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::
:: SUPERSET ::
::
:: FOR HEATH/ZENITH H/Z19 TERMINALS ::
::
:: AND H89/Z90 COMPUTERS ::
::
:::

The TMSI "SUPERSET" adds a new dimension to your Heath/Zenith H/Z19 terminal or H/Z89 series computer. Benefits include a vastly increased character set, improved graphics via the NORCOM GT-PROM*, faster operation, rock stable "flicker-free" display, and reduced power consumption to run cooler.

The SUPERSET has all modes and escape sequences of a standard H/Z19 or H/Z89, so no software changes are needed. It also includes most features of the HUG/Watzman, Super-19, and Ultra-ROM including on-screen clock, new baud rates, and enhanced keyboard and display modes.

FEATURES

- 4 standard text fonts: H19, VT-100, GT-PROM*, and Greek. Optional SUPERFONT adds H29, IBM PC, superscripts, subscripts, and double-wide characters.
- 4 graphic sets: enhanced H19, DEC special graphics, GT-PROM*, and math; Optional SUPERFONT adds IBM PC, fineline, and 100x160 dot graphics.
- Magic Menus, for instant help and setup.
- True reverse screen (black characters on white screen).
- New attributes: blink, reverse video, or alternate character set.
- 4-mode function keys (normal/shift/ctl/ctl-shift).
- Transmit speed limiting for improved screen dumps.
- Improved interlace mode, with reduced flicker.
- Screen saver blanks screen after 15 min inactivity.
- Improved Hold Screen mode with SCROLL key.
- Superfast operation for quick response (up to 38K baud).
- On-screen digital clock/calender. Optional SUPERCLOCK adds battery backup.
- Save/Restore/Swap terminal mode commands for rapid task switching.
- Native and transparent modes for special applications.
- It even does Windows! With SUPERCLOCK, save/restore/swaps any part of screen with off-screen memory.

The kit contains a set of low-power CMOS ICs to replace the program, keyboard, and character generator ROMs; display RAMs; and a few other miscellaneous ICs. The new parts are significantly faster and reduce loading on the +8 volt supply by about 300mA. Installation takes under an hour, and soldering is required.

Since this kit operates in a manner not authorized by Heath/Zenith, it voids the warranty and may not work in all machines. But we have installed it successfully on many machines, and use it ourselves daily.

WARRANTY

This product carries a ninety (90) day limited warranty. If you have any questions or problems with this product or our service, please call or write us at the address below, and we'll do our best to help. Sorry, we can't accept collect calls.

For a period of ninety (90) days after delivery, we will repair or replace free of charge any part or product found defective in either materials or workmanship. We further warrant that the product will meet our published specifications for a period of ninety (90) days when assembled and used according to our published instructions. If a defective part or a design error on our part causes a part or product to fail during the warranty period, we will repair or replace it free of charge.

Our warranty does not cover, and we are not responsible for damage caused by abuse, incorrect assembly, defective tools, or unauthorized modifications. Our warranty does not include reimbursement for inconvenience, loss of use, or customer labor.

This warranty includes only parts and products sold by us, and does not cover equipment to which our parts or products may be connected. We are not responsible for incidental or consequential damages. Some states do not allow exclusion of incidental or consequential damages, so this may not apply to you.

TMSI c/o Lee A. Hart
28612 Middle Crossing Road
Dowagiac, MI 49007

(616) 782-3980

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GT-PROM is included under license from NORCOM, 9630 Hayes, Overland Park KS.

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PARTS SUPPLIED

Check to be sure you have all the following parts. Don't remove the ICs (integrated circuits) from their protective packaging until ready for use.

