet. Also store UHF adapter plug in plastic bag.

F. 83A Control Unit Testing

6.34 Depress ON/CLEAR switch on control unit (Fig. 52). Verify that video monitor display is cleared.

6.35 Write or draw on blackboard with chalk. Pick up eraser from control unit and slowly erase blackboard with end of eraser. Verify that video monitor shows an erased spot about 1/2-inch square (on 23-inch monitor).

6.36 Erase previously written material on the blackboard with narrow edge of eraser and verify that displayed line is erased.

G. Blackboard Testing

6.37 Write lines and numbers at the center and near the corners of blackboard (Fig. 53). Verify that ***all writing*** is visible on monitor display. If necessary, readjust monitor size controls. Erase blackboard and depress ON/CLEAR switch on control unit.

H. Testing System on Telephone Line With Remote Blackboard (if Available)

6.38 Establish telephone call to remote station (paragraph 4.22).

6.39 Write on blackboard and then depress ON/CLEAR switch. Verify that writing appeared at remote display, and was subsequently cleared.

Fig. 51—Test Cable From REC Jack to PLAY Jack

6.40 Request remote operator to write on blackboard and then depress ON/CLEAR switch. Verify that local display shows writing, and that it is subsequently cleared.

I. Testing System on Telephone Line When Remote Blackboard is Not Available

Note: For talk mode, exclusion key must be down; for graphics mode, exclusion key must be up. While these tests can be performed on only one telephone with exclusion key, it is helpful in coordinating mode switching by also using a conference telephone set at each end on a second telephone line.

6.41 Place a call to test center. Ask person at test center to listen to telephone.

6.42 Depress exclusion key and verify that test center person received typical FSK data.

6.43 Request test center to send TOUCH-TONE or FSK signals. Lift local exclusion key. Verify that CO LED on 1AR graphics transmitter-receiver illuminates (Fig. 48).

6.44 Release exclusion key and terminate call to test center.

MULTIPLE SEND-RECEIVE STATION TESTING

6.45 Perform entire procedure from paragraphs 6.01 through 6.44, starting with first blackboard and display (left), then blackboard and display to the right of first blackboard, and finally third blackboard and display, if present. Omit steps outlined in paragraphs 6.25 through 6.27 for second (and third) blackboard(s) and display(s).

SINGLE SEND-ONLY STATION TESTING

6.46 Perform the following tests. (Some of the tests require two persons.)

- AC Power Connection (paragraphs 6.01 and 6.02)
- 1AR Graphics Transmitter-Receiver Testing (paragraphs 6.25 through 6.27 and 6.31 through 6.33).

6.47 In addition to the above tests, if a remote send-receive or receive-only station ***is*** available, perform the following tests:

(1) Place a call to the remote station using the graphics telephone set. Agree with the distant party to lift both exclusion keys.

(2) Draw a line around the edge of the blackboard and write vertical lines near the center of the

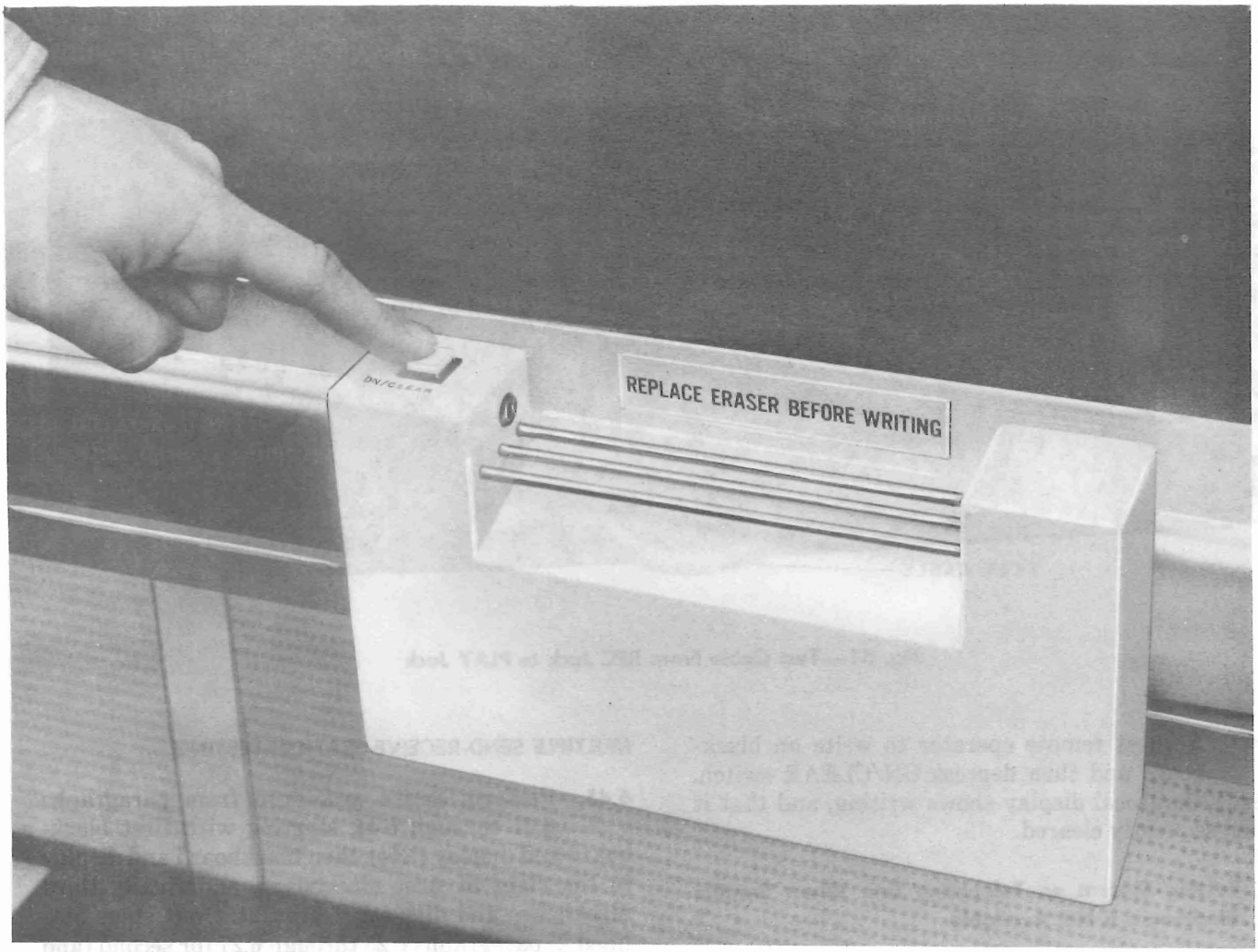


Fig. 52—Depressing ON/CLEAR Switch on Control Unit

blackboard. Following this, erase one of the center lines and depress the ON/CLEAR switch (Fig. 52). Verify with the distant party that all of the above writing, erasing, and clearing were received properly.

6.48 If a remote send-receive or receive-only station ***is not*** available, perform the following two-person tests:

(1) Using the graphics telephone set, place a call to the conference telephone set at the same location. After the call is completed, lift the graphics telephone set exclusion key. Touch the center of the blackboard and verify by listening to the voice line that data is being transmitted. In addition, verify that the following LEDs on the 1AR graphics transmitter-receiver are lighted:

Top row - ON, MR, RS, CS
Middle row - S1
Bottom row - ON, RD, R1

(2) While touching the center of the blackboard, lift the eraser from the tray and verify that in addition to the above, the following LEDs are lighted:

Middle row - SE
Bottom row - RE

(3) Replace the eraser on the eraser tray and remove all contact with the blackboard. Verify that the voice line becomes quiet.

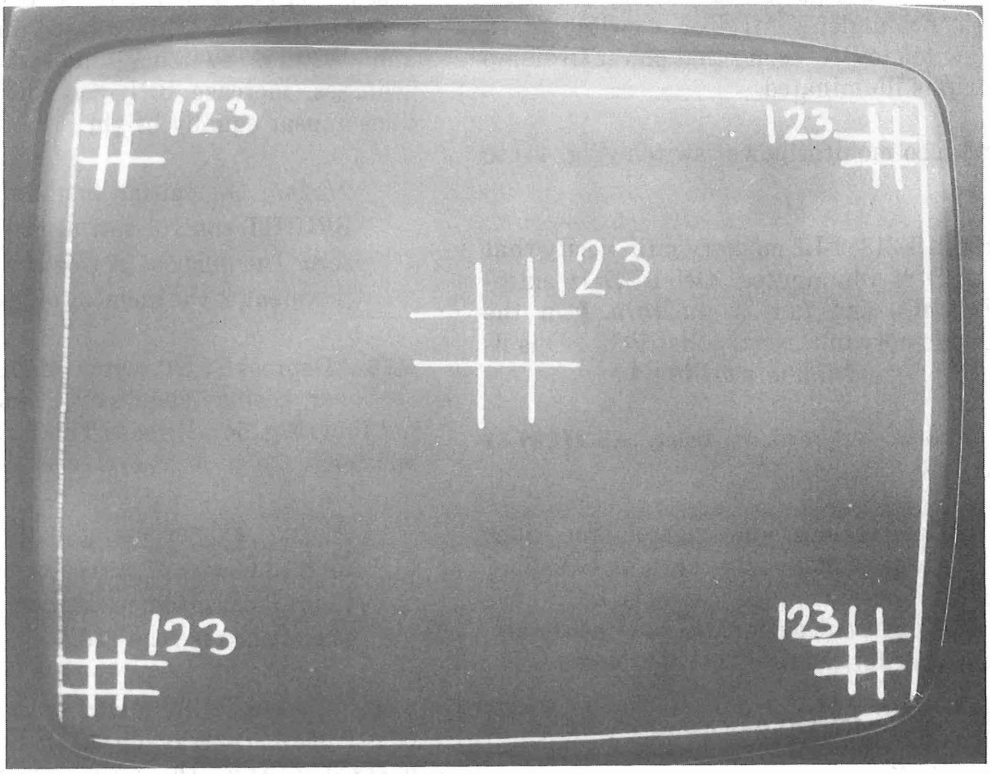


Fig. 53—Test Pattern on Video Monitor

(4) Depress the ON/CLEAR switch on the control unit. Verify that a burst of data is heard on the conference telephone set. Verify also that RD LED on the bottom row is lighted briefly. Touch the blackboard and while touching, depress the ON/CLEAR switch. Verify that RD LED on bottom row of transmitter-receiver is lighted, extinguishes briefly, then is lighted again.

MULTIPLE SEND-ONLY STATION TESTING

6.49 Perform the entire procedure from paragraphs 6.46 through 6.48, starting with the first (left) blackboard, then the second blackboard (just to right of first blackboard), and finally to third (right) blackboard, if present. Requirements of the LEDs are modified as follows:

(1) When the second blackboard is touched, S2 on the middle row and R2 on the bottom row shall light.

(2) When the third blackboard is touched, S3 on the middle row and R3 on the bottom row shall light.

SINGLE RECEIVE-ONLY STATION TESTING

6.50 Remove rear cover from 1AR graphics receiver. Verify that option switches are set as follows (Fig. 35):

SWITCH	POSITION
GAIN	DDD
SEND	OFF
REC	ON
DISP	ONE

Replace rear cover.

6.51 Verify that cords are properly connected to 1AR graphics receiver and that power cord is plugged into cabinet ac power strip.

6.52 Connect cabinet power cord to an ac outlet that is not under control of a switch. Turn power strip switch to ON. Verify that power ON lamp on power strip is illuminated.

6.53 Turn video monitor power switch (Fig. 44) to ON.

6.54 On the KS-21889-L1 memory unit, verify that PO LED is illuminated, ON LED is extinguished (Fig. 45), and fan is ***audible.*** ▶On the KS-21889-L3 memory unit, verify that PO LED is illuminated (Fig. 5) and fan is ***audible.***◀

A. Video Monitor Adjustment Using KS-21889-L1 Memory Unit

Note: Designations and controls for video monitor that follow are for a CONRAC SNA23/C. Other monitor controls may have somewhat different designations. If necessary, ask customer for monitor instruction manual.

6.55 Verify that video monitor controls are set as follows (Fig. 43):

- SYNC set to INT
- Impedance set to 75 Ω.

If picture breaks up, adjust horizontal hold and vertical hold controls (Fig. 44) to obtain steady display.

6.56 Depress VIDEO switch on the KS-21889-L1 memory unit, and while holding VIDEO depressed, adjust brightness and contrast controls on video monitor until background scan lines are barely visible and VIDEO line is bright but not blooming (Fig. 47). Release VIDEO test switch.

Note: An assistant may be required to keep the VIDEO test switch on the memory unit depressed while adjusting monitor.

6.57 Set BRIGHT control on KS-21889-L1 memory unit (Fig. 45) to "0". Depress WRITE test switch on memory unit and hold until a complete vertical line is written on monitor, then release.

6.58 Depress VIDEO test switch on memory unit and compare brightness of VIDEO line on left of display with brightness of WRITE-generated line. The two lines should be equal in brightness. If brightness of WRITE-generated line is less than that produced by the VIDEO-generated line, depress VIDEO and WRITE switches and while holding both switches, increase BRIGHT control until the two lines appear equally bright.

Note: On initial installation, the nominal BRIGHT control setting should be at or near zero. The purpose of this control is for user adjustment of the memory output as the unit ages.

