

ENGINEERING SPECIFICATION FOR THE
6591 DISPLAY TERMINAL AND 56C607
TERMINAL CONTROLLER

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 ** Indicates and addition

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ENGINEERING SPECIFICATION FOR THE
6591 DISPLAY TERMINAL AND 56C607
TERMINAL CONTROLLER

SECTION I

GENERAL DESCRIPTION

1. FUNCTIONAL INFORMATION

1.1 The 6591 Display Terminal is a 3270-compatible workstation which is optimized for low cost, yet provides a highly ergonomic display. The 6591 is very similar in features and functions to the IBM 3191 display terminal. This specification describes the hardware and firmware capabilities of this terminal.

1.2 Features of the 6591 Display Terminal

1.2.1 Display Controller Features

- 8X305 Microcontroller (8MHz)
- 8031 Microcontroller (12MHz)
- VIP video controller
- 2KX24 prom
- 8K bytes static ram
- 16K bytes eprom
- 2K bytes eeprom

1.2.2 Display Features

- Display Format
 - 80 columns
 - 24 text lines
 - 1 (or 2) status lines
- Character Cell Matrix
 - 9x13 on all rows
- Attributes Supported in Hardware
 - Basic 8-bit synchronous field attributing
- Cursor Depiction
 - Block
 - Underscore
 - Blinking block
 - Blinking underscore

1.2.3 Monitors - refer to monitor specifications listed in section II, paragraph 1.

- 12" or 14" Monochrome
 - Green
 - Amber

1.2.4 Keyboards - refer to 122 key keyboard specification listed in section II, paragraph 1.

- 122-key
- 102-key

NOTE: Although AT&T does not presently have a 102-key keyboard, the 6591 firmware has been designed to support one if it becomes available. However, testing will be required.

1.2.5 Additional Features

- A local terminal option mode, called SETUP, is entered upon the depression and release of the SETUP key. This mode is used for volume adjustment, Mono/Dual case selection, Screen Saver, and other terminal options.

- Alarm volume and keyclick volume can be set independently. Both volume settings are stored in nonvolatile memory. Volume adjustments are made in the SETUP mode.

- The 6591 features a security system based on a password. The terminal can be 'locked' so that data can't be entered, modified, or viewed. The terminal is re-enabled after entry of a valid supervisor or user password.

- A Screen Saver option is available to preserve the phosphor on the screen while the terminal is not being used.

- The 6591 contains a 256 character font set that includes international and 'icon' symbols.

- The cursor can be displayed as an underline or as a reverse video block. Blink can be enabled for either cursor type.

- The brightness and contrast controls are easily accessible.

- Self-test diagnostics for the device controller are performed when power is turned on.

- Enhanced terminal diagnostics are displayed if any key is depressed when power is applied. This diagnostic test is similar in function to the AT&T 6528/29/38/39/79/80 test modes.

2. GENERAL TECHNICAL DESCRIPTION

2.1 PHYSICAL DATA

2.1.1 The 6591 is composed of three elements: a 56K460 122-key

keyboard, a 56C607 terminal controller, and a 53D410 monitor or a 53D210 monitor.

2.1.2 The keyboard footprint is 546mm x 203mm, and its weight is 5 lbs.

2.1.3 The terminal controller footprint is 260mm x 260mm, and its weight is 2.75 lbs. The monitor mounts to the top of the terminal controller housing. This combination is 390mm high and its weight is 28 pounds when the 14 inch monitor is used.

2.1.4 The keyboard attaches to the back of the terminal controller with a coiled cord nominally 2 meters in length. The terminal controller and monitor are connected with a cable 0.5 meters in length. The terminal controller attaches to the control unit through a coaxial cable using a BNC connector. AC power is supplied through a standard 2 meter line cord which plugs into the monitor.

2.2 ENVIRONMENTAL DATA

The 6591 Display Terminal tolerates storage temperatures in the range of -40 degrees to +65 degrees centigrade, with relative humidity of 5% to 95% (non-condensing). It operates reliably within the temperature range +4.5 to +40 degrees centigrade at a relative humidity of 5% to 80% (non-condensing). The 6591 operates reliably from sea level to 10,000 feet. The 6591 may be stored reliably from sea level to 50,000 feet.

2.3 ELECTRICAL REQUIREMENTS

The 6591 Display Terminal is available with two power source configurations:

- a. 115VAC (90-132VAC), 47-63Hz, 1.0 amp max.
- b. 230VAC (180-264VAC), 47-63Hz, .55 amp max

The power supply is contained in the monitor and supplies power for the monitor, the terminal controller, and the keyboard. For further details, refer to the monitor specification listed in section II, paragraph 1.

2.4 STANDARDS

2.4.1 In addition to complying with North American safety and EMI requirements, the terminal is in compliance with European safety and EMI requirements.

Organization	Standard
UL	478
CSA	22.2 No. 154
EMI FCC	Part 15 subpart J Class A
IEC	380 (DIN IEC 380/VDE 0806)
IEC	435 (DIN IEC 435/VDE 0805)
EMI DBP	Vfg. 523/1969 (VDE 0871 Class A)
C.I.S.P.R.	22

IEC: International Electrotechnical Commission
DIN: West German Standards Institute
VDE: West German Assoc. of Electrical Engineers
DBP: West German Post Office
C.I.S.P.R.: International Special Committee on Radio Interference

2.4.1.1 All operator accessible circuits are in compliance with the requirements for Safety Extra Low Voltage (SELV) as set forth in IEC 380 and IEC 435.

2.4.1.2 Protection against electric shock relies on protective (earth) grounding.

2.4.1.3 The shield connection on the BNC coaxial connector is not directly connected to protective (earth) ground within the terminal controller. This reduces ground loop noise currents.

2.5 RELIABILITY INFORMATION

2.5.1 In the following specification of reliability, the values stated are statistical by nature. Therefore, field data must always be associated with sample sizes to establish their significance

2.5.2 DEFINITIONS

2.5.2.1 FAILURE - A failure is a malfunction of a unit which requires the service of maintenance personnel. Failures which result from abuse, abnormal shipping procedures, improper repair, maintenance or installation are not included in these rates.

2.5.2.2 INITIAL OPERABILITY/INSTALLABILITY - (I.O.) (%) A device shall be considered initially operable if it contains no defects

which prevent installation and if, after unpacking, operation is established and maintained during the time required to check out the unit. This time shall normally not exceed 2 hours.

2.5.2.3 MEAN TIME BETWEEN FAILURES - (MTBF) (HOURS/FAILURE). The MTBF defines the expected (average) power on, operating time between failures of the product. This failure rate is derived from the failure rates of the individual components which together make up the display terminal and from the expected (average) application of these components. Expected display terminal applications are for a single power (on/off) cycle per working day and average keyboard operations as described in specification 62835S.

2.5.2.4 Values

Component	FIELD	
	I.O. (%)	MTBF (hrs/fail)
Display Controller:	99	200,000 HR/F
53D210/53D410 Monitor:	98	54,000 HR/F
56K460 Keyboard:	98	144,000 HR/F
6591 Display Terminal:	95	32,800 HR/F

SECTION II

DETAILED DESCRIPTION

1. ASSOCIATED DOCUMENTS

1.1 62835S is the engineering specification for the 56K460 keyboard.

1.2 9722S is the specification for the 53D410 monitor.

1.3 9702S is the specification for the 53D210 monitor.

1.4 9744S is the specification for the VIP integrated circuit

1.5 4216SD is the terminal controller schematic diagram package.

1.6 410216 is the terminal controller logic card assembly drawing.

1.7 WDP0738 is the wiring diagram package for 56C607.

1.8 PDL0274 is the 8X305 program description/listing for the 56C607

1.9 PDL0273 is the 8031 program description/listing for the 56C607.

1.10 IBM 3274, 3276 control unit to device product attachment information, October 1977 including Addenda 1-7 updated June 1, 1983, includes information on coax line protocol.

1.11 Print for part number 352305 contains information on the 8X305 microcontroller.

1.12 Print for part number 352051 contains information on the 8031 microcomputer.

1.13 Prints for part numbers 352340 & 352341 contains information on the DP8340 serial bi-phase transmitter and the DP8341 serial bi-phase receiver.

1.14 Print for part number 352817 contains information on the 2Kx8 EEPROM.

2. GENERAL

2.1 The 6591 display terminal is 'plug-compatible' with the IBM 3191 display terminal. When connected to an IBM 3274 Control

Unit, IBM 3174 Control Unit or 3276 Control Unit display station, the 6591 will have the same capabilities as an IBM 3191 Display Terminal. The 6591 screen presentation and response to the Control Unit will be similar to the 3191.

2.2 The 6591 utilizes the IBM Control Unit to Device (CUT) protocol as the logical Control Unit interface. The 6591 attaches to the Control Unit via an RG62AU Coaxial Cable, cable eliminator, or multiplexor that terminates with a BNC connector at the terminal. The firmware that controls terminal operation is resident within the terminal and is NOT downloaded.

2.3 When the 6591 is attached to an AT&T 6500 Communications Controller, the terminal can, potentially, acquire an enhanced set of features via appropriate Communications' Controller software. The terminal will display 3270-type characters and basic field attributes in a 24 line by 80 character format. In addition, two status lines are available.

2.4 The 56C607 terminal controller consists of the 410216 logic card assembly and the associated housing. This makes up the base of the 6591 Display Terminal.

2.5 The 56C607 terminal controller has 3 connectors which are labeled on its back panel (see Figure V-1). The 25-pin male D subminiature connector for the monitor is labeled "1" or "VIDEO". The BNC connector for the coax link to the control unit is labeled "2". The 6-pin modular connector for the keyboard is labeled "3". Refer to 4216SD for connector pin assignments.

3. ARCHITECTURAL DESCRIPTION

3.1 The 410216 logic card assembly contains the microcontroller, video controller, coax interface, a processor-based keyboard interface, memory, and miscellaneous logic. The video dot rate is 21.6675MHz. The video character rate is 2.4075MHz.

3.2 The 410216 consists of a dual-processor architecture - An 8X305 microcontroller and a 8031 microcontroller. The 8X305 handles the coax line interface and memory interface, while the 8031 processor handles the keyboard, non-volatile memory and miscellaneous I/O.

3.3 8X305 INTERFACE DESCRIPTION

3.3.1 The 8X305 microcontroller has a harvard bus architecture; i.e., separate instruction bus and data bus. The processor is capable of fetching, decoding, and executing an instruction in a single cycle time. On the 410216 logic card, the 8X305 operates at 8MHz (250ns cycle time).

3.3.2 The 8X305 contains 16 8-bit registers, a 13-bit instruction address bus, a 16-bit instruction bus, an 8-bit bidirectional multiplexed I/O data/address bus and a 5-bit I/O control bus. Internal logic for rotate, mask, shift, merge, and alu operations is provided.

3.3.3 The 8-bit I/O data/address bus and the 5-bit I/O control bus provide the means for the 8X305 to communicate to external memory and I/O devices. Extended microcoding is used for I/O address selection and read/write strobe generation.

3.4 8X305 MEMORY RESOURCES

3.4.1 The 8X305 instruction store consists of two 2K byte bipolar PROMs. A third PROM is used for 'extended microcode'. The PROMs are wired in parallel.

3.4.2 The 6591 supports 8K of static RAM which is used for display buffer memory and variable storage. The Video Interface Processor (VIP) chip has sole access to the ram address bus, data bus and control signals. All processor accesses to ram and memory-mapped I/O locations go through VIP. This ram is located in the address range 0000H-1FF0H.

3.4.3 A single 256 character font set is internal to VIP. This character set consists of the normal character symbols and the 'icon' symbols. The character codes with bits six and seven set are interpreted as field attributes in the first 24 text lines and displayed as blanks. On the status line(s), these codes address the internal font in VIP and are displayed. The icon symbols occupy these code points.

3.5 8X305 I/O RESOURCES

3.5.1 To provide I/O selection, a technique called 'extended microcode' is used. A third PROM is wired in parallel with the two PROMs required for 8X305 instructions. This PROM is used to select I/O devices. One extended microcode 'address' is then available for every instruction. The 'address' programmed into the extended microcode PROM selects I/O ports according to the following table:

PROM code (binary) -----	Input Port Selected -----	Output Port Selected -----
xxxxlxxx	NONE	NONE
xxxx0000	UNUSED	MEMHI
xxxx0001	UNUSED	MEMLO
xxxx0010	MEMRD	MEMWR
xxxx0011	UNUSED	UNUSED
xxxx0100	RXLO	TXLO

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xxxx0101	RXHI	TXHI
xxxx0110	MISCFLGS	UNUSED
xxxx0111	8031RD	8031WR

Note: "x" may be zero or one.