<u>Gty</u>	<u>Part no.</u>	<u>Description</u>
1	101.402	SUPERSET Program ROM
1	101.412	SUPERSET Character ROM
	(or 101.430)	(SUPERFONT Character ROM)
1	101.422	SUPERSET Keyboard ROM
(1)	(MK48T02)	(SUPERCLOCK)
4	5514 or 2114L 1Kx4 fast static RAM	
1	74S138	1 of 8 decoder, Schottky or Fast
1	74FOO	quad 2-input NAND gate, Schottky or Fast
1	701.402	24-to-28 pin socket adapter
1	701.412	24-to-28 pin socket adapter
	(or 101.440)	(24-to-28 pin socket adapter for SUPERFONT)
1	330 pf	disk ceramic capacitor
1	10uF 20vdc	tantalum capacitor
1	P3.1	3-pin .025" header
1	P6.1	6-pin .025" header
1	---	12" hook-up wire
1	3" piece	braided solder-wick

INTRODUCTION

The SUPERSET is an enhanced set of parts for the H/Z-19 terminal and the H/Z-89/90 computers. It includes ALL features of the standard H/Z19 terminal (Heath, VT-52, and ANSI modes) plus the following:

- Selectable character sets: A standard H19 has one 128-character font. The SUPERSET expands this to 4 fonts of 128 characters each (512 total).

Font 1 is the original Heath set, with minor improvements such as 1/4 dot and 3/4 dot area fills, missing 2x2 graphic character, and improved appearance when using text characters for graphic applications (drawing boxes with :!-/ etc).

Font 2 is the DEC VT-100 with Special Graphics set, useful for thin-line drawings and for displaying control codes.

Font 3 is the NORCOM GT-PROM which adds a boldface text font, and graphics characters to plot dots in a 2x5 matrix within a character cell (160x125 dot resolution graphics).

Font 4 replaces the graphics characters with a set of special characters including math symbols and Greek alphabet.

The optional SUPERFONT adds 4 additional fonts (for a total of 8). Additionally, each font has 256 characters instead of 128, for a total of 2048 displayable characters.

Font 5 is the Heath H/Z29 terminal character set. It has the standard H19 set plus superscripts, subscripts, Greek letters, and fine-line graphics.

Font 6 is the VT-100, but with both single- and double-width character sets (40 or 80 characters per line). In transparent mode or with graphics enabled, it displays mnemonics for all control codes (& for Line Feed, etc.).

Font 7 is APA-graphics (All-Points-Addressable). Each character cell is broken into 8 parts, 2 dots wide by 4 dots high. Thus pictures can be drawn to a resolution of 100 pixels high by 160 pixels wide.

Font 8 is the IBM PC monochrome display adapter character set. Characters are formed in a 7x9 dot matrix (rather than 5x7), and include a variety of special symbols unique to the PC.

- Cuts heat and power consumption. The SUPERSET reduces TLB power consumption by 300 mA for a cooler and more reliable machine.
- Faster operation. Supports up to 38400 baud without handshaking, and a 3 MHZ TLB clock. Previously slow routines like cursor positioning, character insert and delete, and line and screen erase are over 3:1 faster. Screen updates up to 4 times quicker!
- Flicker-free display. The SUPERSET includes our flicker-free kit; no "black dashes" when characters are scrolled or written rapidly on the screen.
- Digital clock/calendar display on the 25th line. The 24-hour clock may be set, read, or reset to 00:00:00. The calendar can be set or read to display the month, date, and year. Time and/or date can be sent to your computer with a single keystroke. The clock/calendar display may be turned on or off, and normal 25th line operation is not affected. The clock is accurate to 10 sec/day, and unaffected by reset; the optional SUPERCLOCK improves accuracy and adds battery backup.
- New display options. True reverse screen mode (white screen with black characters). Improved interlace mode with reduced flicker. Screen saver automatically blanks screen after 15 minutes without activity, and re-enables it if any key is struck or data is received.
- Magic Menus. Control-ESCape calls a series of full-screen menus that outline terminal operation and ESC sequences. Select the desired operation from the menu. When finished, the screen is restored to its original state.
- Local function keys. CONTROL+function keys perform immediate local functions; position cursor, clear screen, select fonts, set modes, display menus, send date or time, etc.
- More attributes. Instead of just reverse video, the attribute (8th bit) can select reverse video, blinking, or with SUPERFONT, a character from the upper half of an extended 256-char set.
- New cursor options. Select any combination of blinking- or non-blinking; and block, underline, or no cursor.