6.59 Depress TEST switch on 1AR graphics receiver. Display should clear, followed by a diagonal line (Fig. 54). Release TEST switch when line is written.

Note: Proper size adjustment cannot be performed locally on a receive-only station. Assistance from a remote station with an electronic blackboard is required.

6.60 Place a call to a remote station with a blackboard (paragraph 4.22). Request the remote operator to trace the entire perimeter of the blackboard with finger, exerting sufficient pressure to ensure an unbroken outline to be displayed at the local station (after exclusion key is lifted). Remote and local station should now agree to go to graphics mode (lift exclusion key).

6.61 If left or right side of perimeter "writing" is not visible (Fig. 49), adjust horizontal hold control on video monitor (Fig. 44) until both sides are visible.

6.62 Turn monitor power switch ***off*** and ***on***. If picture breaks up, indicating horizontal hold control is not adjusted properly, readjust horizontal hold control. Repeatedly turn power switch ***off*** and ***on*** while adjusting horizontal hold control until picture remains steady when power is turned ***off*** and ***on.*** If left or right side of perimeter "writing" is not visible after this procedure, adjust WIDTH control of monitor. If this does not bring both sides of the "writing" into view, internal adjustments are required. ***Do not attempt to adjust customer video monitor internally.*** Refer the problem to the customer.

6.63 Adjust HEIGHT control on monitor until perimeter "writing" at top and bottom are visible. This concludes monitor adjustment.

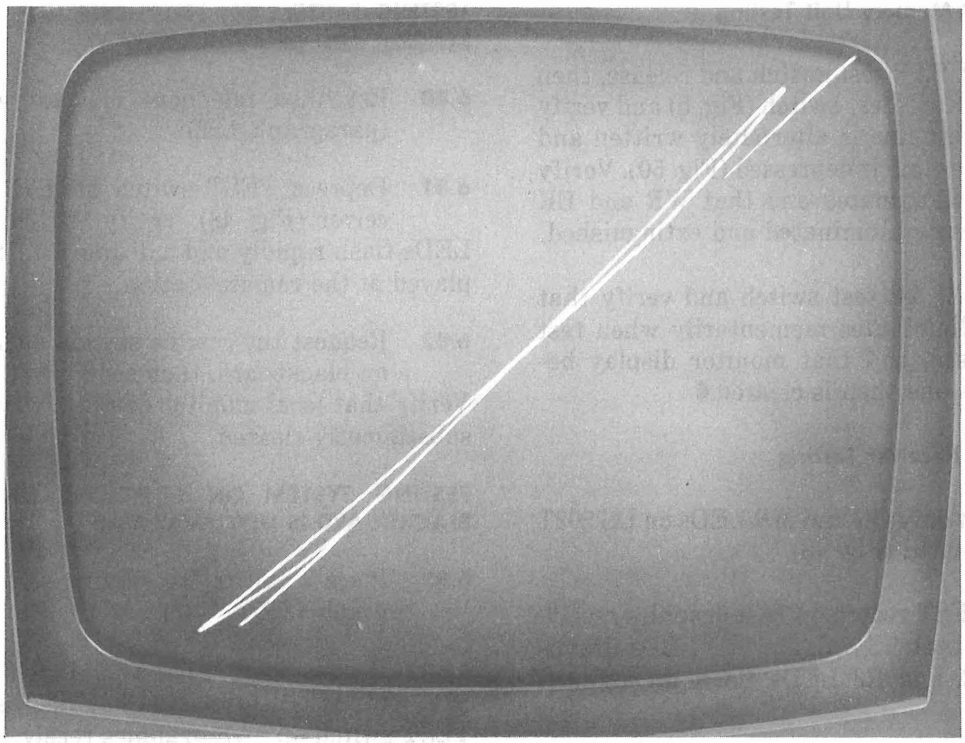


Fig. 54—Diagonal Test Line

B. Video Monitor Adjustments Using KS-21889-L3 Memory Unit

Note: Designations and controls for video monitor that follow are for a CONRAC SNA23/C. Other monitor controls may have somewhat different designations. If necessary, ask customer for monitor instruction manual.

6.64 Verify that video monitor controls are set as follows (Fig. 43).

- SYNC set to INT
- Impedance set to 75 Ω.

If picture breaks up, adjust horizontal and vertical hold controls (Fig. 44) to obtain steady display.

6.65 Depress WRITE switch on the KS-21889-L3 memory unit (Fig. 5), and while holding WRITE depressed, adjust brightness and contrast controls on video monitor until background scan lines are barely visible and WRITE line is bright but not blooming (excessively wide line). Release WRITE test switch.

Note: An assistant may be required to keep the WRITE test switch on the memory unit depressed while adjusting monitor.

6.66 Perform steps given in paragraphs 6.59 through 6.63.

C. KS-21889-L1 Memory Unit Testing

6.67 Depress WRITE test switch (Fig. 45) and verify that a test line is alternately written and erased as long as switch is depressed. Verify that PO and ON LEDs are illuminated and that WR and ER LEDs are alternately illuminated and extinguished.

6.68 Depress CLEAR test switch and verify that CL LED illuminates momentarily when test switch is depressed, and that monitor display is cleared.

◗D. KS-21889-L3 Memory Unit Testing

6.69 Depress CLEAR test switch and release, then depress WRITE test switch (Fig. 5) and verify that a diagonal test line is alternately written and erased as long as switch is depressed (Fig. 50). Verify that PO LED is illuminated and that WR and ER LEDs are alternately illuminated and extinguished.

6.70 Depress CLEAR test switch and verify that CL LED illuminates momentarily when test switch is depressed, and that monitor display becomes fully white and then is cleared.◖

E. 1AR Graphics Receiver Testing

6.71 Verify that only ON and MR LEDs on DS 202T are illuminated (Fig. 48).

6.72 Depress TEST switch on 1AR graphics receiver. Verify that RS, CS, and RD LEDs illuminate and R1, R2, and R3 LEDs flash ***on*** and ***off*** rapidly.

6.73 Verify that CL LED on memory unit (Fig. 45 and 5) illuminates momentarily when TEST switch is first depressed, followed by WR LED flashing rapidly.

6.74 Depress LT test switch on 1AR graphics receiver and verify that ON, MR, RS, CS, and TM LEDs on DS 202T illuminate (Fig. 48).

6.75 Depress locking LOOP switch. Depress TEST switch and verify that RD LED ***does not*** illuminate. Release TEST switch.

6.76 Depress locking AL switch. Depress TEST switch and verify that RD LED illuminates and a diagonal test line appears on the monitor (Fig. 54). Release TEST and AL switches.

6.77 Depress PLAY switch. Depress TEST switch and verify that RD LED ***does not*** illuminate.

6.78 Connect test cable supplied with 1AR graphics receiver between REC and PLAY jacks (Fig. 51). Depress TEST switch (Fig. 48) and verify that RD LED illuminates and monitor shows a test line being written.

6.79 Release LOOP and PLAY switches, and remove test cable.

TESTING SYSTEM ON TELEPHONE LINE WITH REMOTE BLACKBOARD (IF AVAILABLE)

6.80 Establish telephone call to remote station (paragraph 4.22).

6.81 Depress TEST switch on 1AR graphics receiver (Fig. 48). Verify that R1, R2, and R3 LEDs flash rapidly and a diagonal test line was displayed at the remote station.

6.82 Request the remote station operator to write on blackboard, then send ON/CLEAR signal. Verify that local monitor displays writing, which is subsequently cleared.

TESTING SYSTEM ON TELEPHONE LINE IF REMOTE BLACKBOARD IS NOT AVAILABLE

6.83 Place a call to the serving test center (paragraph 4.22).

6.84 Request test person to listen to telephone after local exclusion key has been lifted and TEST switch on 1AR graphics receiver has been depressed.

6.85 After several seconds have elapsed, depress exclusion key and verify that test person received FSK data.

6.86 Request test person to send TOUCH-TONE or FSK signals after local exclusion key is lifted. Verify that 1AR graphics receiver CO LED illuminates (Fig. 48).

MULTIPLE RECEIVE STATION TESTING

6.87 Perform tests for first (left) monitor, 1AR graphics receiver, and memory unit per paragraphs 6.50 through 6.86. In addition, perform tests described in paragraphs 6.53 through 6.68 and 6.80 through 6.86 for second (and third, if present) monitor and memory unit.

> ***Note:*** Test line displayed on second (and third) monitor(s) will appear somewhat different from that produced on first monitor when 1AR graphics receiver TEST switch is depressed (Fig. 55, 56, 57).

MULTIPLE SEND-SINGLE RECEIVE STATION TESTING

6.88 In stations having two or three blackboards and only one video monitor, perform all tests from paragraphs 6.01 through 6.44, except as follows:

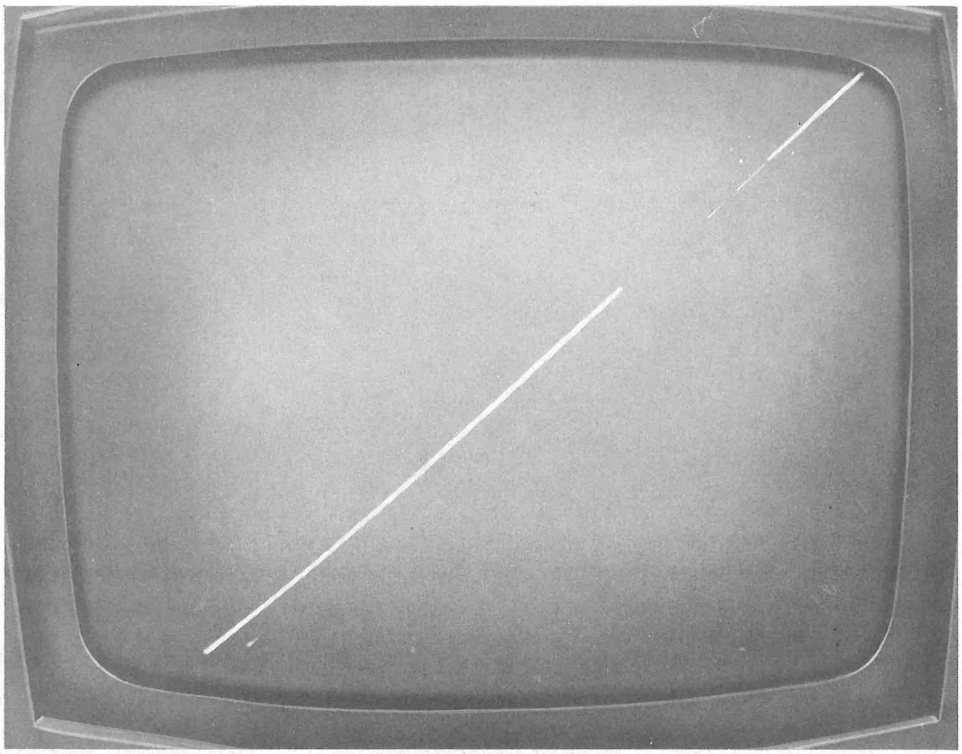


Fig. 55—Diagonal Line Produced by Memory 1 on Monitor 1

(1) Set DISP switch to ONE (Fig. 35). This will cause inputs from all blackboards to appear on the single video monitor.

(2) Verify that the WRITE signals from all blackboards are displayed on the monitor.

(3) Verify that the ON/CLEAR signal from each control unit clears the display.

7. TAPE RECORDER PROCEDURES AND ADJUSTMENTS

7.01 The following instructions are to be used as a guideline in case the customer requires assistance with connecting the tape recorder. The customer is expected to supply all connecting cables for recording and playback of graphics, and all equipment for recording and playback of voice.

GENERAL

7.02 The tape recorder is a customer option. If the customer chooses to supply one, these instructions should be followed.