Input ports are differentiated from output ports by the microcontroller's "SC" and "WC" outputs. Normally, SC active (high) means an address is being output on the IV bus, while WC active (high) means data is being output on the IV bus. Either SC or WC must be high for an output port to be enabled. Both SC and WC must be low for an input port to be enabled. The 410216 logic card assembly or's these two signals together to create a read/write signal (PR). The Right Bank Control (RB-) signal is used to further qualify I/O operations. A read (or input) strobe is generated when RB- is active, PR is active, and a valid extended microcode address is decoded. A write (or output) strobe is generated when MCLK is high, PR is inactive, and a valid extended microcode address is decoded. Because of the way I/O ports are enabled, an 8X305 "IV-bus to IV-bus" instruction should never be done.

3.5.2 If extended microcode PROM bit 3 is a one, no input/output ports will be enabled.

3.6 8X305 INPUT PORTS

3.6.1 MEMRD (02H) This strobe enables character ram data onto the IV bus. The data read by the 8X305 is inverted from the data on the IV bus.

3.6.2 RXLO (04H) The RXLO read strobe enables the low byte (RXD2-RXD9) of receiver data onto the IV bus. RXD2 is the most significant bit, and RXD9 is the least significant. When OUTCNTRL is set to zero, error codes of the receiver are read mapped as follows:

- Bit 7 Data overflow
- Bit 6 Parity error (odd parity detected)
- Bit 5 Transmit Check (error on any of RXD3, RXD5, or RXD6)
- Bit 4 Invalid ending sequence
- Bit 3 Loss of mid-bit transition
- Bit 2 New starting sequence detected before data byte in holding register has been read.
- Bit 1 Receiver disabled during receiver active mode

This data (data or status) is NOT inverted upon input.

3.6.3 RXHI (05H) The RXHI read strobe enables the high bits of the receiver data (RXD10 and RXD11) and various other status bits onto the IV bus as follows:

- Bit 7 VIPINT- Status of VIP's interrupt line
- Bit 6 TXACT Transmitter Active

Bit 5	TXFULL	Transmitter Full
Bit 4	RXACT	Receiver Active
Bit 3	RXDATAV	Receiver Data Available
Bit 2	RXERROR	Receiver Error
Bit 1	RXD10	Receiver data bit 10
Bit 0	RXD11	Receiver data bit 11

This data is inverted upon input.

3.6.4 MISCFLGS (06H) This port address contains miscellaneous flags and status information in the lower order 4 bit positions as follows: (low or high refers to the state of the bits at the register)

Bit 3	HIRES-	When low, causes the supervisor and user passwords to be cleared.
Bit 2	KEYLOCK-	When low, indicates keylock is active
Bit 1	RD8X	When high, indicates that 8031 should read data from the 8x305 dual-processor interface latch. This bit is set when the 8x305 writes to port 8031WR, and reset when the 8031 reads from port DPRD.
Bit 0	DATAV	When high, indicates that 8031 data is available in the 8031 dual-processor interface latch. This bit is set when the 8031 writes to port DPWR, and reset when the 8x305 reads from port 8031RD.

This data is inverted upon input.

3.6.5 8031RD (07H) This read strobe enables the data which has been written to the dual-processor latch from the 8031 onto the IV bus of the 8X305, and also clears the DATAV bit. The data read by the 8X305 is inverted from the data on the IV bus.

3.7 8X305 OUTPUT PORTS

3.7.1 MEMHI (00H) The upper memory address is latched into VIP when this strobe is activated. The upper memory address consists of four bits, and is presented on the low-order bits of the IV bus (bit positions 3 through 0). This data is inverted upon output.

3.7.2 MEMLO (01H) The lower memory address is latched into VIP when this strobe is activated. The lower memory address consists of eight bits, and in conjunction with the upper memory address allows the access of the full 8K of VIP memory. Writing the lower address begins a read cycle in VIP. This data is inverted upon output.

3.7.3 MEMWR (02H) This strobe latches data to be written to VIP

ram and begins a write cycle. The normal write sequence is to latch the upper address, latch the lower address, do a MEMWR, and then wait at least 4 processor cycle times to complete the write before changing the address. The write data is inverted upon output, but will be re-inverted upon input; therefore, what is written will be what is read back.

3.7.4 TXLO (04H) This strobe latches the low-order byte (TXD2-TXD9) of the data to be transmitted over the coax. TXD2 is the most significant bit while TXD9 is the least significant bit. This data is inverted upon output.

3.7.5 TXHI (05H) The following bits are described in their latched sense, the bits are inverted from the 8x305; i.e., to write a one to OUTCNTRL, the corresponding 8x305 data bit must be zero.

Bit 5	OUTCNTRL	Selects data read when RXLO is accessed. When one receive data is selected, when zero error codes are selected.
Bit 4	LPBACK-	When this bit is low, the transmitter is looped back to the receiver. When this bit is high, the receiver is disabled when the transmitter is active.
Bit 3	PARITY	When high TXD10 is entered from TXHI register. When low TXD10 is generated by chip (odd parity over TXD2-TXD9).
Bit 2	TT/AR	When this bit is pulsed high, the transmitter generates an auto response (clean status). When low, transmit data is loaded from external registers.
Bit 1	TXD10	Transmit data bit 10.
Bit 0	TXD11	Transmit data bit 11.

3.7.6 8031WR (07H) A write to this port address causes three actions: 1) Data from the 8x305 is latched, 2) Bit RD8X is set, and 3) an interrupt to the 8031 is generated. The data from the 8x305 is inverted upon output.

3.8 8X305 MEMORY-MAPPED I/O

3.8.1 The uppermost sixteen locations in VIP ram are reserved for memory-mapped I/O as follows:

address	name	*type
-----	-----	-----
1FFF	UNUSED	
1FFE	"	
1FFD	"	
1FFC	"	
1FFB	"	
1FFA	INTSTAT	R

1FF9	MONOCASE	W
1FF8	VIDCON	W
1FF7	CRSRHI	W
1FF6	CRSRLO	W
1FF5	TIMCNT	W
1FF4	COMCLR	Wx
1FF3	KBDCOM	Wx
1FF2	KBDEN	Wx
1FF1	KBDHI	Rx
1FF0	KBDLO	Rx

* R- READ ONLY

x Not Used on 410216

W- WRITE ONLY

The following is an in-depth description of these memory-mapped I/O locations. The memory-mapped I/O data is inverted upon writing and inverted upon reading. In the following description, the values or logic levels refer to the values or logic levels as seen by the VIP chip. The memory-mapped I/O registers are contained within VIP and are defined as follows:

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										1FFFH	
										1FFEH	
RESERVED										1FFDH	
										1FFCH	
										1FFBH	
INTSTAT							CMD	KBD	TMR	1FFAH	R
MONOCASE									MON	1FF9H	W
VIDCON		TEN	RSC	AIN	DIN	CIN	BLK	BNK		1FF8H	W
CRSRHI					A11	A10	A9	A8		1FF7H	W
CRSRLO	A7	A6	A5	A4	A3	A2	A1	A0		1FF6H	W
TIMCNT								EN		1FF5H	W
COMCLR										1FF4H	W
KBDCOM			B5	B4	B3	B2	B1	B0		1FF3H	W
KBDEN								EN		1FF2H	W
KBDHI	ST	D14	D13	D12	D11	D10	D9	D8		1FF1H	R
KBDLO	D7	D6	D5	D4	D3	D2	D1	D0		1FF0H	R

R - READ ONLY
 W - WRITE ONLY

3.8.1.1 TIMCNT (Write-Only) 1FF5H

3.8.1.1.1 A write to this register with D0 set clears bit TMR in INTSTAT and causes the internal timer in VIP to be reset and enabled. An interrupt will be generated after two vertical sync intervals once the timer has been enabled. Upon interrupt, bit TMR in INTSTAT will be set. Rewriting this register after every interrupt will maintain a 30 Hz interrupt rate. Writing a zero to this register causes bit TMR in INTSTAT to be reset and the timer to be disabled.

3.8.1.2 MONOCASE (Write-Only) 1FF9H

3.8.1.2.1 A write to this location with D0 set to zero causes both cases to be displayed, while a write to this range with D0 set to a one causes all lower-case characters to be displayed in upper case(mono case mode).

3.8.1.3 CRSRHI, CRSRLO (Write-Only) 1FF6H-1FF7H

3.8.1.3.1 A cursor is displayed in the character cell corresponding to the address stored in these locations. CRSRHI contains the high-order address bits (4), while CRSRLO contains the low order address bits (8).

3.8.1.4 INTSTAT (Read-Only) 1FFAH

3.8.1.4.1 This location can be read to determine the source of the interrupts internal to VIP. A pending interrupt is indicated by one or more of these bits being set. The three bits are defined as follows:

TMR	Timer Status	- Bit 0
KBD	Keyboard Status	- Bit 1
CMD	Command Status	- Bit 2

3.8.1.5 VIDCON (Write-Only) 1FF8H

3.8.1.5.1 This 6-bit register controls the video controller related functions within VIP. The bits are defined as follows:

Bit 0 - Blink control. When this bit is set, the cursor blinks at 1.875 Hz. The cursor is steady if it is reset.

Bit 1 - Block Cursor. When this bit is set, the cursor is displayed as a reverse video image of the associated character cell. When this bit is cleared, the last scan line of the character cell is reversed.

Bit 2 - Cursor Inhibit. When this bit is set, the cursor is not displayed. When the bit is cleared, the cursor is displayed.

Bit 3 - Display Inhibit. When this bit is set, the display screen, except for the status lines and the cursor, will be blanked. The display is normal if this bit is cleared.

Bit 4 - All Display Inhibit. When this bit is set, the display screen, including the status lines, will be blanked. The cursor is not affected by this bit. When this bit is cleared, the display is normal.

Bit 5 - Ram Section Bit. When this bit is set, the start address of the display buffer will be 4176. The display buffer starts at 80 when this bit is cleared.

Bit 6 - Test Enable Bit. When this bit is set, the on-chip test circuitry is enabled. *NOTE* This bit should never be set in normal operation.

3.9 8031 INTERFACE DESCRIPTION

3.9.1 The 410216 logic card assembly can be optioned to accept an 8031, an 8051 or an 8052 microcontroller. The 8031 is an 8-bit romless microcontroller with 128 bytes internal ram, 32 I/O lines, two 16-bit timer/counters, a full duplex UART, and 5-source interrupt structure. The 8051 is the same as the 8031, except that it contains 4K bytes of internal rom. The 8052 is the same as the 8031 except that it contains 8K bytes of internal rom, an extra timer/counter, 256 bytes of internal ram, and six interrupt sources. As shipped, the 410216 is configured for the 8031.

3.10 8031 MEMORY RESOURCES

3.10.1 The 8031 has an external eeprom (16Kx8), data latches, and a 2Kx8 eeprom sharing the multiplexed address/data bus. Port 2 is used for the upper byte of the instruction address and is not multiplexed. Port 0 is multiplexed between the lower byte of the address and the 8-bit data bus. The lower byte of the address is latched externally.

3.10.2 8X305 to 8031 communications are handled as synchronous I/O operations. The data transfer is handled through a dual-port interface. Flag bits are used to indicate data available and transfer acknowledge. The registers involved are memory-mapped.

3.10.3 The 8031 performs program memory read cycles, internal data memory read/write cycles, and external data memory read/write cycles. During program memory cycles, the 16Kx8 eeprom is accessed occupying 0000H-3FFFH in the memory address space.

During external data memory cycles either the dual-processor interface or the 2Kx8 eeprom is accessed depending on the state of bit 11 in the address. There are 128 bytes of internal data memory mapped in the range 00H-7FH. In addition, the special function register (SFR) space is mapped in the address range 80H-FFH.

The decoding is as follows:

Internal Data Memory Access:			
0000H-007FH	RAM		READ/WRITE
0080H-00FFH	SFR		READ/WRITE
External Data Memory Access:			
0000H-07FFH	DPWR		WRITE
0000H-07FFH	DPRD		READ
0800H-1000H	2KX8 EEPROM		READ/WRITE
Program Memory Access:			
0000H-3FFFH	16KX8 EPROM		READ

3.10.4 The 128 internal ram data bytes are directly and indirectly addressable, whereas the SFR space is only directly addressable. The lowest 32 bytes (00H-1FH) are grouped into four banks of eight byte-wide registers (R0-R7). The next sixteen bytes are bit addressable (20F-2FH). Sixteen addresses in the SFR space are both byte and bit addressable. These are the addresses that end in 000B. The SFR is mapped as follows:

80H	PO	PORT 0
81H	SP	STACK POINTER
82H	DPL	DATA POINTER (LOW)
83H	DPH	DATA POINTER (HIGH)
87H	PCON	PORT CONTROL REGISTER
88H	TCON	TIMER CONTROL REGISTER
89H	TMOD	TIMER MODE REGISTER
8AH	TLO	TIMER 0 LOW BYTE
8BH	TL1	TIMER 1 LOW BYTE
8CH	TH0	TIMER 0 HIGH BYTE
8DH	TH1	TIMER 1 HIGH BYTE
90H	P1	PORT 1
98H	SCON	SERIAL CONTROL REGISTER
99H	SBUF	SERIAL DATA BUFFER
A0H	P2	PORT 2
A8H	IE	INTERRUPT ENABLE REGISTER
B0H	P3	PORT 3
B8H	IP	INSTRUCTION POINTER
D0H	PSW	PROCESSOR STATUS WORD
E0H	ACC	ACCUMULATOR
F0H	B	B-REGISTER

3.10.5 On the 410216 logic card assembly, port 0 serves as the multiplexed address/data bus (AD0-AD7), and port 2 serves as the high order address bus. Port 1 and port 3 are used for miscellaneous I/O and control signals. The input and output port signals are described below.