- Enhanced transmit functions. In addition to transmit page and 25th line, the SUPERSET adds transmit line, character, clock, and calendar. Transmit speed limiting holds speed to 60 chars/sec to allow screen dumps to slow devices like printers or BASIC. A cursor shows characters as they are sent.
- Improved terminal operation. Options for Half and Full duplex, 7- or 8-bit word length, and hardware and software handshaking. New baud rates include 75, 134.5, and 38,400 baud.
- Native mode keyboard. Each key produces a unique 8-bit code instead of multi-character escape sequences. Function keys have unique codes for normal, shifted, control, and control-shift combinations.
- Transparent mode. Each 8-bit code from 0 to 255 produces a unique visible character, so ESC sequences aren't needed for graphics and reverse video. With SUPERFONT, a single code can display any of 256 unique characters.
- Save and Restore Modes. ESC sequences to save and restore current terminal state; normal/shift/alternate keypad, normal/reverse video, text/graphics, cursor type, etc. A "soft" ESC z option resets the terminal to the last saved state, rather than to the DIP switch settings.
- Improved ANSI mode. Much faster, more VT-100 ESC sequences.

SPECIAL CASES

These instructions assume you are installing the SUPERSET in a standard, unmodified H/Z19 terminal or H/Z89 computer. This kit affects ONLY the Terminal Logic Board (TLB); don't worry about any changes you have made elsewhere in the computer.

If you have changed your TLB clock speed, it should be put back to the original 2MHz. Though the SUPERSET will change this to 3MHz, it is best not to mix up two different ways of doing the same thing.

Since the SUPERSET replaces your existing ROMs, you cannot use it with the HUG/Watzman, Ultra-ROM, Super-19, or Font-19 ROMs. But most of the features of these parts are already provided. The SUPERSET also will not work with the Cleveland Codonics Imaginator or Northwest Digital Graphics-Plus boards.

The SUPERSET is derived from the standard H19 ROM and HUG/Watzman ROM, so it includes all of the features and ESC sequences of these parts. As a result, it is 99% compatible with software that works with either of these parts. The remaining 1% includes programs that send previously illegal ESC sequences, or take advantage of bugs in the earlier ROMs.

In addition, the SUPERSET includes most of the features of the Ultra-ROM and Super-19. But it is not software compatible with these ROMs; it is impossible to choose a set of ESC sequences compatible with all these parts. When choosing an ESC sequence for a given function, the SUPERSET's order of preference was:

- 1st: use the same ESC sequence as a stock Heath H/Z-19
- 2nd: same as HUG/Watzman
- 3rd: Heath H/Z-29
- 4th: Super-19
- 5th: Ultra-ROM
- last: invent a new ESC sequence

INSTALLATION

Installation is easiest if you have an H/Z19 terminal. Just follow the numbers in each illustration. Work carefully, and mark off each step as you complete it. Check your work, or better yet, have someone else check it for you -- mistakes suddenly get very expensive after you've turned on the power!

If you have an H/Z89 series computer, things are more involved. But there is an H19 terminal hiding under all that clutter. There are so many variations between computers that we can only give general instructions to remove and install the CPU and accessory boards. Call us if you need help, or refer to the appropriate manuals.