7.03 A good quality audio tape deck, such as the SUPERSCOPE CD 320, may be used to record electronic blackboard writing. To provide for simultaneous taping of voice and graphics, a 2-channel (stereo) unit is required. It is advantageous to use a tape recorder with at least one built-in or associated loudspeaker to provide a convenient voice playback capability. A Wollensak 2522AV, or similar tape recorder may be used. ***For proper operation, the tape recorder shall have a speed accuracy of ±3 percent or better.*** ⏵Certain features are necessary and desirable when considering a tape recorder or deck. There should be right and left channels, LINE inputs and LINE outputs. Also there should be a VU meter for each channel and a manual record level feature. Some recorders have automatic gain control features when recording which lock onto the lowest level signal on either channel. This is not desirable for use on the electronic blackboard. If possible, LINE and MIC inputs should be usable at the same time (ie, R-LINE IN, L-MIC).⏴

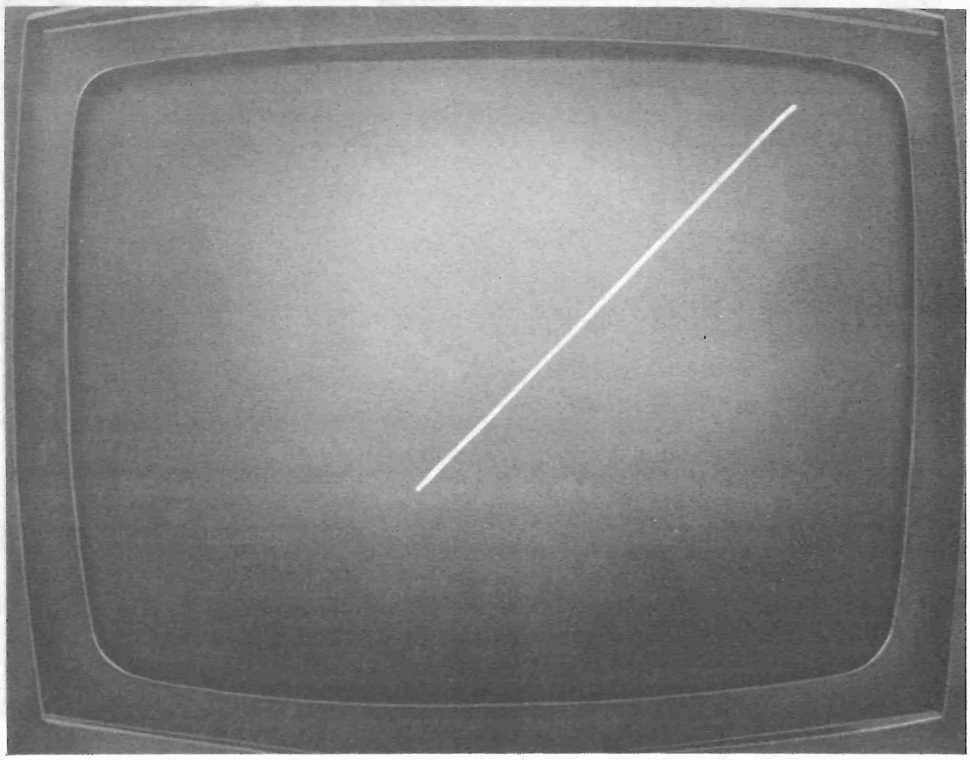


Fig. 56—Diagonal Line Produced by Memory 2 on Monitor 2

7.04 When recording or playing back a tape, the electronic blackboard system can be on-line or off-line; that is, the system can record and play back graphics with or without being connected to the telephone line. When connected to the line both local- and remotely-generated graphics can be recorded. When connected to the telephone line, the played back graphics will be transmitted to the local and remote displays.

7.05 To standardize taping procedures, ***standard practice is to record graphics on the right channel and voice on the left channel.***

7.06 When connected to the telephone line and the PLAY switch on the transmitter-receiver is depressed, remotely generated graphics ***will not*** be received; however, locally generated graphics will be displayed locally and transmitted to the remote display(s). Exercise care not to write while playing back a tape, since blackboard writing will interrupt tape playback.

CONNECTING TAPE RECORDER FOR RECORDING AND PLAYBACK OF GRAPHICS

7.07 Connect phonoplug-terminated cable from REC jack on transmitter-receiver (Fig. 3) to LINE IN R jack of tape recorder (Fig. 58). Connect phonoplug-terminated cable from transmitter-receiver PLAY jack (Fig. 3) to LINE OUT R on tape recorder (Fig. 58).

RECORDING GRAPHICS

7.08 Adjust tape recorder controls as described in the tape recorder manual for recording from a telephone line input signal. If the recorder has recording level meters, depress and hold TEST switch on the transmitter-receiver and adjust recording level on the tape recorder until meter indication is below zero or below the red line (Fig. 59). If recording level is set too high, crosstalk to the adjacent voice channel may occur. If recording level is set too low, errors may appear in the display. ***A recording level of approximately −3 VU (volume units) is recommended.***

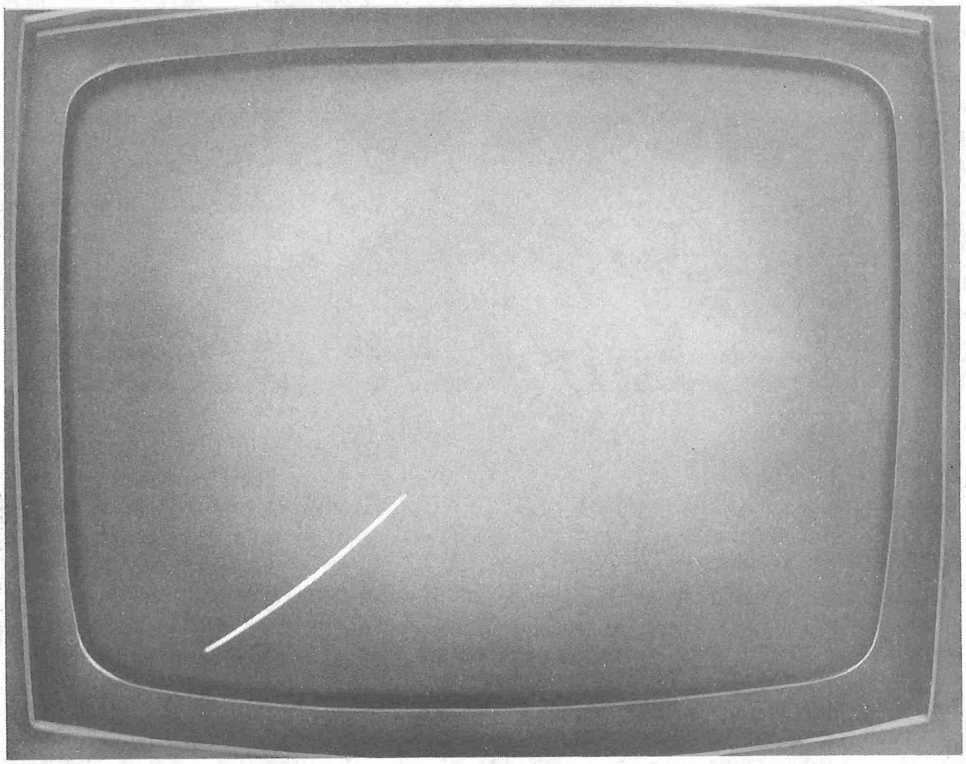


Fig. 57—Diagonal Line Produced by Memory 3 on Monitor 3

PLAYBACK OF GRAPHICS

7.09 Depress PLAY switch on transmitter-receiver. Follow playback instructions in tape recorder manual. If playback level is adjustable, set to a level high enough to avoid display errors.

CONNECTING TAPE RECORDER FOR RECORDING AND PLAYBACK OF VOICE

7.10 Paragraphs 7.11 through 7.18 describe various arrangements for recording and playback of voice.

RECORDING VOICE

7.11 Recording voice to accompany recorded graphics should follow conventional procedures as given in the tape recorder manual.

LOCAL RECORDING (OFF-LINE) USING TAPE RECORDER MICROPHONE

7.12 Record voice using tape recorder microphone as described in tape recorder manual.

LOCAL RECORDING (OFF-LINE) USING PORTABLE CONFERENCE TELEPHONE SET

7.13 Connect a customer-provided cable with phonoplug on one end and bare wires on the other end from LINE IN L on the tape recorder (Fig. 58) to PA OUTPUT terminals on bottom of portable conference telephone set. Disconnect telephone plug from telephone jack. Depress microphone switch (green or gold) and use appropriate lavaliere microphone for voice recording.

LOCAL AND REMOTE RECORDING (ON-LINE)

Warning: Two-way voice communications should not be recorded on the switched network without satisfying legal and tariff requirements.

7.14 Two-way voice communication can be recorded by either using the tape recorder microphone (paragraph 7.12) or the portable conference telephone set PA output (paragraph 7.13).

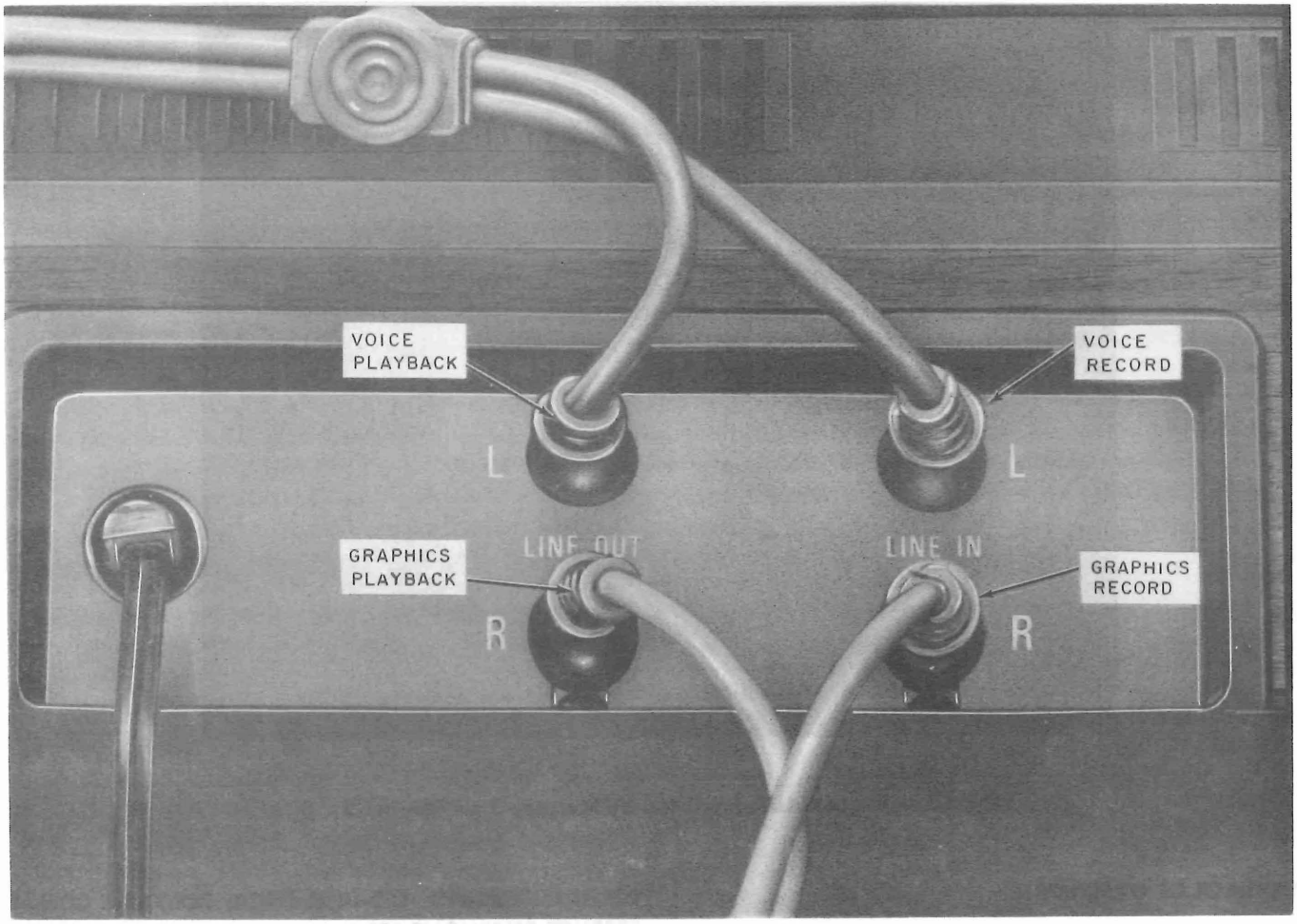


Fig. 58—Typical Stereo Tape Deck Connections

LOCAL PLAYBACK OF VOICE

7.15 Recorded voice may be played back through the customer's own audio system or through the portable conference telephone set. If the tape recorder is equipped with a built-in or external loudspeaker, playback should follow instructions in the tape recorder manual. If the tape recorder is a tape deck with no loudspeaker, an external amplifier and loudspeaker may be used for playback. To play back using the portable conference telephone set, the telephone plug of the conference set must be removed from the telephone jack and connected to a special customer-provided cable that can be constructed from parts available at a local radio/electronics supply store. The cable should have a 4-prong telephone jack at one end and a phonoplug at the other end. For a modular 50A portable conference telephone set, use a standard wall jack wired to a phonoplug as shown in Fig. 60. For playback, connect the phonoplug to the L LINE OUT terminal (Fig. 58) of the tape recorder. Turn the portable conference telephone set ***on*** with the MIKES OFF switch.

LOCAL AND REMOTE PLAYBACK (ON-LINE)

7.16 Recorded voice may be played back over the telephone line by placing one of the portable conference telephone set microphones near the tape recorder loudspeaker. Take care to avoid room noise being transmitted to the remote location(s).

7.17 Recorded voice may also be played back to the remote location(s) by connecting the L LINE OUT terminal (Fig. 58) of the tape recorder to one of

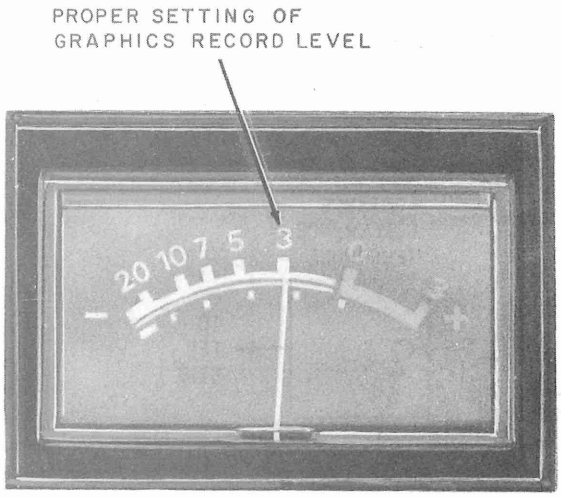


Fig. 59—Right Stereo Recorder Level Meter

the two microphone inputs (green or gold) of the portable conference telephone set.