3.11 8031 INPUT/OUTPUT PORTS

3.11.1 REVERSE- (PORT 0, BIT 4) OUTPUT When this bit is set, the screen will be displayed normally. When this bit is reset, the screen will be displayed in reverse video.

3.11.2 KBSND (PORT 0, BIT 5) OUTPUT When this pin is pulsed high, the duration specifies the command to be generated by the keyboard. Refer to keyboard spec. for pulse widths.

3.11.3 BKBDATA (PORT 0, BIT 6) INPUT This is the buffered input data from the keyboard. This lead is sampled upon every interrupt from the keyboard clock lead.

3.11.4 KEYLOCK- (PORT 3, BIT 0) INPUT This pin is used to monitor the status of the keylock. If this signal is low, the keylock is active.

3.11.5 PASSWD- (PORT 3, BIT 1) INPUT This pin is used to determine if a keylock switch is available. If this pin is low, no keylock is available. If this signal is high, keylock is available.

3.11.6 BKBCLK (PORT 3, BIT 2) INPUT This signal is the buffered keyboard clock signal. This signal should be programmed to generate an interrupt on every high-to-low clock transition.

3.11.7 8031INT- (PORT 3, BIT 3) INPUT This signal being low indicates that data has been written from the 8x305 to the data latch. This pin can be programmed to interrupt on the high-to-low transition.

3.11.8 DATAV (PORT 3, BIT 4) INPUT This signal indicates that the 8031 has written data to its data latch and it has not been read. When the data has been read by the 8x305, this bit is reset.

3.11.9 VSYNC- (PORT 3, BIT 5) INPUT This pin is used to count vertical sync pulses for software timing purposes.

3.11.10 WR- (PORT 3, BIT 6) OUTPUT This signal denotes that an external data write cycle is in progress. It is used to strobe data into external data memory.

3.11.11 RD- (PORT 3, BIT 7) OUTPUT This signal denotes that an

external data read cycle is in progress. It is used to enable data from external data memory onto the data bus.

3.12 Programming Notes

3.12.1 For the 8X305 program to read the Character RAM, the memory low and memory high addresses must be written in inverted form. To read location 0, memlo should equal 11111111 binary and memhi should be 11111111 binary. After writing the address, four instruction times must occur before the memory read data (memrd) is valid. After memory writes (to memwr), the memory address must not be changed for four instruction times in order to write the RAM properly. During this time, the memory read data (memrdc) is also invalid. Therefore, four nop's must be performed after a memory write instruction to ensure proper writing. If a memory read is to be performed after a memory write, four nop's are required between the four instructions to ensure proper writing and reading.

3.12.2 The 8X305 memory data is inverted during reads and writes. This means that what is written is read back uninverted, but the video circuitry still sees the inverted codes. Table II-a shows how the memory codes are interpreted by the video circuitry. Figure II-1 detail the resident font.

3.12.3 The 8031 external data transfers (to 8X305) are done by writing to, or reading from, data latches that are memory mapped to address 0000. This is done by loading 0000 into the address pointer register(DPTR), before performing a Move External (MOVX) instruction.

4. COAX LINE PROTOCOL

4.1 The 6591 communicates with the Control Unit via the IBM CUT protocol. This protocol uses 12-bit words which are transmitted at 2.3587 Mbaud using dipulse serial encoding. Bits are numbered for reference from 1 to 12. The first bit (bit 1) is always a one. Bit 12 always maintains even parity over bits 1 through 12. The coax link is half-duplex, with the control unit the master. The device will never transmit spontaneously -- it only transmits in response to a control unit transmission.

4.2 A transmission between the Control Unit and device is composed of one or more consecutive words, called a word group, preceded by 5 'one' bits and a code violation, and followed by a 'zero' bit and two mini-code violations. A device, such as the 6591, will transmit a maximum of 4 words per group, or 32 words per group for a big read command. The control unit may transmit an indefinitely large number of words per group. Unless another response is specified by the command descriptions below, the

device responds to a word block with all zeroes in bits 2 through 11 (this is called TT/AR -- Transmission Turnaround / Auto Response).

4.3 The control unit sends "commands" and "data" to the device. The device responds with "status" and "data". The control unit commands understood by the 6591 are:

Bit Code	Hex. Code	C	Function
=====	=====	a	=====
11	11	i	
2345 6789 01	2-5 6-9 01	n	Commands
-----	-----	-	-----
1100 0001 x1	c 1 1	n	Enable Keyboard Click
1000 0001 x1	8 1 1	n	Sound Alarm
0100 0001 x1	4 1 1	n	Disable Keyboard Click
0000 0001 x1	0 1 1	n	Poll
0001 0001 x1	1 1 1	n	Poll/Acknowledge
0000 0011 x1	0 3 1	n	Read Data
0000 0101 x1	0 5 1	n	Read Address Counter High
0001 0101 x1	1 5 1	n	Read Address Counter Low
0000 1001 x1	0 9 1	n	Read Terminal I.D.
0000 1101 x1	0 d 1	n	Read Status
0000 1011 x1	0 b 1	n	Read Multiple
0000 0010 x1	0 2 1	y	Reset
0000 0110 x1	0 6 1	y	Clear
0000 1100 x1	0 c 1	y	Write Data
0000 1010 x1	0 a 1	y	Load Control Register
0000 0100 x1	0 4 1	y	Load Address Counter High
0001 0100 x1	1 4 1	y	Load Address Counter Low
0000 1110 x1	0 e 1	y	Insert Byte
0001 0000 x1	1 0 1	y	Search Forward
0001 0010 x1	1 2 1	y	Search Backward
0001 1010 x1	1 1 1	y	Load Secondary Control Register
0001 0110 x1	1 6 1	y	Load Mask

Note: "x" represents 0 or 1; the hexadecimal coding assumes 0.
 If the device will properly execute a command embedded in a word group, then the "Chain" column has a "y" in it.

4.4 The device can, depending on the control unit command, send status information in bits 2 through 11. Both the device and the control unit, can send data words. Bits 2 through 9 in a data word contain the data byte, with bit 2 being the data byte's most significant bit. Bit 10 is odd parity over bits 2 through 10. Bit 11 is always 0. This causes bit 12 (the even parity bit) to always be 1.

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4.5 In discussing what the control unit commands do, it is necessary to assume the terminal controller has the following architecture:

4.5.1 Storage:

This is a 2080 word display memory. It contains the characters and character attributes of the displayed screen. Locations 0-79 contain the status line, which is displayed at the bottom of the screen. On the 56C607, locations 2000-2079 contain the status line separator located just above the status line. The status line separator area should only be read and written on the 56C607 (i.e. no Searches, Clears or Insert Bytes). Location 80 is displayed in the upper left corner of the screen. Successive locations are displayed left-to-right and top-to-bottom until location 1999, which is displayed in the lower right corner of the screen. On the 56C607, location 2000 will always contain F1 hexadecimal, and the way to display a cursor on the status line is to change the address counter to 2080-2159.

4.5.2 Address Counter:

This register contains an address of a Storage location. It is used to point to the Storage data to be examined or changed. Also, this is where a cursor is displayed, if enabled.

4.5.3 Mask Register:

This is used in conjunction with Search and Clear commands. Ones in the Mask Register specify bit positions for which the Storage data bytes should be compared to the pattern byte specified in the Search or Clear command. The Mask Register is loaded with the Load Mask command.

4.6 Description of Commands:

4.6.1 Enable Keyboard Click,
Disable Keyboard Click,
Sound Alarm,
Poll:

Performs the operation (Poll has no associated operation). The device responds with a special status word called a Poll Response. The bits in the Poll Response have the following meanings:

4.6.1.1 Bit 11: (Feature Error)

If this bit is a one, all the other bits are undefined. This bit is set if the control unit sends a command with bits 2 through 5 equal to 0010 through 1111, with the exceptions of the Sound Alarm, Enable Keyboard Click, and Disable Keyboard Click commands.

4.6.1.2 Bit 10: (Keyboard Indicator)

If this bit is valid and set, bits 2 through 9 contain a special

code defined as follows:

Bits	Definition
2345 6789	-----
x000 0000	Keyboard error - overrun
0000 0010	Device was just powered on
all others	Keyboard scan code (see Fig. II-3 through II-12)

4.6.1.3 Bit 9: (Operation Complete)

If this bit is valid and set, it means that a Search Forward, Search Backward, Clear, or Insert Byte has been completed.

4.6.1.4 Bit 8,7: always zero

4.6.1.5 Bit 6: (Status Transition)

If this bit is valid and set, then bit 2, 5, or 9 of the Read Status command response has changed.

4.6.1.6 Bit 5,4,3,2: always zero

4.6.2 Poll/Acknowledge

The same Poll Response will be sent to the control unit in response to a Poll until the device receives a Poll/Acknowledge. The Poll Response after a Poll/Acknowledge will be whatever updated status is available.

4.6.3 Read Data:

Responds with the data word from Storage pointed to by the Address Counter. The Address Counter is then incremented.

4.6.4 Read Multiple:

Responds with the data word(s) from Storage pointed to by the Address Counter and increments the Address Counter. This is repeated until the Address Counter steps to a multiple of 4 or 32(see Load Secondary Control Register).

4.6.5 Read Address Counter Low:

Responds with a data word containing the lower eight bits of the Address Counter.

4.6.6 Read Address Counter High:

Responds with a data word containing the upper eight bits of the Address Counter.

4.6.7 Read Terminal I.D.:

This has the same effect as a Poll/Acknowledge if bits 11 (Feature Error) or 9 (Operation Complete) were set in the last Poll Response. The response contains 010000 binary in coax bits 6 through 11, and keyboard dip switches 4 through 1(keyboard I.D. bits 3 through 0) in coax bits 2 through 5, respectively, with

off a one and on a zero.

4.6.8 Read Status:

Responds with a data word in the following format:

- Bit 2: set if monospace option is set
- 3: always 0
- 4: always 1
- 5: set if the keylock is on, 0 if keylock is off
- 6: always 0
- 7: set the same as Poll Response bit 11 (Feature Error)
- 8: set the same as Poll Response bit 9 (Operation Complete)
- 9: set if keylock is turned off (display blanked).

4.6.9 Reset:

Causes a partial POR sequence in the terminal. The Address Counter is set to 80 decimal. The Poll Response is the special "just powered on" response. The display is enabled. Base and feature storage and mask register will not change.

4.6.10 Load Mask:

The data byte following this command is loaded into the Mask Register.

4.6.11 Clear:

This command is followed by a "Pattern" data byte. The Storage locations from the Address Counter address up to the storage byte matching the Pattern in the bit positions set in the Mask Register are tested and set to null. If no match is found, the command terminates with address 0 (i.e. it doesn't wrap around). A null Mask Register will not match anything. While clearing, the device does not execute any coax commands, and responds with bits 2 through 11 equal to zero. Upon command completion, the Poll Response bit 9 (Operation Complete) is set.

4.6.12 Write Data:

Causes all following data words to be put into Storage. The Address Counter is incremented after each data word is stored.

4.6.13 Load Control Register:

The data word following this command affects the terminal in the following ways:

- bit 6: Inhibit Display. When this bit is set, the display screen (except for the cursor, status line, and status line separator) will be blanked.
- bit 7: Inhibit Cursor Display. When this bit is set, the cursor will not be displayed.
- bit 8: Block Cursor. When this bit is set, the cursor will be a reverse-video block instead of an underline.
- bit 9: Blink Cursor. When this is set, the cursor will blink

4.6.14 Load Secondary Control Register:

The data word following this command affects the terminal in the following ways:

Bits 2 thru 8 undefined

Bit 9: Affects the number of bytes returned in response to a read multiple command. If bit 9 is set, a maximum of 32 bytes are returned, otherwise a maximum of 4 are returned.

4.6.15 Load Address Counter Low:

This command loads the low eight bits of the Address Counter with the data word following the command. This command also reenables the cursor if it was disabled by an insert command.

4.6.16 Load Address Counter High:

This command loads the upper eight bits of the Address Counter with the data word following the command.