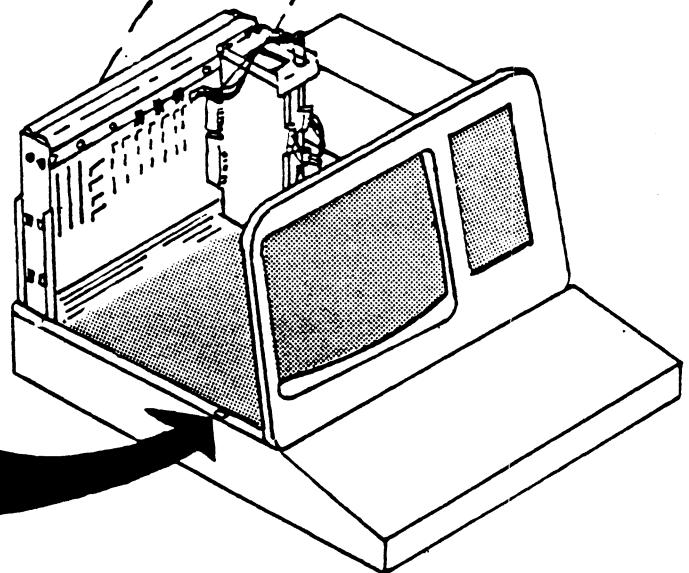
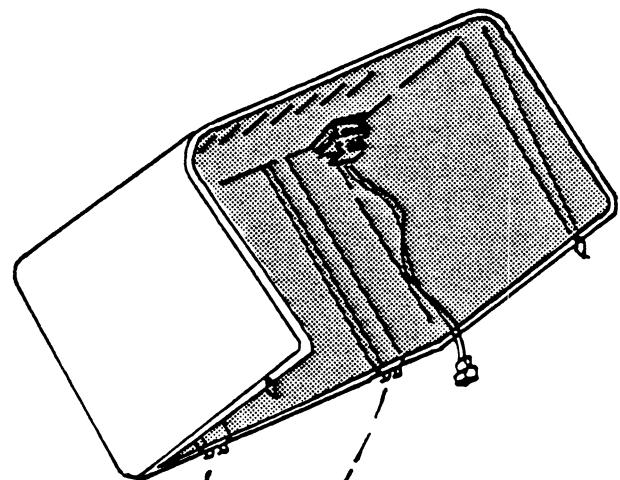
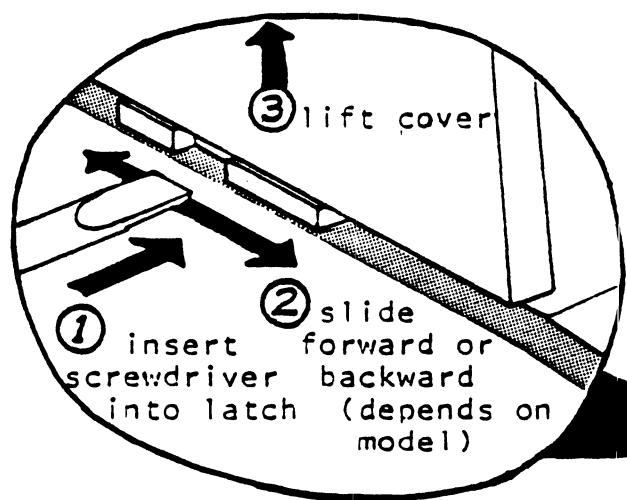
This is NOT a project for a beginner. Installation requires skill in soldering, counting pins on integrated circuits, and locating and cutting traces on a printed circuit board. If you did not build your H19/H89 as a kit or have no experience as an electronics technician, please find someone else to do the installation.

TMSI can install your SUPERSET for you. Please call first to get an RMA (Return Material Authorization) number. This lets us plan ahead to avoid long delays. Installation is \$25 if you send us your working TLB; or \$50 (plus parts) if you tried to do it yourself, broke the TLB, and THEN send it in.