Note: Local playback of voice must be through a user-supplied speaker when this method is used.

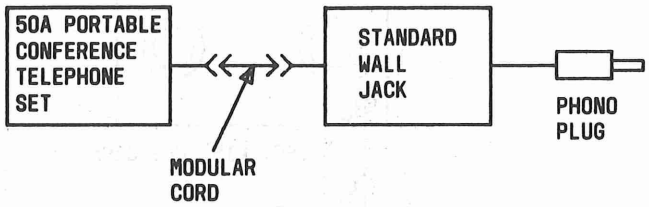


Fig. 60—Modular Conference Telephone Set Connections

7.18 If the tape recorder does not have a playback volume control, use a customer-provided adapter and connect as shown in Fig. 61.

Caution: Since the microphone input of a portable conference telephone set is very sensitive, it is essential to verify with the remote location that audio is not distorted due to excessive signal level.

8. MAINTENANCE

8.01 Little periodic maintenance is required for the system; items requiring periodic maintenance

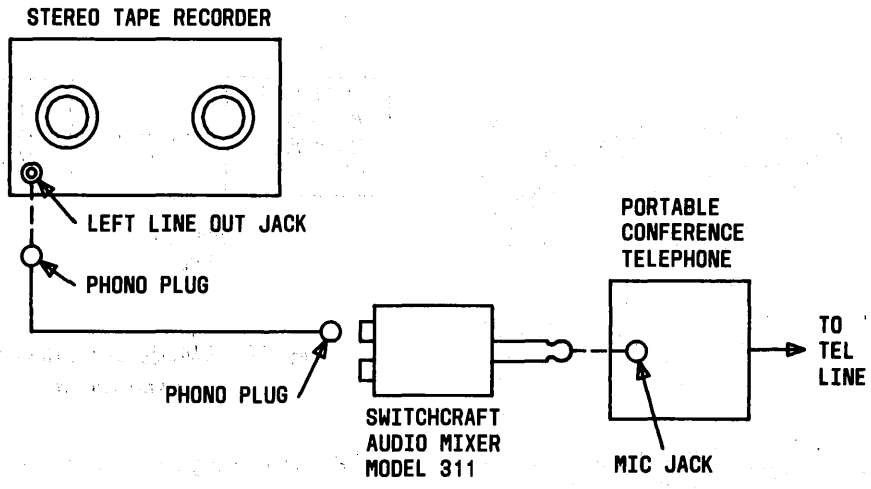


Fig. 61—Arrangement for Local and Remote Playback (On-Line)

are listed, together with maintenance of malfunctioning equipment, in this part.

KS-21890 BLACKBOARD

8.02 No periodic maintenance is required. If blackboard surface exhibits excessive wear, or if the blackboard fails or is damaged, return to a Western Electric Service Center for repair.

> ***Note:*** Dust-free chalk and felt-type eraser replacements are the responsibility of the user. The eraser must be 1 inch minimum height by 2 inches minimum width by 7 inches maximum length.

83A CONTROL UNIT

8.03 No periodic maintenance is required. If the control unit fails, return to a Western Electric Service Center for repair.

1AR GRAPHICS TRANSMITTER-RECEIVER AND 1AR GRAPHICS RECEIVER

8.04 No periodic maintenance is required. If a transmitter fails, CP TS1, CP TS2, and CP TS4 may be field replaced. If a receiver fails, CP TS3 and CP TS4 may be field replaced. Front and rear covers, card stop assembly, and fuse are field-replaceable. Part numbers for these items are as follows:

Fuse	3/8A Buss SB
Front cover	842 307 456
Rear cover	842 307 514
Card stop	842 307 548

Data set 202T is also field-replaceable. Return defective circuit packs and/or data set to a Western Electric Service Center for repair. If CP replacement does not remedy the fault, return entire unit for repair.

> ***Note:*** It is important that card stop be in place before unit is returned to service.

KS-21889-L1 MEMORY UNIT

8.05 Periodic adjustment may be required to maintain display size, resolution, and brightness. Perform adjustments per Part 10. Front and rear covers, fuse, video cable, and UHF adapter are field-replaceable. Part numbers for these items are as follows:

Front cover	660C4011
Rear cover	660C4012
Fuse	1A Buss SB
Video cable	Hughes Aircraft Co. or Pomona Electronics 2249-E-72
UHF adapter	ITT Pomona Electronics 3286

In case of a damaged or failed memory unit, return to a Western Electric Service Center for repair. ▶The

KS-21889-L1 memory unit is directly replaceable with a KS-21889-L3 memory unit.◀

▶KS-21889-L3 MEMORY UNIT ADJUSTMENTS AND MAINTENANCE

8.06 Periodic adjustments may be required to maintain display size. This consists of adjusting four potentiometers labelled BOTTOM, TOP, RIGHT, and LEFT behind front cover (Fig. 62). While viewing video monitor, adjust LEFT potentiometer, then adjust RIGHT potentiometer; adjust BOTTOM potentiometer, then TOP potentiometer. No other adjustments are required.

8.07 The fuse, video cable, and UHF adapter are field-replaceable. Part numbers for these items are as follows:

Fuse	1A 3AG 250V
Video Cable	Pomona Electronics 2249-E-60
UHF Adapter	ITT Pomona Electronics 3286

In case of a damaged or failed memory unit, return to a Western Electric Service Center for repair.◀

KS-21888 CABINET

8.08 No periodic maintenance is required. The ac power strip may be field replaced if required (P/N UL-24-CB-15; SGL Weber Electric Co.).

KS-21887 BLACKBOARD STAND

8.09 No periodic maintenance is required.

VIDEO MONITOR AND TAPE RECORDER

8.10 The monitor and tape recorder are customer-owned. ***Do not attempt repairs on customer equipment.*** If repairs are needed, refer the problem to the customer.

9. TROUBLESHOOTING

GENERAL

9.01 The following procedures provide a systematic approach to isolating trouble in an electronic blackboard station. These procedures ***are not*** intended for periodic maintenance and only need to be consulted in case of system malfunction. These procedures are supported by 11 troubleshooting charts (Fig. 63 through 73).

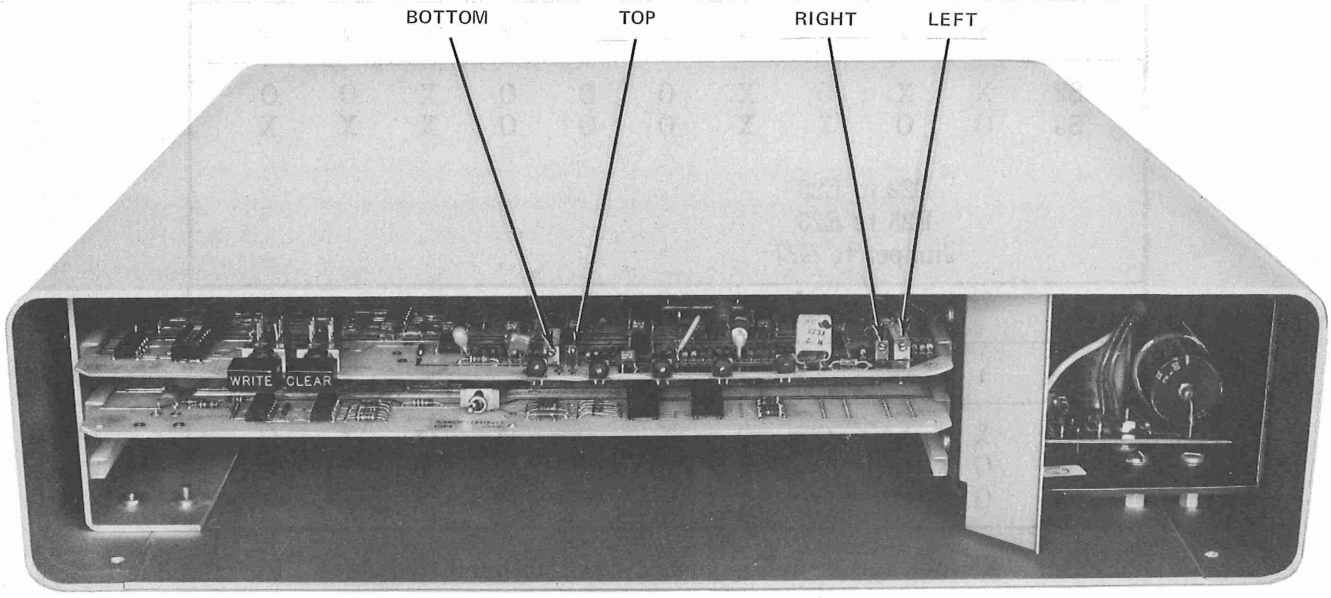


Fig. 62—▶KS-21889-L3 Memory Unit Adjustments◀

Note 1: If a step requires removal of a circuit pack, disconnect power before removing and replacing circuit pack. Handle circuit pack by nonconductive surfaces only.

Note 2: If data set (DS) 202T needs checking or replacement, verify option settings per Table D.

TABLE D

DATA SET 202T OPTION SETTINGS

OPTION										
FEATURE							SELECTION		DESIGNATION	
2/4 Wire Operation							4 WIRE		ZK	
Compromise Delay Equalization							MAX		ZU	
Compromise Amplitude Equalization							MAX		ZW*	
Channel Condition							BASIC		ZY*	
Soft Turn-off and Squelch Intervals							8 ms		Y	
Fast Carrier Detection							IN		Q	
Clear-to-Send Interval							8 ms		M	
Control by Data Auxiliary Set 828 or 829							OUT		A	
Clamp							OUT		E	
Carrier Detector Reset							OUT		ZM	
Continuous Carrier							OUT		ZO	
State of CC During Analog Loopback							OFF		YA*	
202T-L1 SWITCH SETTINGS										
	1	2	3	4	5	6	7	8	9	10
S2	X	X	O	X	O	O	O	X	O	O
S3	O	O	X	X	O	O	O	X	X	X
E22 to E23 E25 to E26 Jumper to E27										
202T-L1A SWITCH SETTINGS										
	1	2	3	4	5	6	7	8	9	10
S2	X	X	O	O	X	O	O	O	X	O
S3	O	O	O	O	O	X	X	X	X	X
S4	O	O	O							

Note: "X" indicates switch is pushed down on numbered side.

*Only applies to 202T-L1A.

AC POWER

STEP	PROCEDURE
1	Verify that power strip line cord is plugged into customer 117 Vac outlet.
2	Verify that circuit breaker on power strip is not tripped.
3	Verify that power strip switch is ***on.***
4	Using a volt-ohm-milliammeter (VOM) verify that power is present at customer outlet.
5	Verify that all fuses are in place and not blown.
6	Verify that all power cords are securely in place.

VIDEO MONITOR DISPLAY (RASTER)

STEP	PROCEDURE
1	Check video monitor fuse.
2	Using VOM, check power at socket where monitor power cord is connected.
3	Turn BRIGHT control on monitor fully clockwise. If still no raster, request customer to repair or replace monitor.
4	Verify SYNC switch is in INT position.
5	Verify BNC connector on cable from memory unit is in place. If problem persists, go to Fig. 63.

WRITING

STEP	PROCEDURE
1	No writing on display when VIDEO switch on memory unit is depressed ▶(KS-21889-L1 and L-2 only).◀ Go to Fig. 63A.
2	No writing on display when WRITE switch on memory unit ▶(-L1 or -L3)◀ is depressed. Go to Fig. 63B.

STEP	PROCEDURE
3	No writing on display when TEST switch on transmitter-receiver is depressed. Go to Fig. 64.
4	No writing on display when local blackboard is written on. Go to Fig. 65.
5	No writing on display when remote blackboard is written on. Go to Fig. 66.
6	No writing transmitted; local writing ok. Go to Fig. 67.
7	Continuous writing on display with no switches operated and no contact with blackboard. Using VOM, check for shorted blackboard. Check for SEND or REC switch on backplane of 1AR transmitter-receiver in TEST position.

ERASING

STEP	PROCEDURE
1	No erasing when memory unit WRITE switch is depressed. Go to Fig. 68.
2	No erasing when transmitter-receiver TEST switch is depressed. Go to Fig. 69.
3	No erasing when eraser is removed from control unit and blackboard is erased. Go to Fig. 70.
4	System erases when it should write. Check for presence of eraser on tray. Also check for bright sunlight or room lights striking right "window" on control unit. If neither of these are at fault, disconnect 83A control unit. Depress TEST switch on transmitter-receiver. If a line is written and erased, replace 83A control unit. Otherwise replace CP TS1 and CP TS2, then go to Fig. 68.

CLEARING

STEP	PROCEDURE
1	Display does not clear when CLEAR switch on memory unit is depressed. Go to Fig. 71.
2	Display does not clear when TEST switch on transmitter-receiver is depressed. Go to Fig. 72.
3	Display does not clear when ON/CLEAR switch on control unit is depressed. Go to Fig. 73.