4.6.17 Insert Byte:

The data in the data word following the command is placed in Storage at the Address Counter location. The previous contents of the altered location are placed in the next successive location. This sequence is repeated for successive locations until a null character or a field attribute is found, or the Address Counter steps to 0000. A null (code=0) character is overwritten, but a field attribute and, in the case of overflow, location 2000 are not overwritten (a character is lost). The ending value of the Address Counter is the location of the character which caused the command to end. This command alters the Mask register. While inserting, the device does not execute any coax commands, and responds with bits 2 through 11 equal to zero. Upon command completion, the Poll Response bit 9 (Operation Complete) is set.

4.6.18 Search Forward:

This command is followed by a "Pattern" data byte. Successive Storage locations, starting at the Address Counter location, are compared to the "pattern" in the bit positions which are set in the Mask Register. If there is a match, the Address Counter will contain the address of the matched character. If there is no match before the end of Storage, the Address Counter will contain 0000. A Mask Register value of zero does not match anything. While searching, the device does not execute any coax commands, and responds with bits 2 through 11 equal to zero. Upon command completion, the Poll Response bit 9 (Operation Complete) is set.

4.6.19 Search Backward:

This command works as in "Search Forward" above, except that it searches backwards in Storage instead of forward. Locations 0 to 79 cannot be searched. If no pattern match is found, the Address Counter is set to 79.

4.6.20 Read Extended Terminal I.D.:

This command causes the device to return 4 bytes to the control unit:

Byte 1.

Bit 2: If '0' the keyboard is in the Emulation mode, allowing the keyboard to emulate other language keyboards selected by bits 5-9.

If '1' then the keyboard is in the Native mode.

Bit 3: Numeric lock is set when bit 3 is '1'. This means that only numeric data can be placed in numeric fields.

Bit 4: When Bit 4 is '1' and the keyboard is in the Native mode, then the keyboard key functions have been redefined to the layout of the users choice.

Bits 5-9: If in the Emulation mode (Bit 2-4 are 0x0) then bits 5-9 define the language that the keyboard is emulating.

If in the Native mode (Bit 2 is a '1'), and bit 4 is '0', then bits 5-9 define keyboard layout as typewriter or Data entry.

If in the Native mode and bit 4 is '1', then Bit 5-9 define the layout chosen by the user.

Bytes 2 and 3: contain '31' and '91' respectively.

Byte 4: Indicates whether the device is an IBM device or an AT&T device and the type of keyboard connected. The 6591 will respond with 00000000(122 key keyboard id). This is similar to the IBM 3191 response.

5. LOCAL OPERATIONS

5.1 Self-test

5.1.1 Upon power-up, the 56C607 Terminal Controller performs self-test. If the test passes, the terminal will show a cursor and a status line separator on the screen. If the test fails, the word "FAIL" will appear in the middle of the screen or garbage will appear on the screen.

5.2 Interactive Test Mode

5.2.1 If the unit is powered up with any key depressed on the keyboard, the unit will enter the INTERACTIVE TEST MODE. The INTERACTIVE TEST MODE displays the following:

1. An Attribute Test Field, which displays field attributes. These attributes are Normal, Intensify, and Blank. See table II-2a for field attribute decoding.
2. The Character Set Field, where the character set is displayed.
3. A Keyboard Test Field, which displays the actual scan codes returned by the keyboard for any key depressed and released per the keyboard specification. The scan codes for depression are displayed as intensified characters and the scan codes for the release of keys are displayed as normal characters. Also in this field is the Keyboard I.D. section which displays the DIP switch settings on the bottom of the keyboard. The DIP switch settings displayed are those that were present upon power-up (refer to 5.9 for DIP switch bit definitions).
4. A Software Issue Field, where the left digit(or character) represents the Keyboard Interface software version number and the right digit(or character) represents the Line Interface software version number.
5. An eeprom status area, where the status of the user setup options, the record buffer allocation, and the password are displayed. This field is only displayed if the default options are loaded or if the eeprom failed self-test.
6. An Option Field, where the current option settings are displayed.

This test mode provides a through test of the 6591's display capabilities, and allows the user to test the keyboard and to modify the current option settings. Depression and release of the RESET key causes the 6591 to go to the normal operating state.

5.3 If the unit is powered up with pin #8 of the monitor connector tied to the terminal controller's ground, the supervisor and user passwords will be set to their default state.

5.4 Option Setting

5.4.1 The 6591 terminal options are selected in the OPTIONS SETUP mode, which is available during normal terminal operation, and in the TERMINAL CONFIGURATION SETUP mode, which is only available from the Interactive Test mode at power on. Some options are available in both SETUP modes, while others are specific to the SETUP mode.

5.5 OPTIONS SETUP Mode

5.5.1 During normal operation, the OPTIONS SETUP mode is entered by depressing the SETUP key. The blinking symbol '§' on the status line indicates that the 6591 is in the SETUP mode. The following options are available:

<u>Option Key</u>	<u>Option</u>
PF 4	Alarm Volume
PF 5	Click Volume
PF 21	Case Selection
PF 20	Reverse Image
PF 3	Screen Saver
PF 12	Password

Once in the set-up mode, any of the option keys may be depressed in order to select an option. The following set-up mode characters are used to indicate to the operator that the unit is in the set-up mode, and which options are selected:

§ ¤ A,a F1 F2 F3

- § indicates that unit is in set-up mode.
- ¤ indicates that Auto Dim (screen saver) option is selected
- A,a indicates that the Dual case option has been selected.
- A indicates that the Monocase option has been selected.
- F1 single digit that indicates current alarm volume setting (0-7).
- F2 single digit that indicates current click volume setting (0-7).
- F3 character that indicates current keyboard type setting (1,2,?).

5.5.2 The Alarm or Click volume is increased each time the respective option key is depressed until maximum volume is reached. When the Alarm or Click is at maximum volume and the respective option key is depressed, the volume will be set to zero. Each time a volume setting is changed, an Alarm or Click sound is made at the new volume level.

5.5.3 The case selection option is used to select whether letters are displayed all in upper case (monocase), or both upper case and lower case (dual case). While in the SETUP mode, the letters "A,a" are used to indicate that the dual case option is currently selected. If the monocase option is selected, an "A" is displayed on the status line.

5.5.4 The Screen Saver option, when enabled, blanks the display screen if there have not been any keys depressed for 10 minutes AND no CUT commands that change the low address counter are received. If a CUT command causes the low address counter to change or a key is depressed, the screen reappears. The depressed key will not be displayed or stored. Each depression of the Screen Saver option key will toggle the option between its enabled and disabled states. If the option is disabled, buffer

data will always be displayed. If the Screen Saver option is enabled a 'X' will appear on the status line.

5.5.5 The Reverse Image option determines whether the display has light characters on a dark background or dark characters on a light background. Depression of the "Reverse" key will toggle the display selection between reverse video and normal.

5.5.6 The password option is used to protect access to sensitive and confidential data and applications by providing a way to, in effect, "lock" or inhibit terminal operation so that data can't be entered, modified, or viewed.

5.5.6.1 The password feature is only functional when ALL of the following requirements are met:

- 1) The password option is enabled.
- 2) The supervisor password is set to something other than the default value.
- 3) The user password is set to something other than the default value.

These values are set in the TERMINAL CONFIGURATION SETUP mode, which is described in section 5.6.

5.5.6.2 If the password feature is functional, as described above, depression of PF12 (F12) in the OPTIONS SETUP mode "locks" terminal operation. In the locked state, the display is cleared, except for the status line, separator line, and the cursor. The message "ENTER PASSWORD" will appear on the status line, and will blink until keystrokes are entered in an attempt to re-enable terminal operation by entering a valid password. Other than comparing the keystrokes entered to the stored passwords, the terminal ignores keystrokes and does not send them to the control unit.

NOTE: If the 6591 power is turned off when the terminal is "locked", the 6591 will re-enter the locked state when power is reapplied.

5.5.6.3 Normal interactive terminal operation is restored, and the terminal is "unlocked", by entering either the same user password or the same supervisor password as is stored in the terminal, and then depressing "Enter". These valid passwords were the last values entered via the TERMINAL CONFIGURATION SETUP mode.

As the password is entered, the ENTER PASSWORD message stops

blinking. If the keystrokes entered match the stored user or supervisor password, terminal operation is re-enabled. If the keystrokes do not match the stored passwords exactly, the terminal remains locked and the message REJECTED is displayed on the status line for 5 seconds. The blinking ENTER PASSWORD message is then displayed and another attempt can be made to unlock the terminal.

NOTE: Only the keys shown in Figure II-2 are valid for passwords. Other keys will not be accepted and will generate an alarm.

5.5.7 To exit the OPTIONS SETUP mode and return to normal device operation, depress and release the SETUP key. This is identical to the procedure used to enter SETUP mode.

NOTE: IF THE TERMINAL IS TURNED OFF AFTER ANY OPTIONS HAVE BEEN CHANGED, BUT BEFORE THE NORMAL SETUP OR TERMINAL CONFIGURATION SETUP MODE IS EXITED, THE NEW OPTION SETTINGS WILL NOT BE SAVED UNLESS THE TERMINAL WAS TURNED OFF IN THE LOCKED STATE.

5.6 TERMINAL CONFIGURATION SETUP Mode

5.6.1 The TERMINAL CONFIGURATION SETUP Mode is entered from the INTERACTIVE TEST Mode by depressing the "SETUP" key. Refer to section 5.2 for details on the INTERACTIVE TEST Mode.

5.6.2 All of the options available in the OPTIONS SETUP Mode can also be selected in the TERMINAL CONFIGURATION Mode, and function in the same manner as described in section 5.5, except for the Password option, which is redefined. In addition, several other SETUP parameters are available in the TERMINAL CONFIGURATION SETUP mode. These are keyboard type selection, record buffer allocation, and password utilities. The SETUP parameters and Options are selected as shown in section 5.5.1 and in the following table:

Selection Key	Operation
PF10	Record Buffer Allocation
PF12	Password Utilities
PF23	Keyboard Type

5.6.3 The Keyboard Type option will display the type of emulation

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or native keyboard on the status line as a one-digit number. The following IDs are available:

- 1 = 3191 Native or Emulation Typewriter Keyboard
- 2 = 3191 Native Data Entry Keyboard
- ? = Incorrect Value

If the keyboard is in native mode, the keyboard type is based on DIP switches 4 to 8 on the keyboard. If the DIP switches are in an undefined state, the '?' will be displayed.

If the keyboard is in emulation mode, subsequent depressions of PF23 will step the keyboard type through the possible values.

5.6.4 Record Buffer Allocation

5.6.4.1 RECORD BUFFER ALLOCATION is used to set or review the current EEPROM storage that is allocated to each Function key (PF or F) for the record and playback function. Depression of PF10 displays the RECORD BUFFER ALLOCATION SCREEN, which is formatted as follows:

```
PF1:   xxxx
PF2:   xxxx
.
.
.
PF24:  xxxx
```

ALT RESET TO CLEAR

SETUP TO EXIT

where xxxx is the character storage that is assigned to the corresponding function key. The status line indicates the alternatives available:

- SETUP key depression will return the terminal to Terminal Configuration SETUP mode without altering any buffer allocations. This is typically done when reviewing the buffer allocation without modifying it.
- ALT-RESET depression will start the process to set the buffer allocation for each function key to zero characters. This is done as a prelude to entering new allocation values.

Before actually clearing the buffer allocation, the prompt REALLOCATE STORAGE (Y/N) will appear on the status line. At this point, two responses are accepted:

- Depression of 'N' will return the terminal to the previous

screen which displays the storage allocation and allows the user to exit without affecting the storage allocation. This is normally used when the user reaches this point inadvertently.

- Depression of 'Y' will change the buffer storage to zero characters for all PF keys.

After the buffer allocation is set to zero for all function keys, the Function Key Select Screen (5.6.4.2) is displayed.

5.6.4.2 The Function Key Select Screen displays the following message on the status line, and allows the user to select a function key buffer to modify, or stores the displayed allocation:

PFNN TO MODIFY

SETUP TO EXIT

As shown, several inputs are accepted:

- Depression of SETUP will store all of the displayed record allocation values in non-volatile storage. This is usually done after the user has finished modifying all of the buffer values.
- Depression of any PF key will move the cursor to the selected function key buffer allocation field, and the field will be cleared. A new value can now be entered. The status line will display:

ENTER TO STORE VALUE

YYYY

The maximum buffer length for the selected function key can now be entered. YYYY indicates the amount of unused non-volatile storage that can be allocated to the record buffers. Allowed responses are:

- A 1-4 digit number, composed of the characters '0' through '9', that represents the maximum buffer allocation length in characters that is desired for the selected function key. If an incorrect character is entered, BACK SPACE will delete it.
- Depression of ENTER loads the value, and modifies the count of storage remaining (YYYY). The Function Key Select Screen (5.6.4.2) will then be displayed. Another buffer allocation can be modified, or the buffer allocations can be saved in non-volatile storage.