OPENING THE CABINET

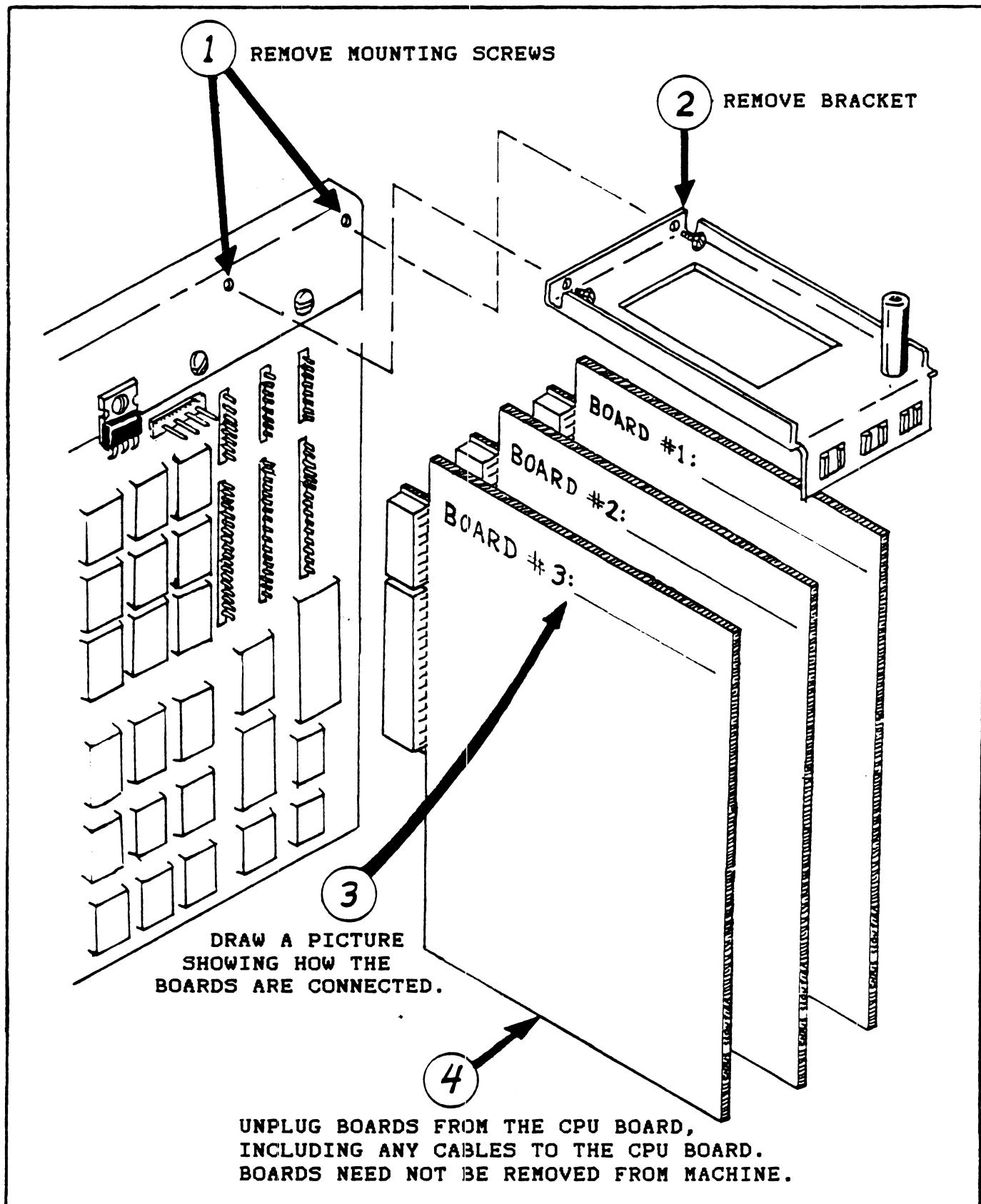
CAUTION!

Hazardous voltages are present in the computer. Be sure the line cord is unplugged whenever the cabinet is open. A high voltage charge may be present on the flyback transformer and picture tube even if unplugged. DON'T TOUCH THESE AREAS!