TAPE RECORDING OF GRAPHICS

STEP	PROCEDURE
	Tape Recording Meter Indicates Very Low or No Record Input
1	Verify that AL, LT, and RT switches on transmitter-receiver are ***not*** operated.
2	Verify that ON, MR, RS, and CS LEDS on transmitter-receiver are illuminated when TEST switch is depressed.
3	Connect REC and PLAY jacks together using test cable provided (Fig. 51).
4	Depress LOOP, PLAY, and TEST switches on transmitter-receiver. Verify that ON, MR, RS, CS, and CO LEDs illuminate on transmitter-receiver. If these LEDs illuminate, the problem is in the recording cable or tape recorder. If these LEDs do not illuminate, replace CP TS3 and CP TS4 and repeat this step.

TAPE PLAYBACK OF GRAPHICS

STEP	PROCEDURE
	No Displayed Graphics When Played Back From Recorder
1	Verify that PLAY switches on both transmitter-receiver and recorder are depressed. Check for presence of recorded data by observing the deflection of the right channel VU meter on the recorder (if present) and by observing the CO LED on DS 202T. If the recorder indicates that data is present and no writing appears, perform the steps outlined in Tape Recording of Graphics.
	Displayed Image Contains Errors (Streaks, etc)
2	Using a new tape, record and play back a test line. If displayed image does not contain errors on the newly prepared tape, determine whether tape that caused errors was prepared on a different tape recorder. If so, request customer to have speed checked on all tape recorders. ***Note:*** For proper operation, the absolute speed accuracy of each tape recorder shall be within ±3 percent.
3	If displayed image does not contain errors, check connections to tape recorder. Request customer to check tape recorder. ***Note:*** If trouble is encountered in the tape recorder do not attempt repairs. Ask the customer to have the tape recorder repaired or replaced.

TELEPHONE LINE PROBLEMS

STEP	PROCEDURE
	Line Dropped When Exclusion Key is Lifted
1	Check wiring inside telephone set. Check wiring to transmitter-receiver.
	Graphics Heard in Handset When Exclusion Key is Lifted
2	Telephone set not properly optioned. The monitoring feature on the 503CM or 2503CM telephone set must be disabled.
	CO LED on Transmitter-Receiver Flickers When Receiving Data on Switched Network
3	Verify that DDD-PL switch on transmitter-receiver is in DDD position.
4	Check for telephone cable continuity.

RECEIVE-ONLY STATIONS

STEP	PROCEDURE
1	See AC POWER.
2	See VIDEO MONITOR DISPLAY (RASTER).
3	See WRITING, step 1.
4	See WRITING, step 2.
5	See WRITING, step 3.
6	See ERASING, step 1.
7	See ERASING, step 2. Display ***does not*** erase in receive-only test mode.
8	See CLEARING, step 1.
9	See CLEARING, step 2.
10	See TAPE RECORDING OF GRAPHICS.

STEP	PROCEDURE
11	See TAPE PLAYBACK OF GRAPHICS.
12	See TELEPHONE LINE PROBLEMS.

MULTIPLE ARRANGEMENT PROBLEMS

STEP	PROCEDURE
1	At send-receive stations, writing appears on wrong display. Verify that blackboards, memory units, and video monitors are connected according to paragraph 5.53.
2	At receive-only stations, writing appears on wrong display. Verify that memory units and video monitors are connected according to paragraph 5.53. ***Note:*** If the DISP switch is in the ONE position, writing from ***any*** blackboard will appear on monitor No. 1 in addition to appearing on the monitor associated with the blackboard. If this is not desired, place DISP switch in MULT position.