If, however, the value entered is larger than the remaining storage, the value is not accepted when the

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ENTER key is depressed, and the cursor remains in the buffer allocation field. The value can be modified, or a second depression of the ENTER key clears the allocation count to zero.

5.6.5 Password Utilities

Upon depression of PF12 in TERMINAL CONFIGURATION SETUP Mode, the 6591 will display the Password Utility Screen. If the Supervisor Password is known and entered correctly, the following items are available:

- Modify Supervisor Password
- Clear User Password
- Enable or Disable the Password Option

If the User Password is entered correctly, the User Password may be changed.

NOTE: The default user and supervisor password is nothing; just depress "Enter". It is recommended that the supervisor password be modified and the password enable/disable be set to the proper state at the time of installation.

5.6.5.1 The initial screen will display the following status line:

PF1-SUPERVISOR PF12-USER SETUP TO EXIT

The following keystrokes are recognized:

SETUP key - Returns the terminal to the TERMINAL CONFIGURATION SETUP screen without modifying anything.

PF1 key --- Displays a request for Supervisor password as shown in section 5.6.5.2. This is the route to take if the Supervisor Password is to be modified, the User password cleared, or the Password Feature disabled or enabled.

PF12 key -- Displays a request for the User password as shown in section 5.6.5.4. This should be done if the User Password is to be changed.

5.6.5.2 The Supervisor Password is requested on the status line as shown below:

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SETUP screen without modifying the User Password.

New User Password - If the password entered differs from the previous new user password, the TERMINAL CONFIGURATION SETUP mode is redisplayed, and the original password remains in effect and is not modified.

If the same new password is entered as previously, it will be stored in non-volatile storage and must be used for all subsequent requests for the User Password. The following screen will confirm the change:

USER PASSWORD LOADED

SETUP TO EXIT

At this point, the only valid entry is SETUP, which will return the terminal to the TERMINAL CONFIGURATION SETUP screen.

5.7 Record/Play Operation

5.7.1 The 24 Program Function keys (PF or F) can be used to record a sequence of keystrokes, and at a later time, play them back. Each key can store up to the number of characters that was allocated in the Record Buffer Allocation SETUP mode (5.6.4).

NOTE: THE DEFAULT ASSIGNMENTS FOR PF1-PF12 ARE 96 KEYSTROKES EACH.

THE DEFAULT ASSIGNMENTS FOR PF13-PF24 ARE 48 KEYSTROKES EACH.

The following description of record/play operation refers to local status indications and local error indications. These are messages displayed on the status line for local terminal operations. See sections 5.8.1 and 5.8.2 for a complete list and description. Error indicators 1-3 are not described below, but occur when invalid keys are depressed. Depression of a proper key clears the errors. Error indicator 4 is not described, but is obvious.

5.7.2 To record a keystroke sequence:

1. Press the RECORD key. The Status line will display Status Indicator #1.
2. Press the desired function key (F or PF). The terminal status line indicators and Alarm will respond as shown:

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Condition	Local Status Indicator	Local Error Indicator	Alarm
- The buffer associated with the selected function key has space allocated and does not have keystrokes already assigned. Continue with step 3.	4	-	-
- The buffer associated with the selected function key has no space allocated to it. To use record/playback, assign storage for the selected function key, or use a different function key.	3	5	X
- The buffer associated with the selected function key has keystrokes assigned to it. If it is desired to overwrite the stored keystrokes, continue with step 3.	3	6	X

3. The new keystrokes to be stored are depressed in the order they are to be played back. After depression of the first keystroke, the status line will display Status Indicator #2. The number adjacent to the 'R' indicates the remaining number of keystrokes that can be entered for the selected function key. This number decreases by one for every keystroke entered.

NOTE: In addition to normal keystrokes, a 'PAUSE' in the play back can be inserted into the recorded sequence. See 5.7.5.

4. The RECORD key is depressed after the keystroke sequence is completed to store the data and return to normal operation.

5.7.3 To clear the recorded keystroke sequence for a function key:

1. Press the RECORD key. The Status Line will display Status Indicator #1.
2. Press the desired function key (F or PF). The terminal status line indicators, and Alarm will respond as shown:

Condition	Local Status Indicator	Local Error Indicator	Alarm
- The buffer associated with the selected function key has space allocated and does not have keystrokes assigned. Continue with step 3.	4	-	-

- The buffer associated with the selected function key has no space allocated to it. This buffer can not be cleared. Depress RECORD to exit this mode. 3 5 X
- The buffer associated with the selected function key has keystrokes assigned to it. Continue with step 3. 3 6 X

3. The buffer for the selected function key is cleared, and the screen returns to normal operating mode when ALT is depressed and held, and then RESET is depressed.

5.7.4 To clear all recorded keystroke sequences for all function keys:

1. Press the RECORD key. The Status Line will display Status Indicator #1.
2. All function key buffers are cleared when ALT is depressed and held, and then ERINP is depressed.

5.7.5 The recorded keystroke sequence can include a "PAUSE" during which the playback will stop temporarily for keystroke input. See 5.7.6 for a description of how a PAUSE affects the playback of a record keystroke sequence. To record a PAUSE while recording a keystroke sequence:

1. Enter keystrokes as described in 5.7.2. At the point where a PAUSE is desired, depress the PAUSE key, which is ALT-RECORD. Status Indicator #5 will be displayed while in the RECORD PAUSE state. While in this state, keystrokes will not be recorded. To continue recording the keystroke sequence, depress the PAUSE key and continue as in 5.7.2.

5.7.6 To playback a recorded keystroke sequence:

1. Press the PLAY key. The Status line will display Status Indicator #6.
2. Press the function key (F or PF) that is associated with the keystroke sequence to be played back. The terminal status line indicators and Alarm will respond as shown:

Condition	Local Status Indicator	Local Error Indicator	Alarm
- The buffer associated with the selected	9	-	X

function key has space allocated and does not have keystrokes assigned. Continue with step 3.

- The buffer associated with the selected function key has no space allocated to it. To use record/playback, assign storage for the selected function key, or use a different function key. 7 5 X

- The buffer associated with the selected function key has keystrokes assigned to it. The keystroke sequence will start at the current cursor position. See step 4 for PAUSE. At the completion of the keystroke sequence, the Status Indicator disappears and normal operation resumes. 7 - -

3. Depression of the PLAY key during playback will abort the playback sequence, clear the Status Indicator, and return the 6591 to normal operation.

4. If the selected keystroke buffer contains a recorded PAUSE, the keystrokes before the PAUSE will be played in the normal manner. When the PAUSE occurs, Status Indicator #8 is displayed. Appropriate data or commands can be entered. The recorded sequence will continue when the PLAY key is redepressed.

5.8 Status and error indications for local 6591 terminal operations, such as the SETUP modes and Record/Playback, are displayed on the status line (lower status line if 2 are used). The Local Status Area is in columns 20 through 32, while the Local Error Area is in columns 55 through 64.

5.8.1 The SETUP state indicators shown in 5.5.1 are displayed in the Local Status Area during Options SETUP mode and Terminal Configuration SETUP mode. The following indicators are displayed during Record/ Playback operation:

Reference Number	Status Indicator	Description
1.	R	The 6591 is waiting for depression of a function key to select a buffer for keystroke recording.
2.	R xxxx	The 6591 is recording the entered keystrokes. The xxxx is the count

- of the remaining storage allocated for the selected keystroke buffer.
3. R Fnn The 6591 displays the selected keystroke buffer number (nn) for Record operation.
 4. R FNN <? The selected function key buffer has storage allocated, but no keystrokes are stored.
 5. R *^ The 6591 is in the Record Pause state.
 6. P The 6591 is waiting for depression of a function key to select a buffer for keystroke playback.
 7. P Fnn The 6591 displays the selected keystroke buffer number for playback operation.
 8. P *^ The 6591 is in the Play Pause state.
 9. P Fnn <? The selected function key buffer has storage allocated, but no keystrokes are stored.

5.8.2 The following local error indicators are displayed on the status line during Options Setup mode, Terminal Configuration Setup mode, and during Record/Playback:

Reference Number	Error Indicator	Description
1.	?+	Invalid Function Key Selection - This error occurs in Record and Play when a function key buffer selection is required and a key other than PF1 through PF24 is depressed.
2.	-F	Invalid Key - An invalid key was depressed in Record or Setup mode.
3.	-FP	Invalid Key - An invalid key was depressed in Play mode.
4.	*>+	Zero Count - This record error appears when the keystroke buffer

has no more space available.

5. *<+

No Allocation - A function key was selected in Record/Playback that does not have any keystroke storage assigned.

6. ??

Overwrite - This warning occurs when a record buffer is selected that contains previously recorded keystrokes.

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5.9 Keyboard

5.9.1 The keyboard repeats at 10 characters per second if one and only one key is depressed. Figure II-3 shows which keys repeat. Figures II-4 through II-7 show the scan codes returned to the control unit when the 6591 is configured in Native or Emulation modes. If the terminal is powered up without a keyboard attached, a K will appear on the status line and the control unit will be ignored.

5.9.2 The DIP switches on the bottom of the keyboard are used to select various configurations of the 6591(similar to IBM's). The chart below defines the function of each DIP switch setting.

NOTE: THE KEYBOARD DIP SWITCH IS ONLY READ WHEN THE TERMINAL IS POWERED ON. THE 6591 SHOULD BE POWERED DOWN AND THEN POWERED BACK ON IF THE KEYBOARD DIP SWITCHES ARE CHANGED.

SWITCH 1 = ON - The keyboard is in NATIVE mode.
= OFF - The keyboard is in EMULATION mode.

SWITCH 2 = ON - For EMULATION or NATIVE mode, the keyboard numeric lock is enabled. Only numeric data (0-9,-,+,".", ",", or DUP) can be inserted into numeric fields.

OFF - For EMULATION or NATIVE mode, the keyboard numeric lock is disabled. Numeric and non-numeric data can be placed into numeric fields.

SWITCH 3 = ON - For NATIVE mode, switches 4-8 indicate one of 4 layouts:

SWITCH	4	5	6	7	8	KEYBOARD TYPE
	OFF	OFF	OFF	OFF	ON	Choice A
	OFF	OFF	OFF	ON	OFF	Choice B
	OFF	OFF	OFF	ON	ON	Choice C
	OFF	OFF	ON	OFF	OFF	Choice D

The layout choices are determined by the Control Unit Keyboard Definition Utility.

SWITCH 3 = OFF - For NATIVE mode, switches 4-8 indicate the keyboard type:

SWITCH	4	5	6	7	8	KEYBOARD TYPE
	OFF	OFF	OFF	OFF	ON	Typewriter
	OFF	OFF	OFF	ON	OFF	Data Entry

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In EMULATION mode, Switch 3 should be OFF.

SWITCHES 4 - 8 - For NATIVE mode - See switch 3.

For EMULATION mode, switches 4-8 indicate
the keyboard languages:

SWITCH	4	5	6	7	8	KEYBOARD TYPE
	OFF	OFF	OFF	OFF	OFF	US English
	OFF	OFF	OFF	OFF	ON	UK English
	OFF	OFF	OFF	ON	OFF	Canadian French
	ON	OFF	OFF	OFF	OFF	Austrian/German
	ON	OFF	OFF	OFF	ON	Belgian
	ON	OFF	OFF	ON	ON	Danish
	ON	OFF	ON	OFF	OFF	Swiss French
	ON	OFF	ON	OFF	ON	Swiss German
	ON	OFF	ON	ON	OFF	French Azerty
	ON	ON	OFF	OFF	OFF	Italian
	ON	ON	OFF	OFF	ON	Norwegian
	ON	ON	OFF	ON	OFF	Portuguese
	ON	ON	OFF	ON	ON	Spanish
	ON	ON	ON	OFF	OFF	Spanish Speaking
	ON	ON	ON	OFF	ON	Finnish/Swedish

NOTE: FOR KEYBOARDS IN EMULATION MODE, THE KEYBOARD TYPE
MUST BE SET IN THE TERMINAL CONFIGURATION SETUP MODE.
REFER TO 5.6.

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6. 6591 STATIC TESTING SET-UP AND TEST PROCEDURE

This is a description of the electrostatic discharge testing performed on the 6591. The test is intended to simulate, as close as possible, the ESD of an operator to all accessible parts of the product or metal parts in the immediate vicinity of the product.

6.1 Environmental Conditions:

Ambient Temperature: 25 C +/- 10 C
Relative Humidity: 40% +/- 10%

6.2 Test Equipment and Set-up:

EUT refers to the Equipment Under Test:

- A 56C607 Display Controller connected to a 12" or 14" monochrome monitor and a 56K460 keyboard.
- Testing was performed with a Series 2000 KeyTek ESD gun; R = 150 Ohms, C = 150 pF, TR = 5 nsec.
- A 30" x 24" Metal Plate was placed under the EUT. The Metal Plate was grounded by a 36" braided wire to the same AC outlet that the EUT was plugged into.
- The ESD gun was grounded to the Metal Plate by the insulated grounding strap that came with the ESD gun. The ESD gun power supply was plugged into an AC line separate than that of the EUT.
- The EUT was connected to a IBM 3274 Controller by approx. 50' of RG-62A/U coax cable.