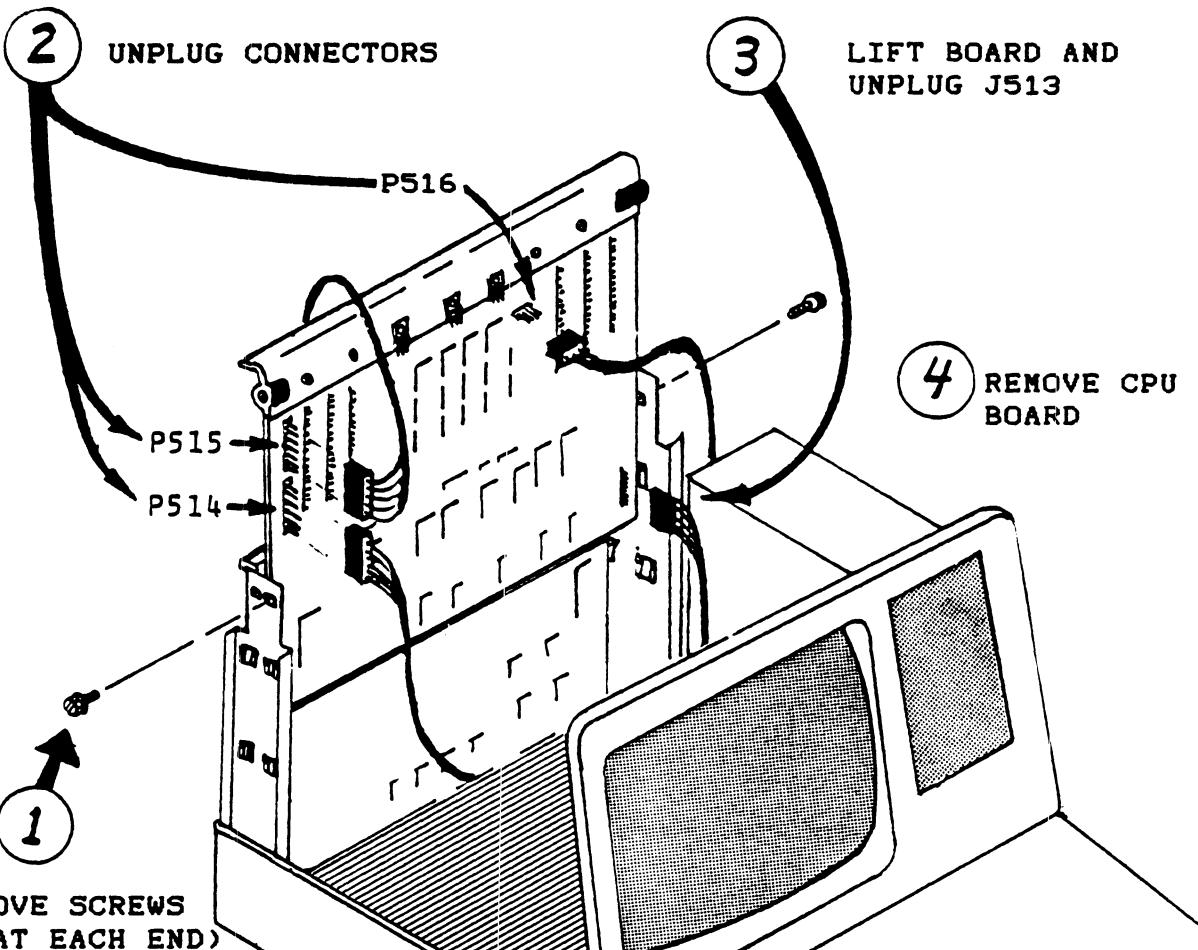


1. Turn the machine off and unplug the power cord.
2. Find the two latches on the cover (one on each side). Open as shown above.
3. Tilt the cover back, and unplug the fan's power connector.
4. Slide the cover off the machine, and set it aside.