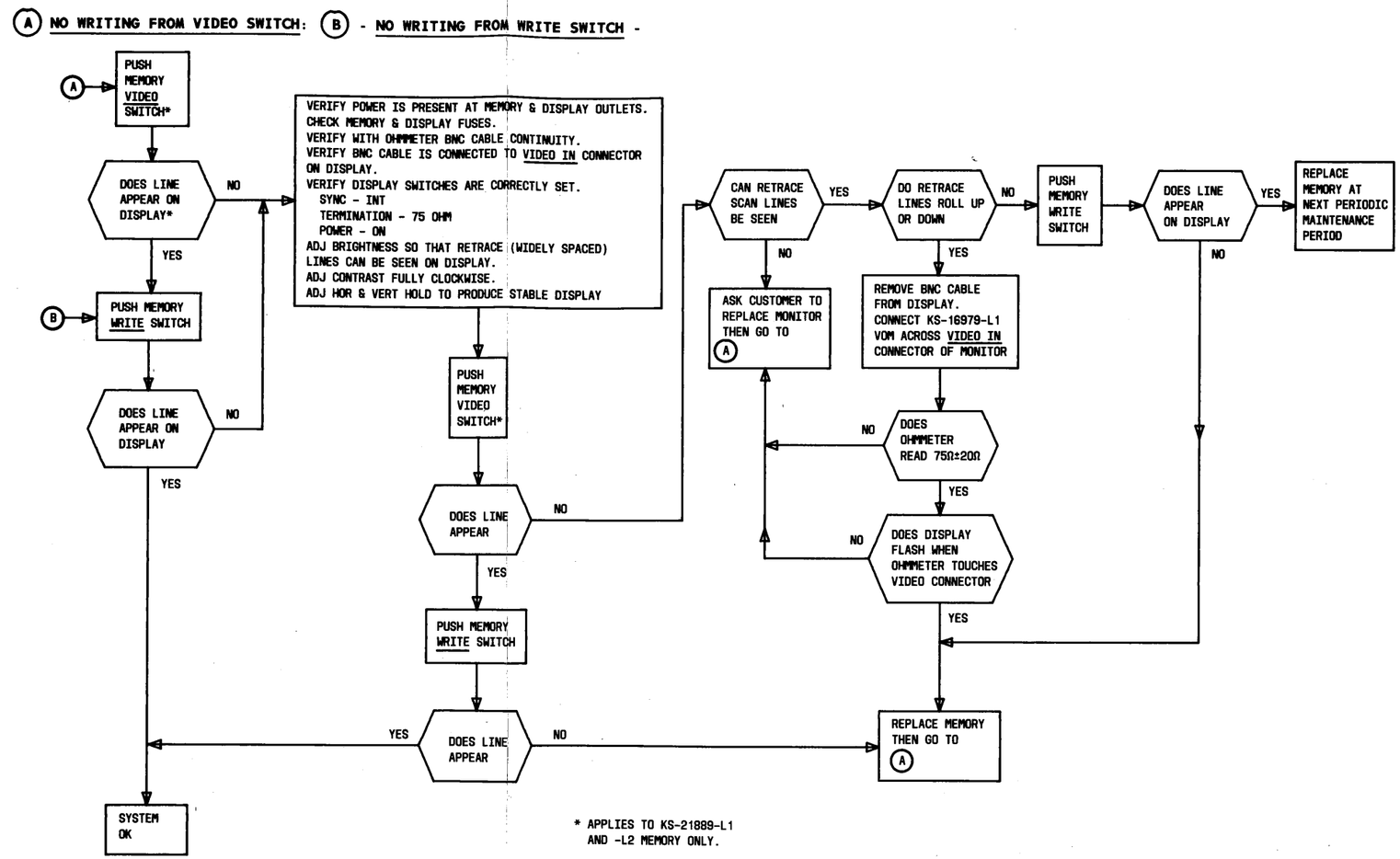


Fig. 63—Troubleshooting—Sheet 1

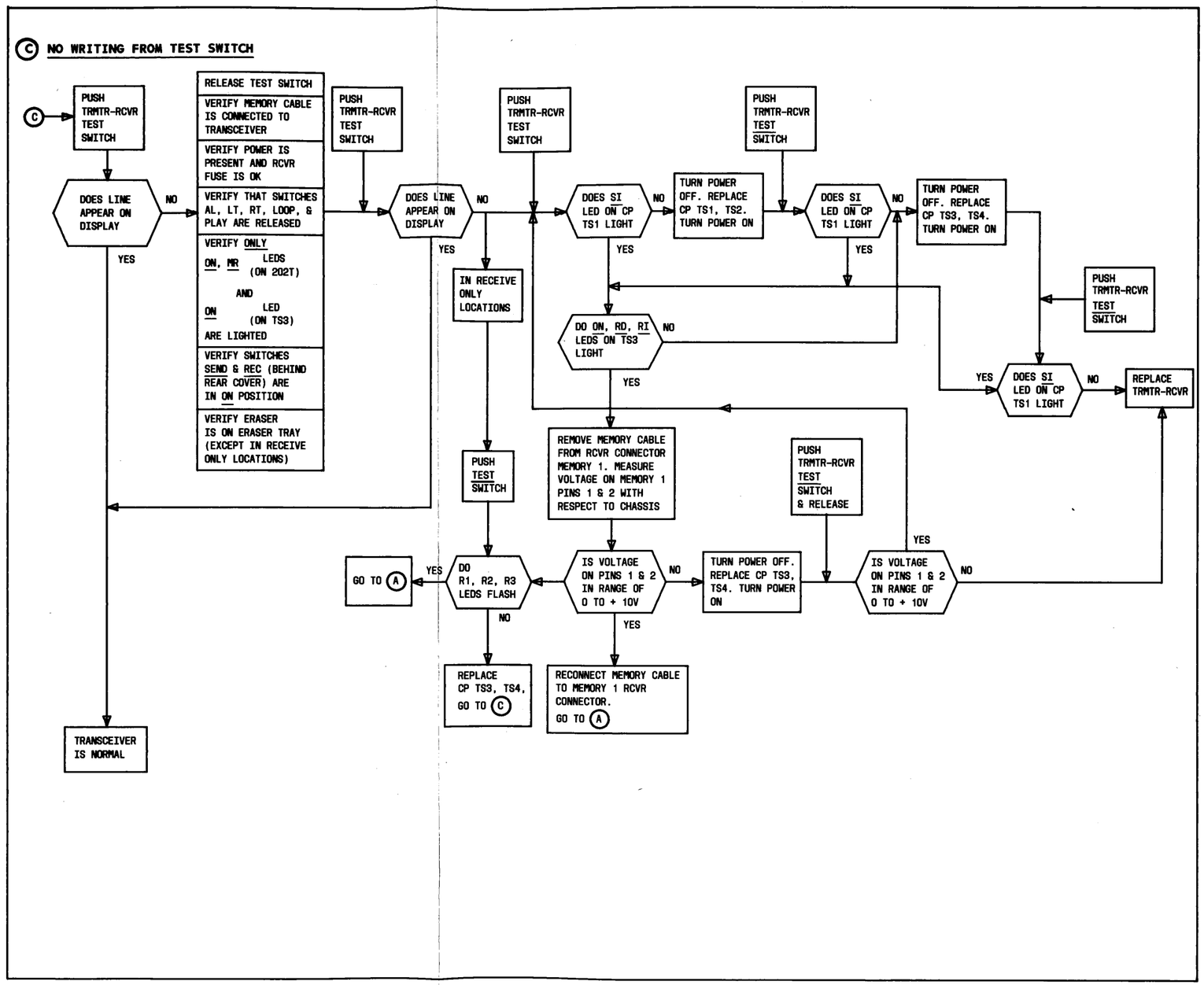


Fig. 64—Troubleshooting—Sheet 2

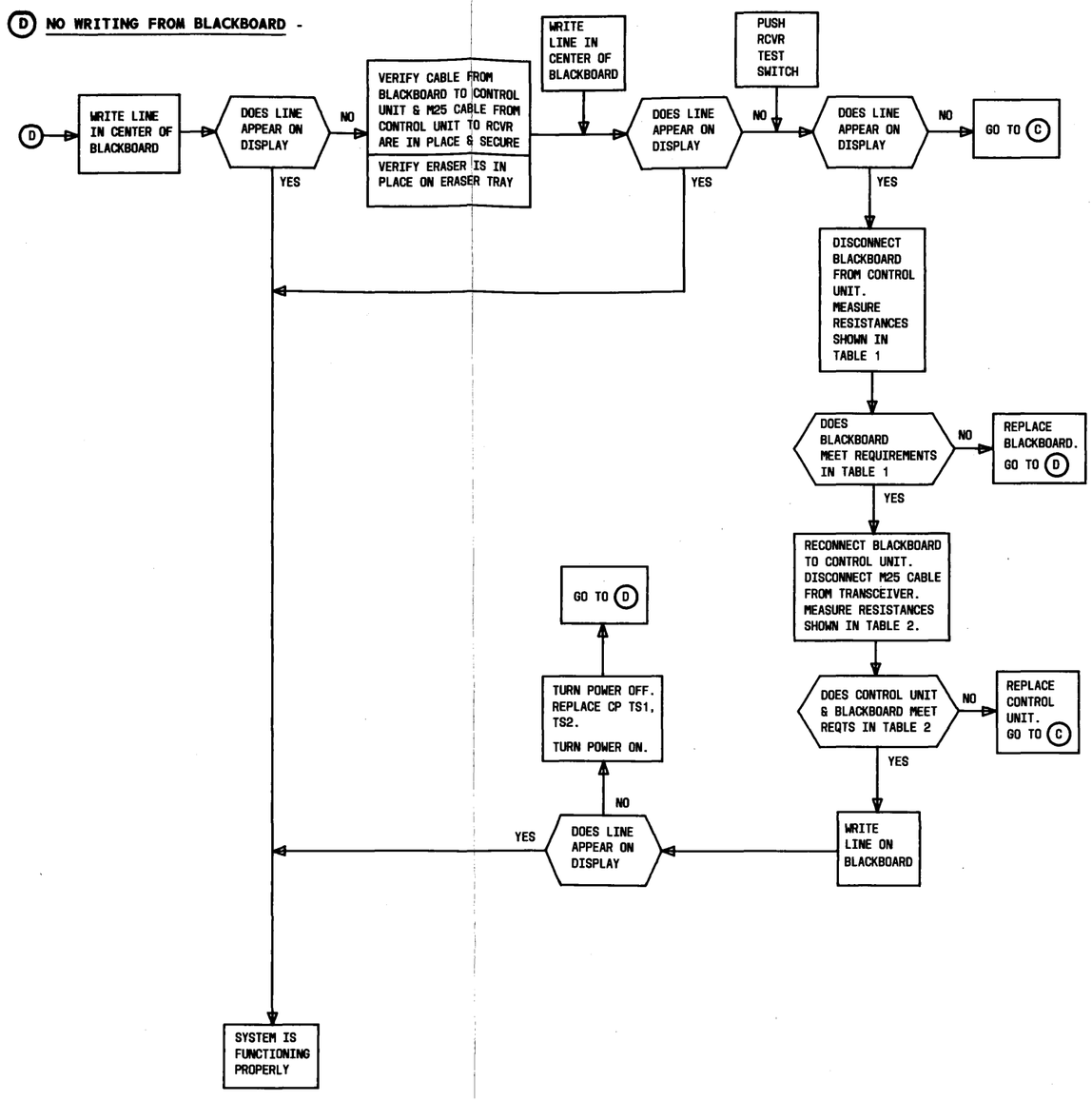


TABLE 1 - TYPICAL RESISTANCES AT BLACKBOARD CONNECTOR	
A.) NO CONTACT MADE TO BLACKBOARD	
PIN A TO PIN D	450Ω-800Ω
PIN B TO PIN E	800Ω-1600Ω
PIN A TO PIN E	>500KΩ
PIN A TO FRAME	>500KΩ
PIN B TO FRAME	>500KΩ
B.) CONTACT MADE TO BLACKBOARD	
PIN A TO PIN E	<3000Ω

TABLE 2 - TYPICAL BLACKBOARD & CONTROL UNIT RESISTANCES	
M25 CONNECTOR	
PIN 8 TO PIN 9	= 450Ω-800Ω
PIN 2 TO PIN 5	= 800Ω-1600Ω
PIN 8 TO ANY OTHER PIN EXCEPT PIN 9	>500K
PIN 2 TO ANY OTHER PIN EXCEPT PIN 5	>500K