6.3 Test Procedure:

There are two basic tests: Direct Discharge and Radiated Discharge. Each of these two tests are performed at 10kv and 15kv.

Direct Discharge

- With the terminal "On-Line", so that characters could appear on the screen, discharge was done to the following areas with the keyboard on and off the ground plate:

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Video connector screw, left
Video connector screw, right
Coax connector
Monitor screw, left
Monitor screw, right
Power switch

Radiated Discharge:

With the terminal "On-Line", so that characters could appear on the screen, discharge was done to the ground plate near the base and near the keyboard.

Typically a small number of discharges were performed to all of the above configurations (i.e. 10-20). Then, any configurations that had questionable failure rates were re-tested more thoroughly. (i.e. 100+ discharges)

Acceptable failure rates were defined as follows:

10kv - < 25% "soft" failures
10kv - < 10% "hard" failures
15kv - no physical damage

A "soft" failure is defined as any situation that could cause a loss or modification of data and doesn't require manual intervention to restore terminal operation; however, some data may have been lost. Some examples of "soft" failures are:

DE - Data Error i.e. loss of characters that were present on the screen.
POR - Power On Reset

A "hard" failure is defined as a failure that requires the device to be turned off and turned back on to make the unit operational again. An example of a "hard" failure is:

LU - Keyboard Lock-Up

Physical damage is defined as a failure that requires a service technician to make the unit operational again, and involves replacement of hardware devices.

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Bit	2 3 4 5 6 7 8 9	Attribute
	-----	-----
	1 1 x x 0 x x x	Normal
	1 1 0 x 1 0 x x	Intensify
	1 1 x x 1 1 x x	blank

Field Attribute Decoding
TABLE IIa

	1 (00:XX)				2 (01:XX)				3 (10:XX)				4 (11:XX)			
	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0																
1	I	N	U	L	I	S	P	0	z							
2																
3	I	E	M	=	1	-										
4																
5	I	F	F	'	2	.										
6																
7	I	M	L	"	3	,										
8																
9	I	S	T	/	4	:										
A																
B	I	C	R	\	5	+										
C																
D																
E																
F																

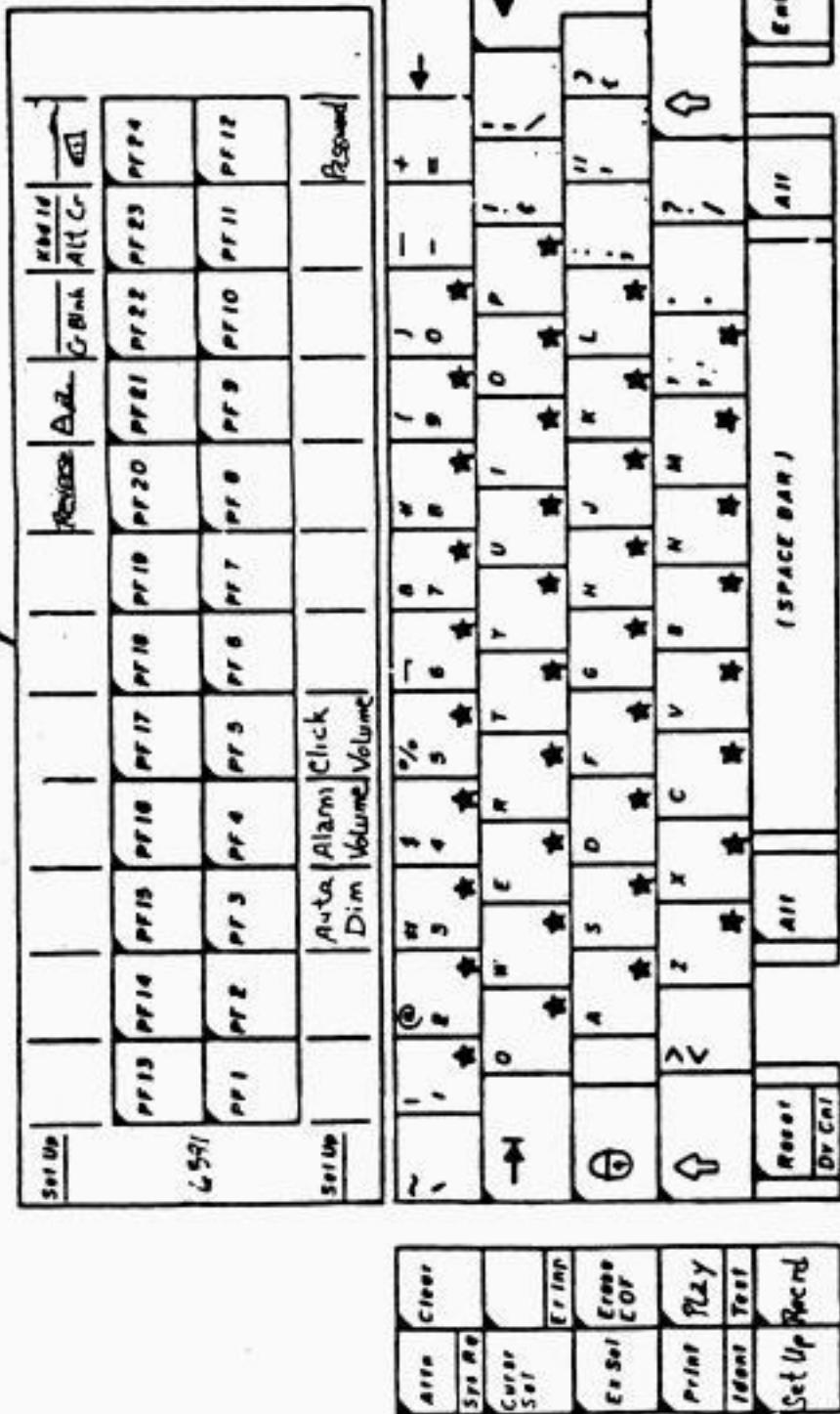
↑ MONOCASE FOLD ↑ INDICATORS AND ATTRIBUTES
 ----- ADDRESS FOR CHARACTER GENERATOR -----

Notes:

- (1) Characters in locations 00 thru 07 display as blank.
- (2) Codes Hex 9E and 9F are the FN and DUP characters.
- (3) Lower case characters in columns 4 & 5 and 8 & 9 fold to upper case characters, columns 6 & 7 and A & B, when the Display is in the Monocase Mode.
- (4) Printers are required to support only those graphics that are defined as valid for that particular language.

FIGURE II - 1

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58K480 KEYBOARD FOR G591 DISPLAY TERMINAL - 122 KEYS

FIGURE II




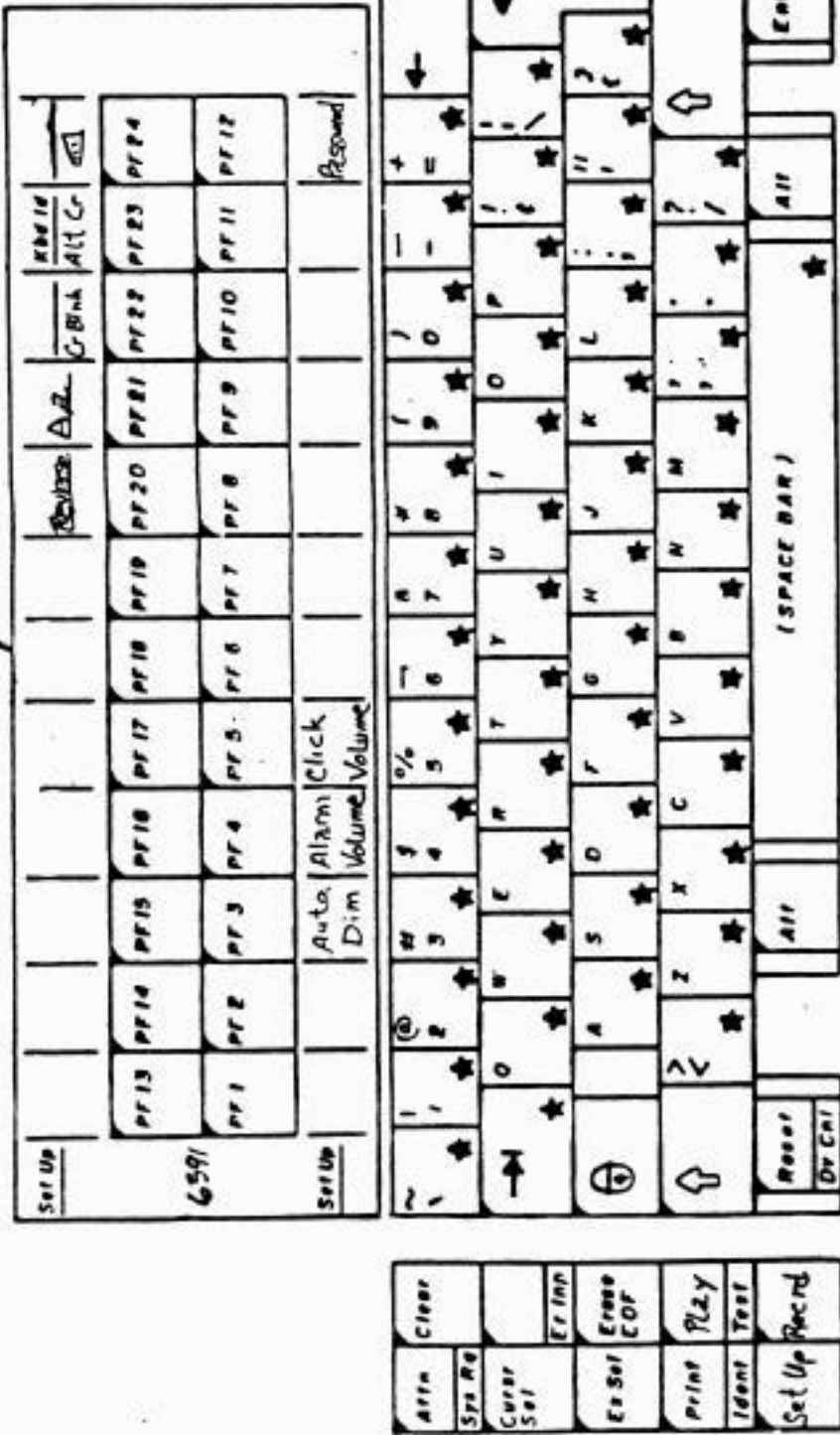
-  — FRONT FACE PRINTING
-  — DARK COLOR
-  — VALID PASSWORD

Figure II-2

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AT&T INFORMATION SYSTEMS - PROPRIETARY (RESTRICTED) SOLELY FOR AUTHORIZED PERSONS HAVING A NEED TO KNOW PURSUANT TO TCI'S. MAY NOT BE REPRODUCED.

TEMPLATE



56K460 KEYBOARD FOR 6591 DISPLAY TERMINAL - 122 KEYS

FIGURE II - 4

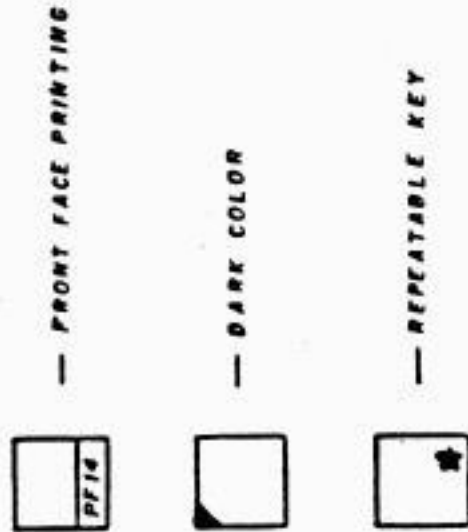
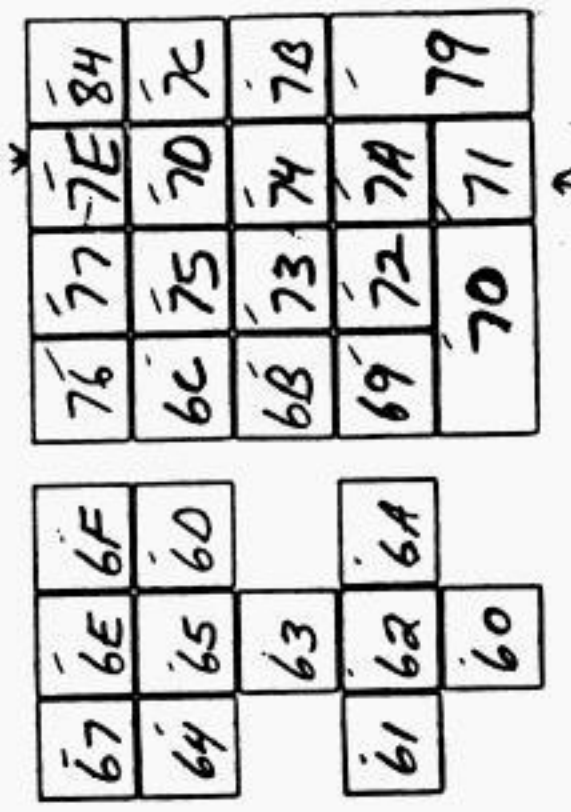
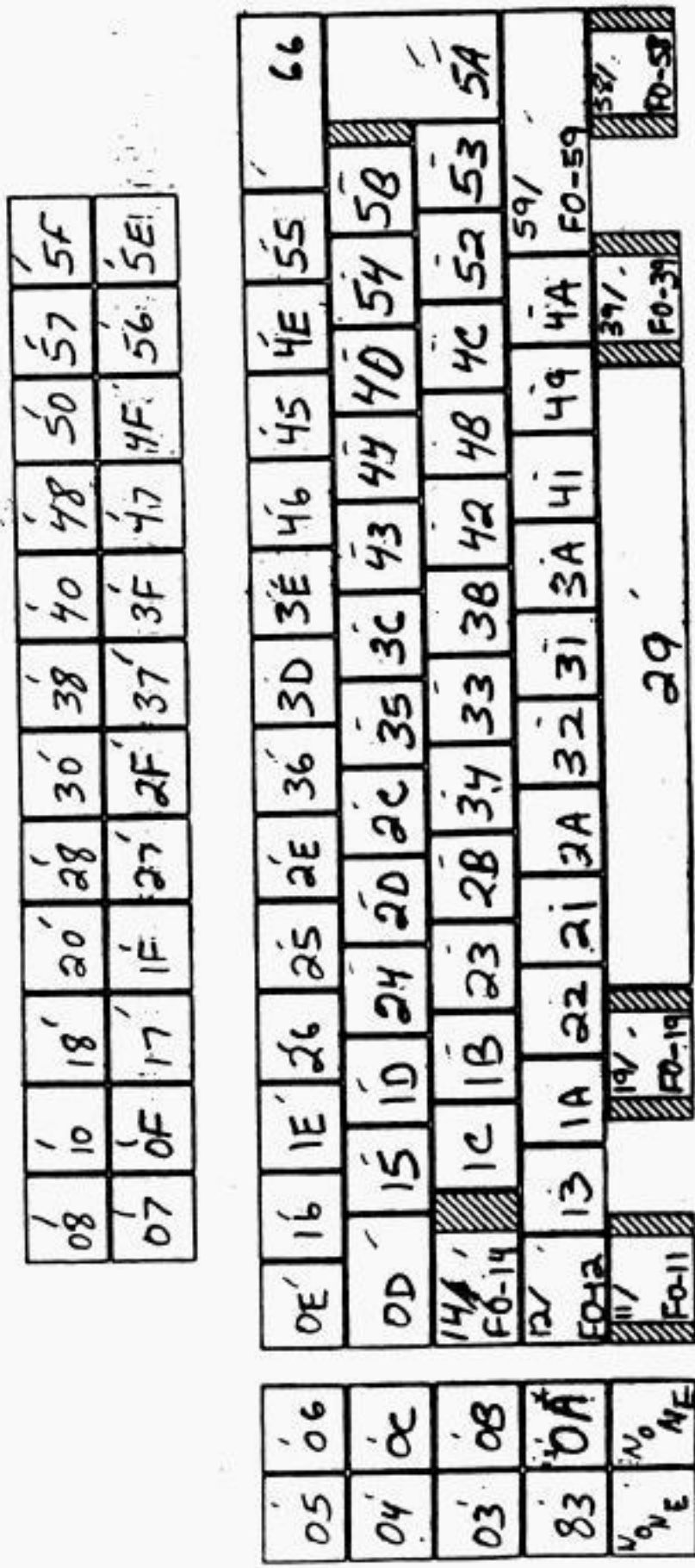


Figure II-3

6591 NATIVE KEYBOARD SCAN CODES SENT TO CLUSTER CONTROLLER



NOTE: KEY SCAN CODES SEPARATED BY A "/>" ARE
 DEPRESSION/RELEASE CODES.

* ONLY GENERATED WITH ALT DEPRESSED

Figure II-4

6591 EMULATION U.S. TYPE WALTER SCAN COOBS SENT TO THE
 CLUSTER CONTROLLER (NORMAL STATE ONLY)

50	4F	51	CF	53	3D	21	22	23	24	25	26	27	28	29	20	30	11	31	
51	NONE	55	4F	53	36	70	76	64	71	73	78	74	68	6E	6F	1B	15	08	
52	NONE	56	NONE	55	4C/CC	60	72	63	65	66	67	69	6A	6B	7E	12	0F		
56	NONE	NONE	NONE	56	40/CO	09	79	77	62	75	61	6D	6C	33	32	14	40/CD		
NONE	NONE	NONE	NONE	56	34	4F/CF	10												

4F	5F	5E	5F	CF	35	0C	0D	NONE	NONE
16	NONE	1A	13						
NONE	NONE	NONE	NONE	NONE	27	28	29	33*	1.0
24	25	26	30*	36					
21	22	23	32A	33					
20	20	23	32A	33					

NOTES: # TOP NUMBER IS FOR DIPSWITCH 4 "OFF". BOTTOM NUMBER
 IS FOR DIPSWITCH 4 "ON".

KEY SCAN COOBS SEPARATED BY A "Y" ARE DAPASSEM/RELEASE COOBS.

Figure II-5

6591 EMULATION U.S. TYPEWRITER SCAN CODES SENT TO THE CLUSTER CONTROLLER (EITHER ALTERNATE KEY DOWN)

40	41	42	43	44	45	46	47	48	CF	CF	CF
NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
									57	54	57

NONE				
NONE			57	

	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE

NONE	NONE			
NONE				
			35	

	NONE	NONE	NONE	NONE
	NONE	NONE	NONE	NONE
	NONE	NONE	NONE	NONE
	NONE	NONE	NONE	NONE

NOTE: UNMARKED KEYS FOR ONE OR BOTH STATES RETURN THE SAME SCAN CODES AS THE NORMAL STATE (SEE FIGURE II-4).

Figure II-6

IV-1

SECTION IV

MANUFACTURING INFORMATION

1. ASSEMBLY

1.1 Figures IV-1 and IV-2 are exploded drawings of the terminal controller. The figures include assembly information.

1.2 56C607 set/unit label must have date of manufacture on the label.

2. Initial Operability

2.1 The initial operability of the individual components which make up the 6591 display terminal, prior to shipping, must be as follows to guarantee the previously stated 95% initial operability at the customer's site:

Component	FACTORY	
	I.O. (%)	MTBF (hrs/fail)
Display Controller:	99.5	200,000 HR/F
53D210/53D410 Monitor:	98	54,000 HR/F
56K460 Keyboard:	99	144,000 HR/F
6591 Display Terminal:	96	32,800 HR/F

Refer to Section I, paragraph 2.5 for further information.

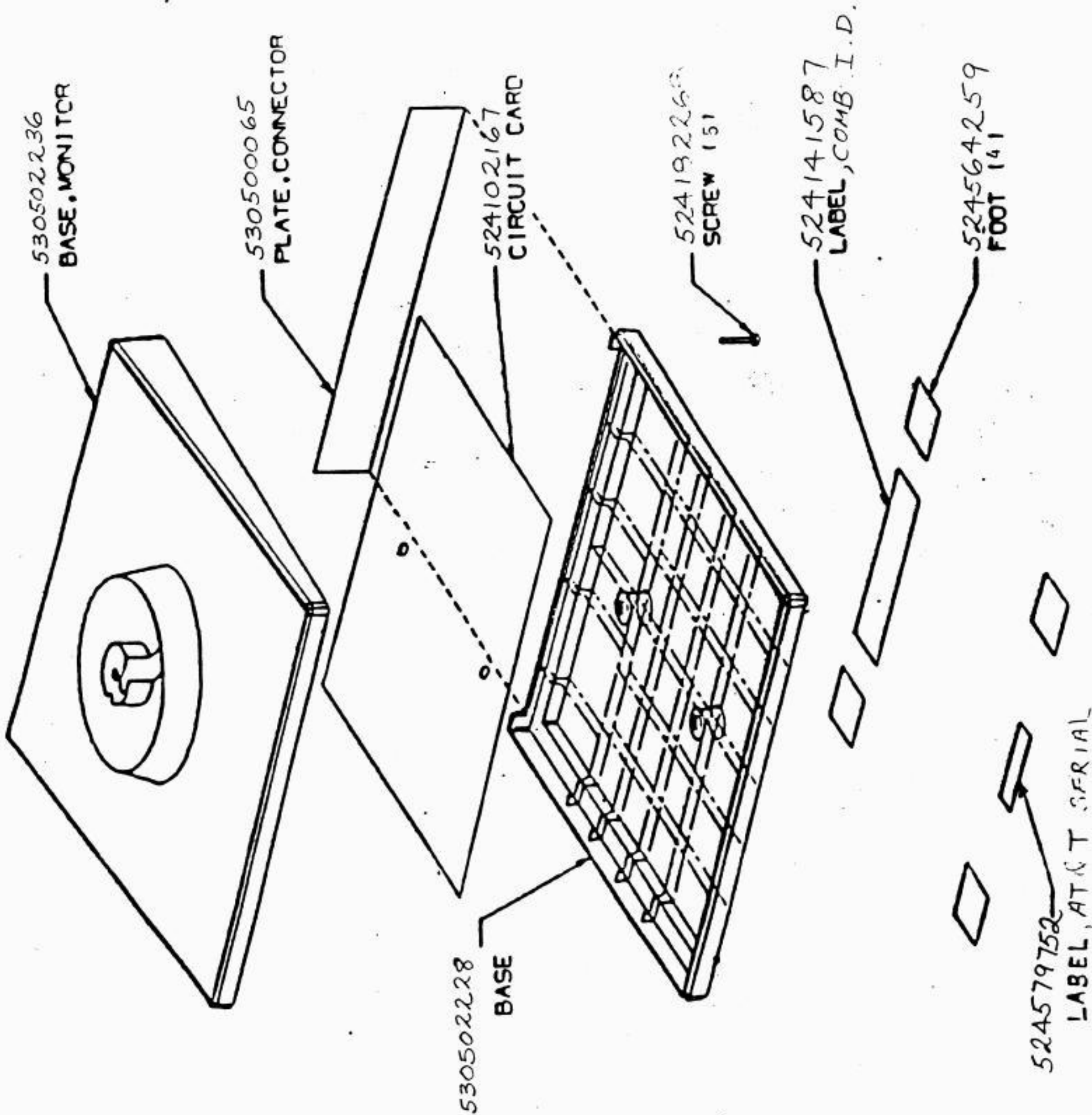


Figure IV- 1

56C607 Terminal Controller Exploded View

ASAT (P) (S) (M) (P) (S) (T) (E) (M) (S)
Safety Precautions: Read and understand all instructions
before using this equipment. Do not use if you are
having trouble to know how to use it.
to Compare instructions.