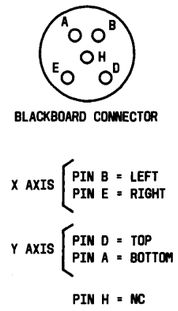


Fig. 65—Troubleshooting—Sheet 3

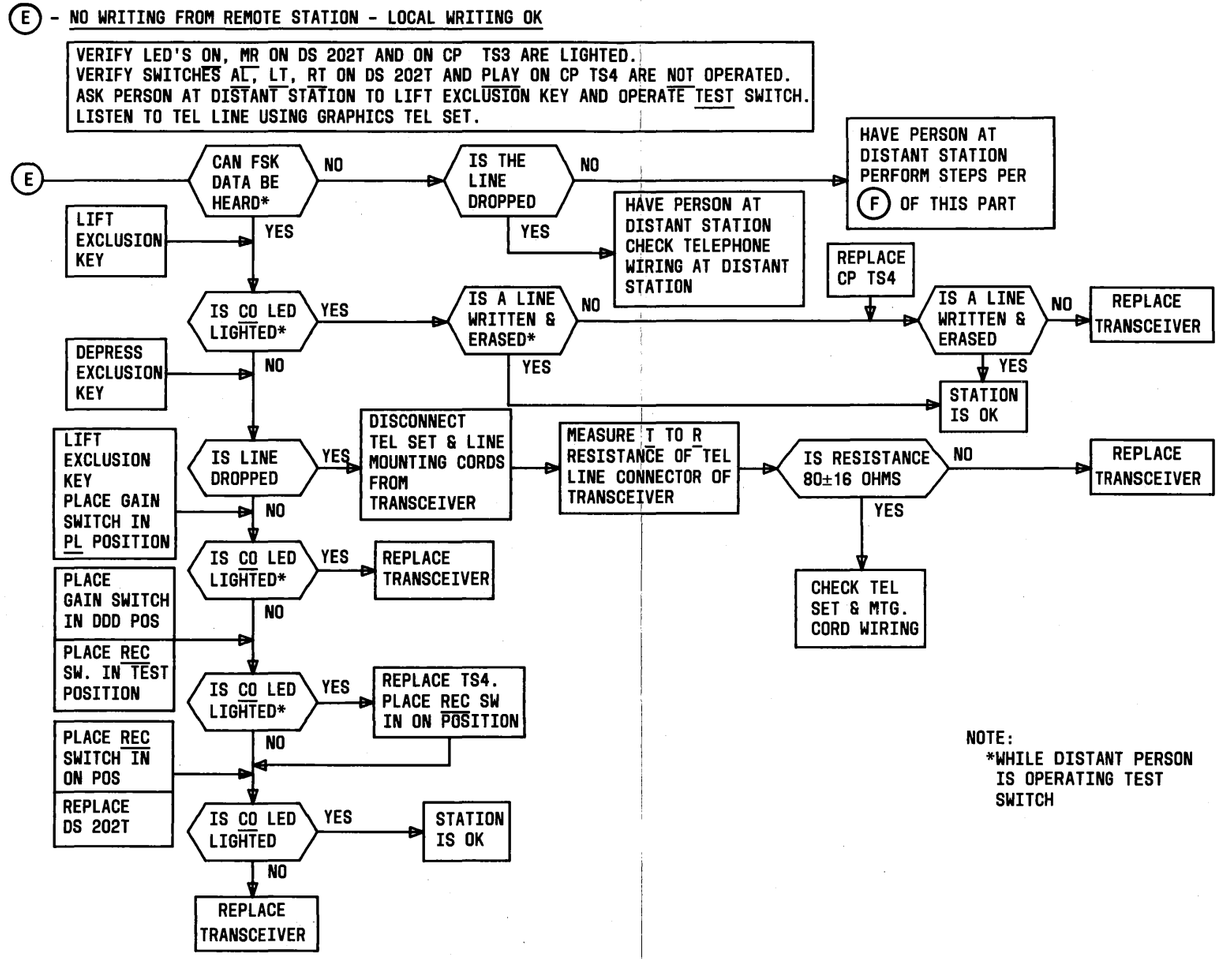


Fig. 66—Troubleshooting—Sheet 4

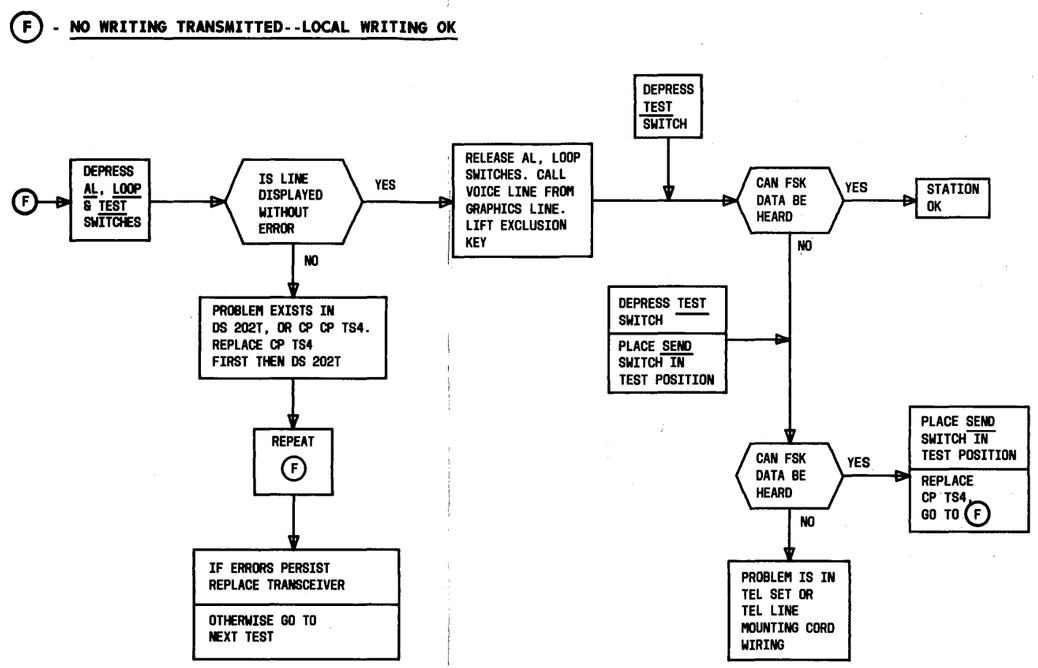


Fig. 67—Troubleshooting—Sheet 5

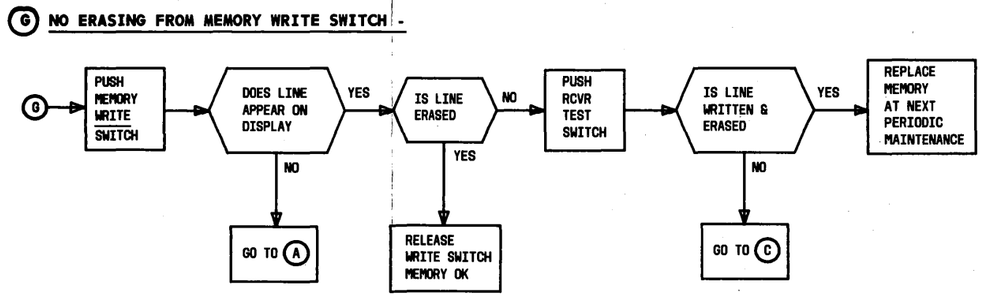


Fig. 68—Troubleshooting—Sheet 6

Fig. 67 and 68

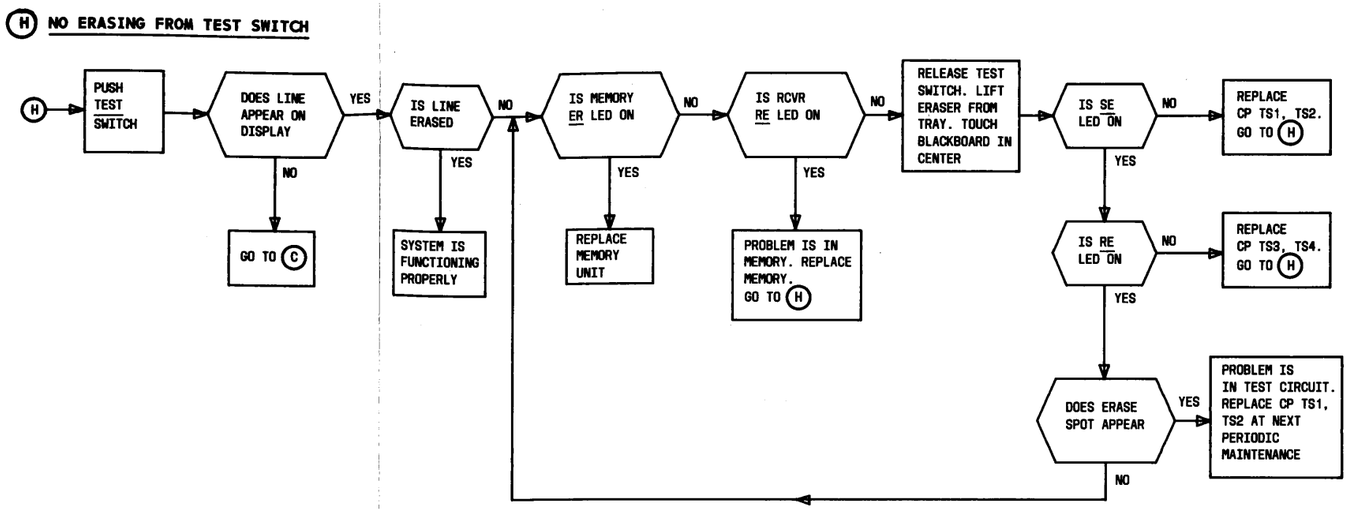


Fig. 69—Troubleshooting—Sheet 7

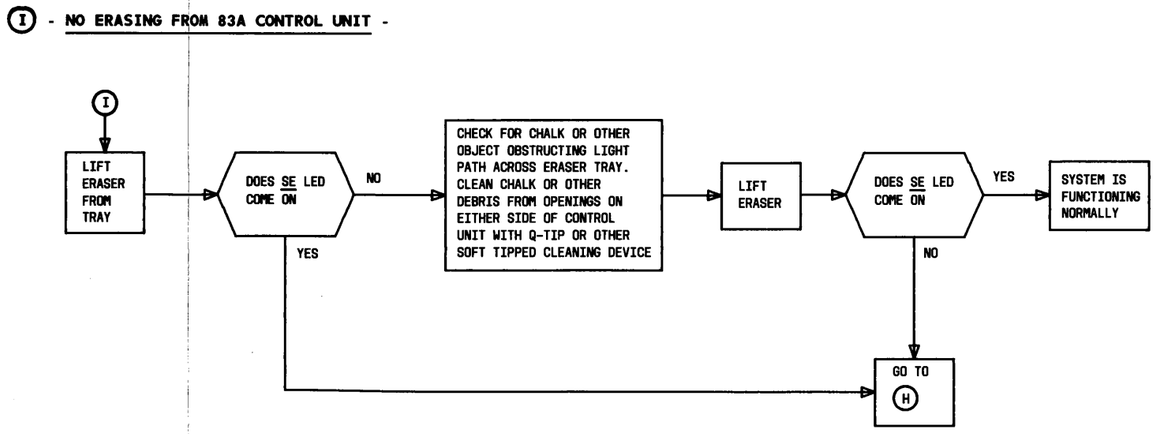


Fig. 70—Troubleshooting—Sheet 8

Fig. 69 and 70

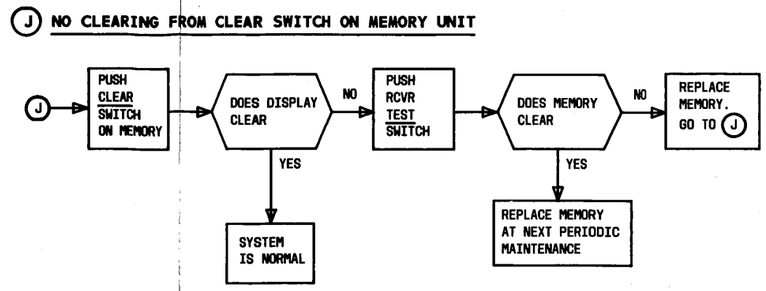


Fig. 71—Troubleshooting—Sheet 9

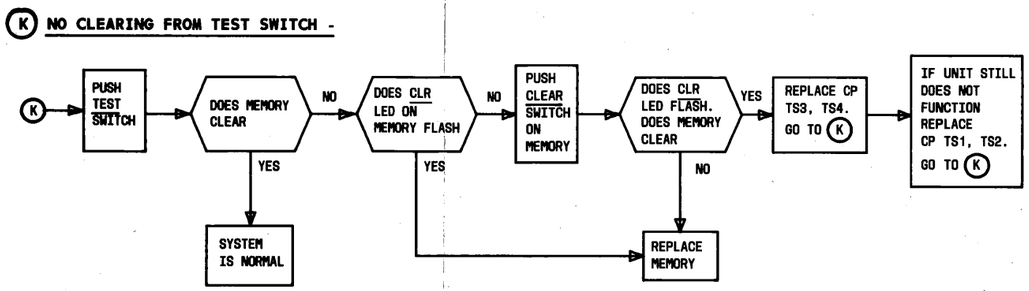


Fig. 72—Troubleshooting—Sheet 10

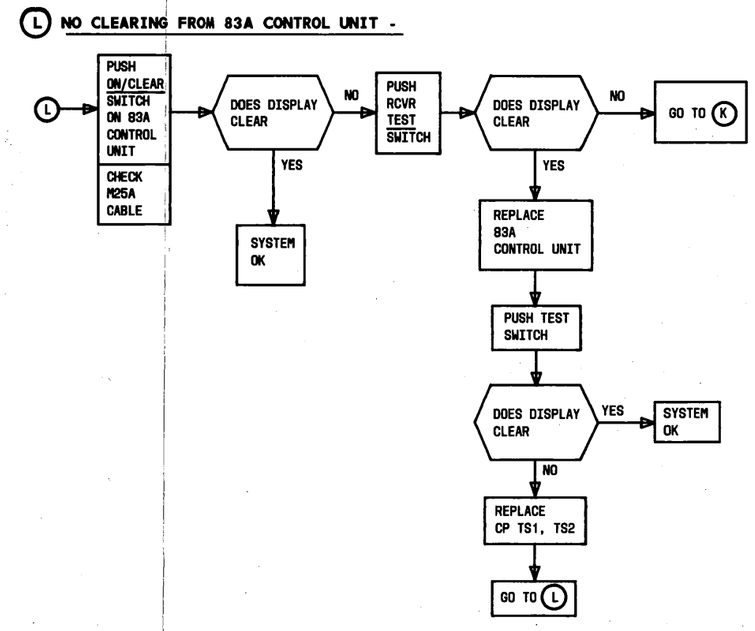


Fig. 73—Troubleshooting—Sheet 11

Fig. 71, 72 and 73

10. KS-21889-L1 MEMORY UNIT ALIGNMENT PROCEDURES

GENERAL

10.01 These procedures are provided for realignment of the memory unit when testing indicates that picture quality is not acceptable because of the memory unit. No special test equipment is required in performing these procedures. Adjust video monitor and memory BRIGHT controls first to solve customer complaints. Do not change any memory adjustments except as specifically mentioned in this part.

10.02 Before proceeding to make any adjustments, make sure that all cables are properly connected and ac power is applied to all units, per paragraphs 5.53 and 6.02. Operate remote turnon test switch to TEST position. ***After alignment procedure return remote turnon test switch to NORMAL. ◆Failure to do so will cause premature failure of the memory unit.◆***

PRELIMINARY PROCEDURES

10.03 Remove BNC connector from VIDEO OUTPUT jack of memory unit (Fig. 4). Remove front cover, then reconnect BNC connector to VIDEO OUTPUT. Turn video monitor power switch to ON (Fig. 44).

> ***Note:*** For receive-only installations the complete alignment procedure can only be performed if a remote location can send graphics, or if a test tape (with graphics as shown in Fig. 53) and a tape recorder are available.

BLURRY VIDEO MONITOR DISPLAY

10.04 Depress VIDEO test switch on memory unit (Fig. 74). Adjust FOCUS control on video monitor (Fig. 44) so that displayed image is as sharp and clear as possible. Release VIDEO test switch. Adjust BRIGHT control on monitor so that raster lines are just visible.

10.05 Trace the perimeter of the blackboard and draw other graphics as shown in Fig. 53. Adjust R36 (Fig. 74) to improve sharpness of display in corners as well as the center. Retrace the perimeter of the blackboard to check if the edges are still visible on the monitor as R36 can affect display size.

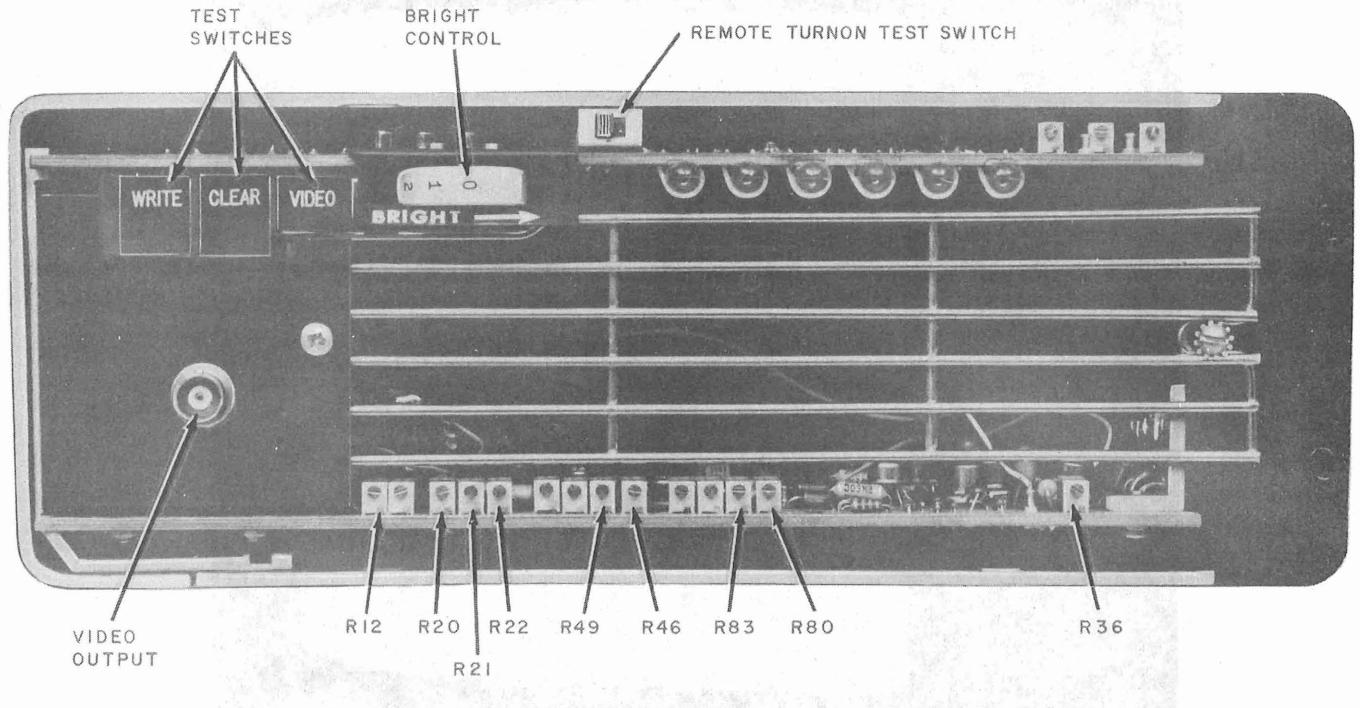


Fig. 74—KS-21889-L1 Memory Unit Adjustments

WRITING NOT VISIBLE AT RIGHT OR LEFT EDGE OF BLACKBOARD

10.06 Check to see if all edges of the display can be seen on the monitor. Adjust BRIGHT control on monitor until raster lines are just visible, then adjust H. HOLD, WIDTH, and HEIGHT controls, if necessary, until edges of display are visible. If edges of display cannot be adjusted into view with horizontal hold and width controls, adjust R12 on memory unit (Fig. 74) one turn clockwise and readjust H. HOLD and WIDTH controls on video monitor (Fig. 44).

10.07 An example of writing not visible at the edges is shown in Fig. 49. To rectify this condition, depress VIDEO switch on memory unit and turn R12 clockwise (Fig. 74) until black level is visible on monitor (Fig. 75). Release VIDEO test switch.

10.08 Draw vertical lines at the left and right edges of the blackboard. If the lines on the blackboard are not visible on the display, turn R80 (Fig. 74) one turn counterclockwise and redraw the lines. Repeat this procedure until both lines are visible.

10.09 After both lines become visible, adjust R83 until the lines are equidistant from their respective edges of the raster. A clockwise rotation of R83 will move the lines to the right; a counterclockwise rotation of R83 will move the lines to the left. Redraw the lines after each adjustment to determine the effect of each adjustment. Clear the display by depressing the CLEAR test switch on the memory unit.

10.10 Adjust R80 (Fig. 74) clockwise until the two vertical lines appear about one-half inch from the edge of the raster (on 23-inch monitor). Redraw the lines on the blackboard after each adjustment to determine effects of the adjustment. Proceed to paragraph 10.11 to readjust the black level to proper level.

BLACK LEVEL EXCESSIVELY HIGH

10.11 Depress VIDEO test switch on memory unit (Fig. 74). If the blanked area at the left of the raster appears much blacker than the right section of the raster (Fig. 75), rotate R12 counterclockwise until the unblanked right portion of the raster is just slightly brighter than the left blanked portion of the raster (Fig. 76).

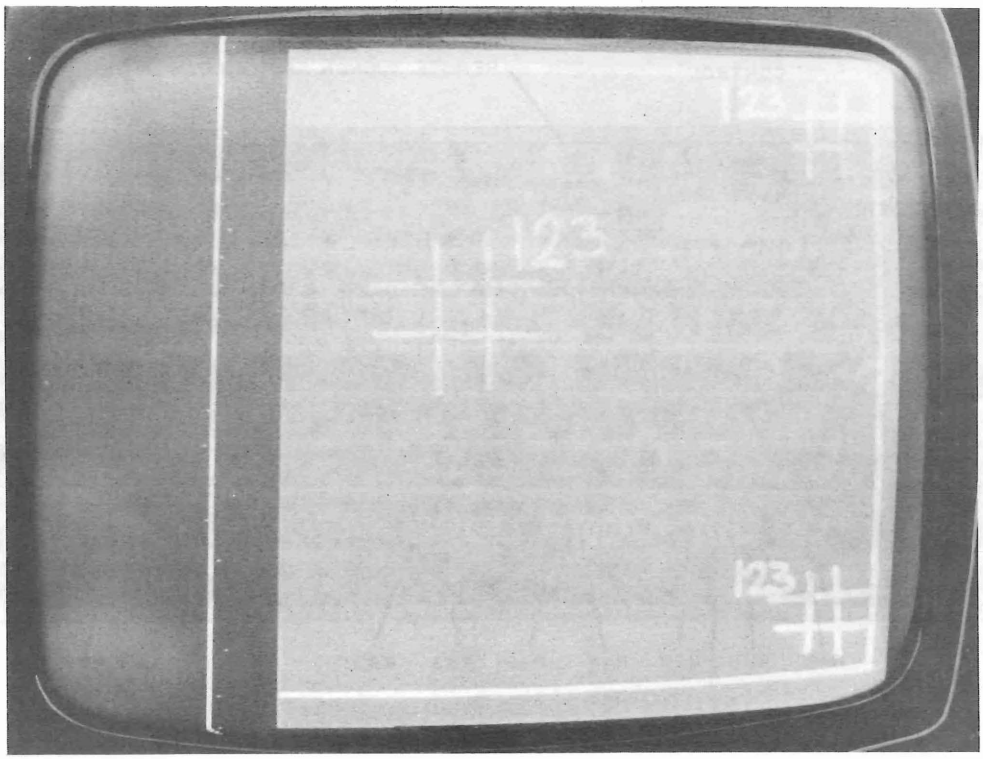


Fig. 75—Black Level Visible on Video Monitor

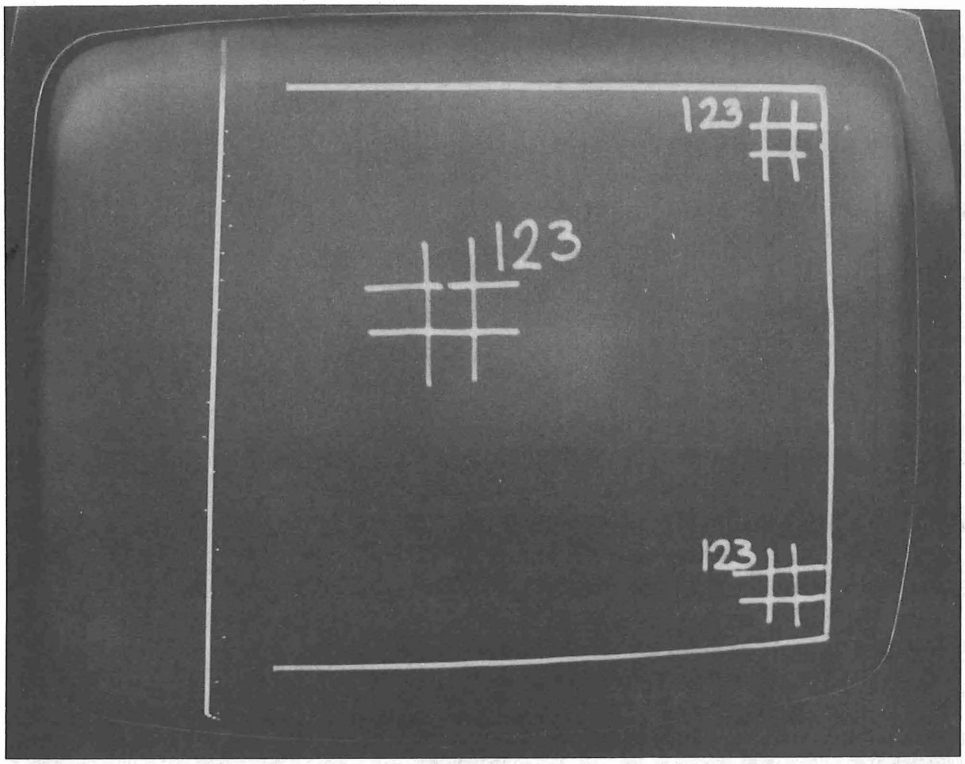


Fig. 76—Black Level Adjusted Correctly

VIDEO LEVEL TOO LOW

10.12 Set BRIGHT control on memory unit (Fig. 74) to "0". Depress WRITE test switch to draw a vertical test line. Compare the WRITE test line to the VIDEO test line. If the WRITE test line is not as bright as the VIDEO test line, depress and hold VIDEO and WRITE switches, and while holding both switches, adjust BRIGHT control until the two vertical lines appear equally bright.

10.13 If the BRIGHT control has insufficient range to make the two vertical test lines equally bright, clear the display by depressing the CLEAR test switch on the memory unit. Set the BRIGHT control back to "0". Draw a spot at the center of the blackboard. Carefully trace over the spot four or five times. This will produce a saturated spot. Depress VIDEO test switch to produce a vertical VIDEO test line. The spot should appear noticeably brighter than the video test line (Fig. 77). If the spot is not brighter than the test line, adjust R22 (Fig. 74) until the spot appears brighter. The black level may require readjustment after this adjustment. If so, repeat paragraph 10.11.

10.14 Depress CLEAR test switch on memory unit (Fig. 74). Rapidly draw four lines on the blackboard as shown on the display in Fig. 77. (The arrows show the direction in which the lines were drawn.) If one of the four lines is significantly less bright than the other lines, replace the memory unit.

10.15 Depress VIDEO test switch on the memory unit (Fig. 74) to produce a video test line. If all of the four lines drawn in paragraph 10.14 appear dimmer than the video test line (Fig. 78), adjust R21 (Fig. 74) one-half turn clockwise. Depress CLEAR test switch to clear the memory. Again draw four test lines as in paragraph 10.14. Depress VIDEO switch on memory unit to produce video test line. Compare brightness of the four lines to the VIDEO test line. If the four written test lines are less bright than the VIDEO test line, repeat adjustment of R21. If brightness of test lines cannot be increased sufficiently with R21, replace the memory unit.

WRITING AT TOP OR BOTTOM OF BOARD NOT VISIBLE

10.16 Check to see if all edges of the display can be seen on the monitor. Adjust BRIGHT control on monitor until raster lines are just visible, then

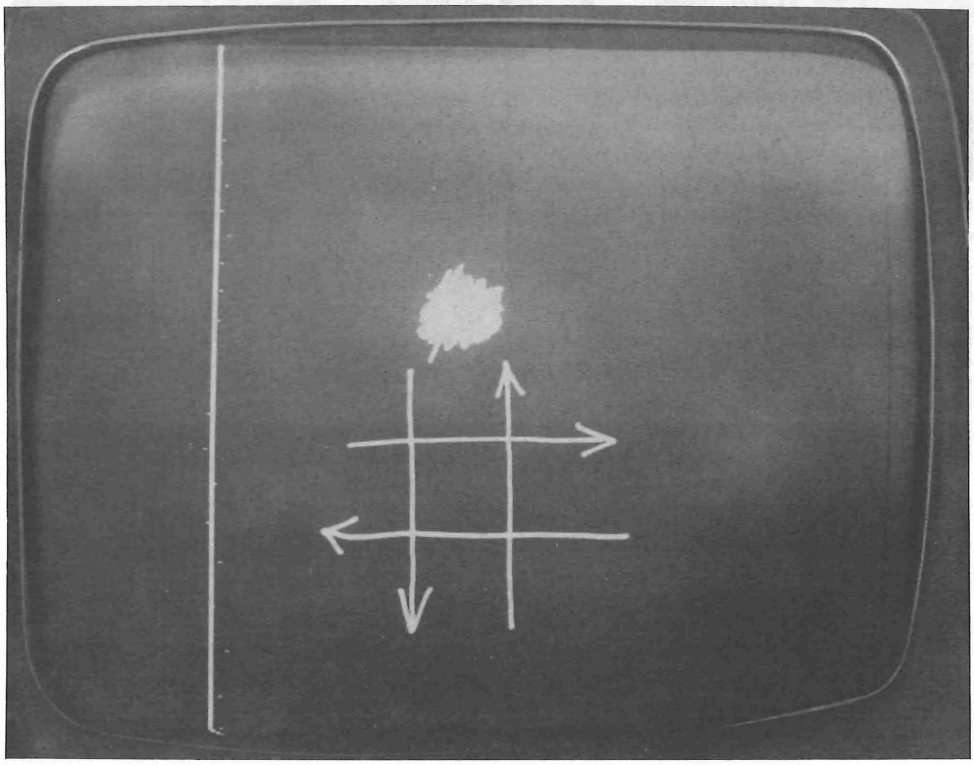


Fig. 77—Test Spot and VIDEO Test Line on Video Monitor

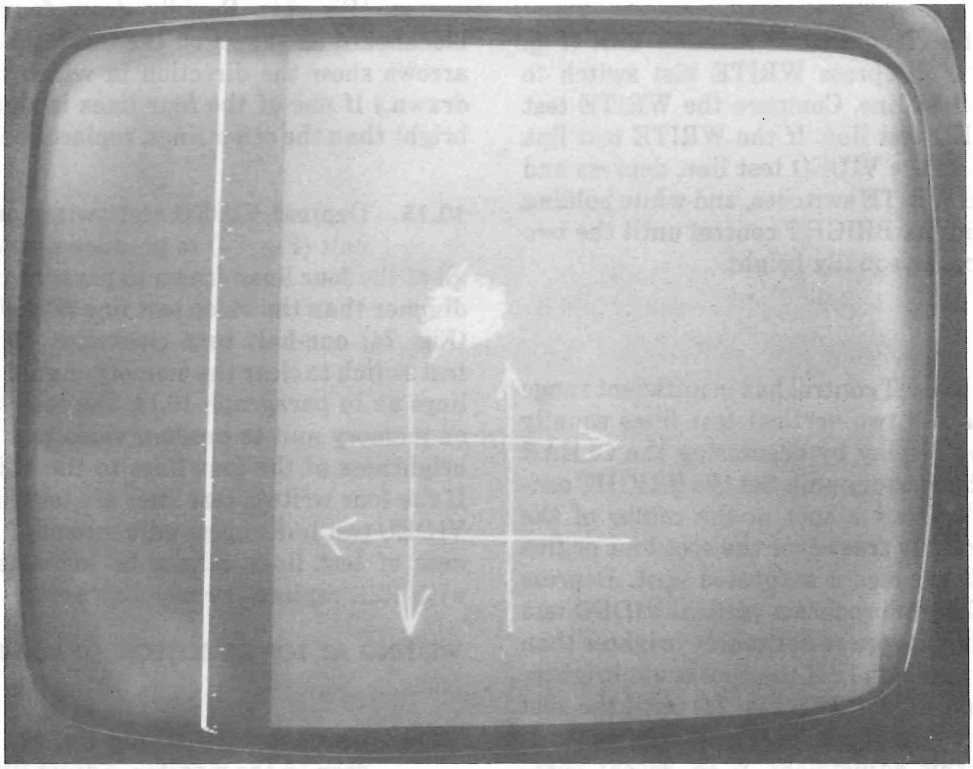


Fig. 78—Dim Test Lines on Video Monitor

adjust H. HOLD, WIDTH, and HEIGHT controls, if necessary, until edges of display are visible. If edges of display cannot be adjusted into view with horizontal hold and width controls, adjust R12 on memory unit (Fig. 74) one turn clockwise and readjust H. HOLD and WIDTH controls on video monitor (Fig. 44).

10.17 Draw lines at the top and bottom edges of the blackboard. If the lines at the top and bottom edges are not visible on the display, depress CLEAR switch to clear display. Turn R46 one turn counterclockwise and redraw the lines. Repeat until both top and bottom lines are visible.

10.18 When both lines are visible, adjust R49 until the top and bottom lines are equidistant from their respective edges of the raster. A clockwise rotation of R49 will move the lines down; a counterclockwise rotation of R49 will move the lines up. The lines must be cleared and redrawn after each adjustment, to determine the effect of the adjustment. Depress CLEAR test switch on memory unit to clear display.

10.19 After the top and bottom lines have been centered, adjust R46 clockwise until the two lines appear about one-half inch from the top and bottom of the raster (on a 23-inch video monitor). The lines must be cleared and redrawn after each adjustment to determine the effect of the adjustment.

IMPROPER ERASING

10.20 Depress WRITE test switch to draw and erase a vertical test line. If the line is not erasing completely, rotate R20 clockwise (Fig. 74) until erasure is complete. Adjust R20 just far enough to erase the line completely. Otherwise, the erase spot can affect nearby graphics information.

OTHER MEMORY PROBLEMS

10.21 Other problems not specifically mentioned may require that the memory unit be replaced. These might include problems such as: stored graphics information fades rapidly; unit does not completely clear stored graphics information; bright lines along edges of raster, or graphics that appear broken or splotchy. ***Verify that remote turnon test switch has been returned to NORMAL position prior to replacing front cover. Failure to do so will result in premature failure of the memory unit.***

11. GLOSSARY OF TERMS

TERM	MEANING
AL	Analog loop (test button)
Chalk Switched	Automatic switching which occurs in the transmitter-receiver circuitry to switch from receive mode to transmit mode when chalk (or any other object) touches the blackboard, provided incoming graphics is not present.
FF	Fan fail (LED)
Graphics	(1) Any material written on the blackboard for presentation on the local or remote video monitor, or such information in the circuitry, on the telephone line, or on the right channel of the tape recorder. (2) Symbols on the front cover of the transmitter-receiver and memory unit which are visible only when lighted from behind.
Infrared	Light of wavelength longer than the visible spectrum.
LED	Light-emitting diode
Lockout Circuitry	Circuitry which prohibits transmission of graphics while incoming graphics is being received.
LT	Local test (switch)
Raster	A predetermined pattern of scanning lines on a video monitor.
RT	Remote test (switch)
Transceiver	Marking applied to the transmitter-receiver or receiver.
Window	Small hole through which invisible infrared light passes in the control unit.
Ω	Greek letter ***omega,*** meaning ohms.

12. REFERENCES

12.01 The following publications provide additional information on the electronic blackboard and associated equipment.

SECTION	TITLE
502-501-120	Reference — 503CM-Type Telephone Set
502-503-120	Reference — 2503CM-Type Telephone Set
502-531-401	Reference — 502BM-Type Telephone Set
502-533-401	Reference—2502BM Telephone Set
512-630-111	50A1 Conference Set
590-101-103	97A-Type Connecting Block
590-106-100	330-Type Adapter—Description, Installation, and Tests
592-031-200	Data Set 202T Transmitter-Receiver — Installation and Connections