*IV-3

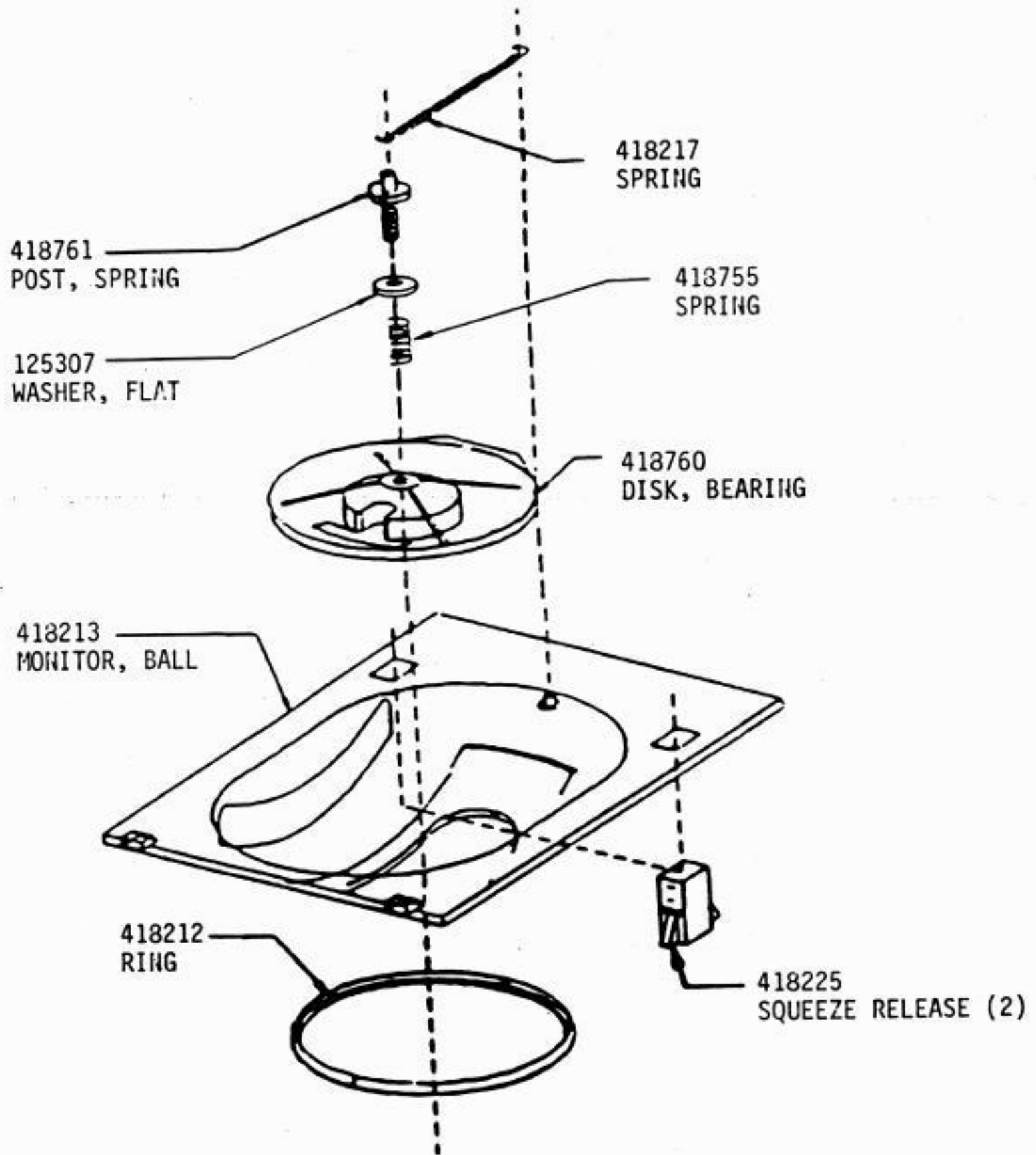


Figure IV-2

56C607 Terminal Controller
Exploded View

SECTION V

INSTALLATION INFORMATION

1. Assembly and Dissassembly

1.1 Unpack the terminal. The terminal is shipped as three modules in three boxes - the monitor, keyboard, and the terminal controller.

1.2 ASSEMBLY (Refer to figure V-1)

1.2.1 The 56C607 terminal controller is completely assembled prior to being shipped. The only assembly required is to attach the terminal controller to the monitor.

*1.2.2 Turn the monitor upside down on a flat surface.

**** CAUTION: DO NOT REST MONITOR ON FRONT FACE OF CRT ****

Slide the terminal controller's two tabs into the two slots on the bottom of the monitor, snap the controller into place (see Figure V-1), and turn the assembly upright.

1.2.3 Connect monitor to a.c. outlet via power cord. Connect the cable attached to the monitor to the 25-pin video connector (labeled "1" or "VIDEO") on the rear of the terminal controller (Refer to Figure V-2 for connector locations).

1.2.4 Connect the keyboard cable to the 6-pin input device connector (labeled "3") on the rear of the terminal controller.

1.3 INSTALLATION

1.3.1 Connect the terminal to the control unit by attaching the coaxial cable to the BNC connector (labeled "2") on the rear of the terminal controller.

1.3.2 After installation, it is strongly recommended that the supervisor password and the password enable/disable be set. The default, power-on user and supervisor passwords are set to no characters; i.e., depressing the 'ENTER' key allows access.

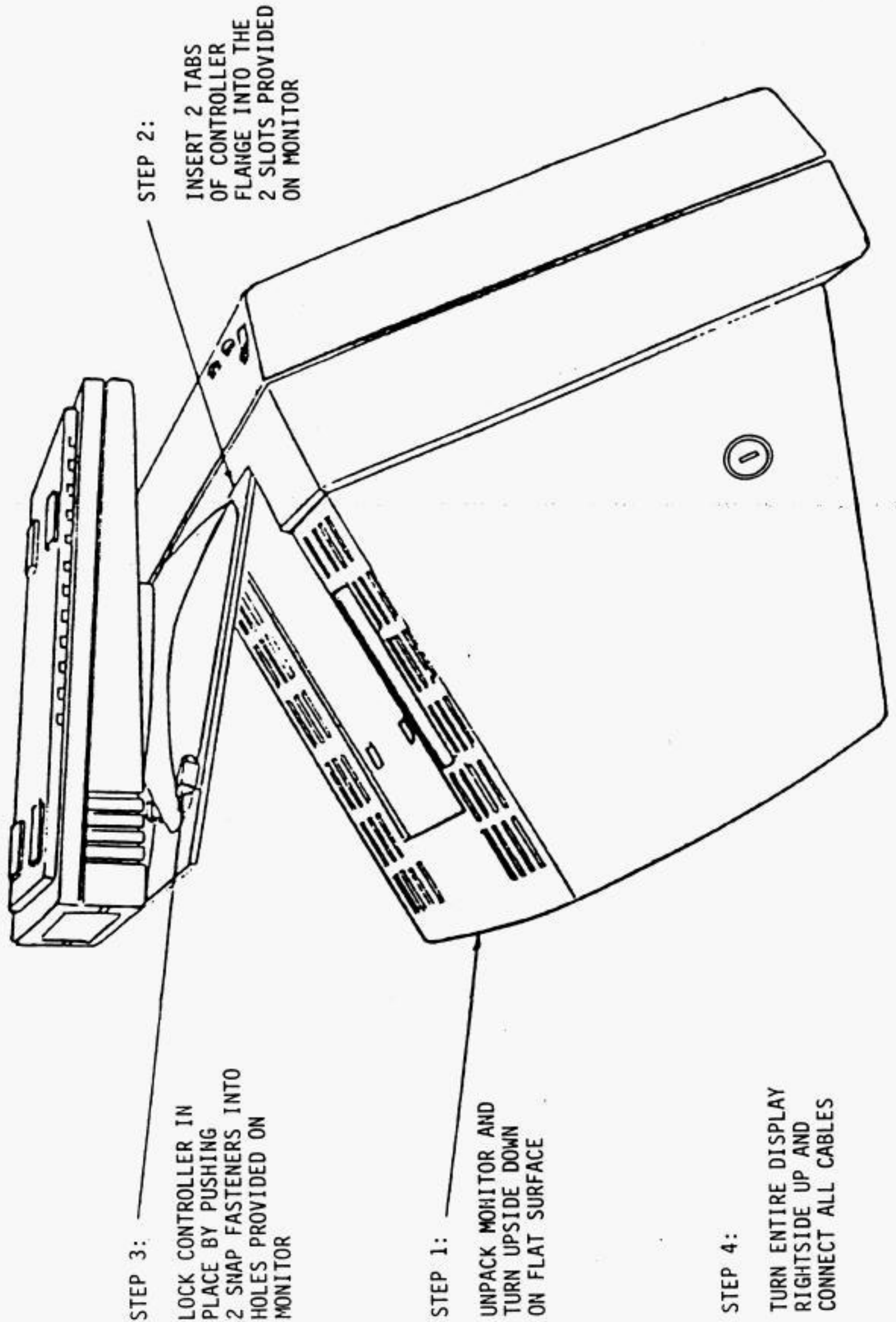
1.4 DISASSEMBLY

*1.4.1 If the terminal needs to be disassembled for shipping, the assembly process is reversed. (To release the terminal controller from the monitor, the two snap fasteners on the monitor ball are squeezed.)

*V- 2

Figure V- 1

Terminal Assembly



POWER LINE

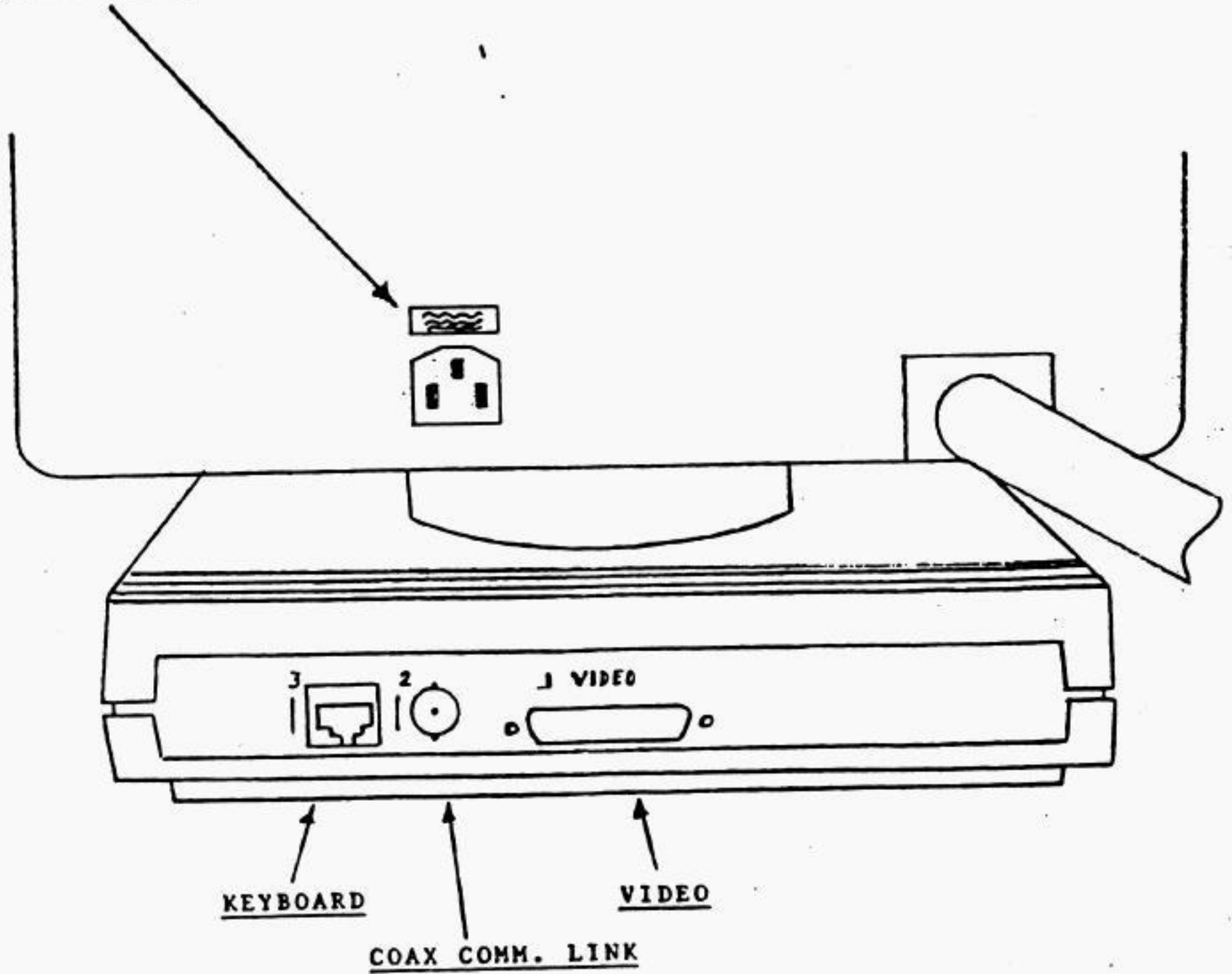


Figure V-2

View of Connectors

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SECTION VII

SERVICE INFORMATION

1. Servicing and Maintenance

1.1 Servicing is to be performed only by qualified maintenance personnel.

1.2 ROUTINE MAINTENANCE

1.2.1 The terminal does not require periodic maintenance other than routine cleanliness procedures performed by the operator. Service personnel are required only for failure correction.

1.2.2 The following instructions are to be followed when cleaning the cabinet surfaces (CAUTION: All power should be removed from the terminal prior to cleaning).

1.2.2.1 Use a soft cloth moistened with water and wring almost dry. When necessary, the cloth may be moistened with a weak solution of mild detergent to remove stubborn dirt, grease, or fingerprints.

1.2.2.2 Harsh or abrasive cleaning agents or solvents should never be used.

2. SELF TEST DIAGNOSTICS

2.1 The intent of the self-test diagnostics is to isolate problems down to major modules which may be easily replaced and serviced at the customer site. These major modules are the monitor, keyboard, and display controller.

2.2 A diagnostic self-test is performed upon power up. Figure VII-1 is a flowchart showing the possible failures and the part or parts causing the failures.

Figure VII-1
Self-Test Diagnostic Flowchart