UNPLUG I/O BOARDS (COMPUTERS ONLY)



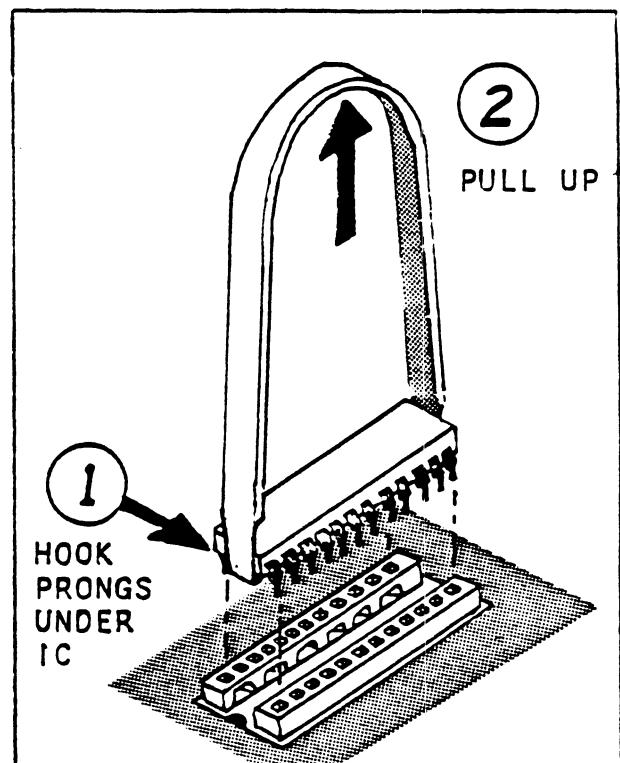
REMOVE CPU BOARD (COMPUTERS ONLY)



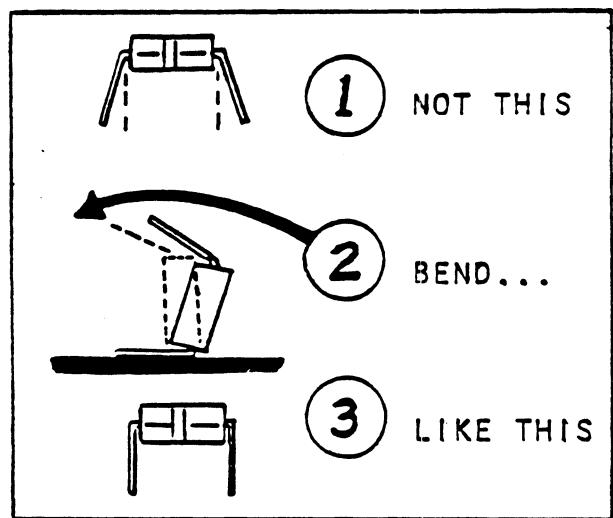
INTEGRATED CIRCUIT HANDLING

Integrated circuits (ICs) are rugged and reliable components, but they can be easily damaged by static electricity or improper handling. Use the following procedures when installing or removing ICs:

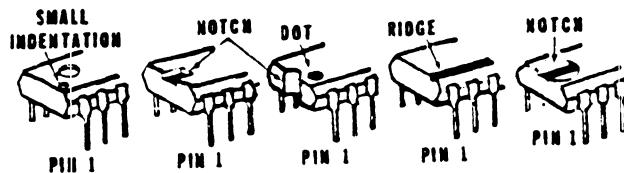
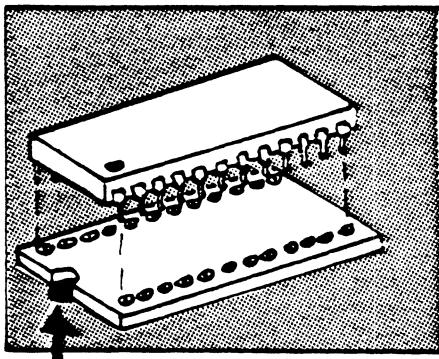
1. Remove the IC with an IC extraction tool (or a small screwdriver). Hook the tool over the ends of the IC and pull straight up, rocking slightly from end to end.
2. Hold on to the IC until it is either replaced on a board or stored safely. ICs can be safely stored in special IC tubes, black conductive foam, or wrapped in aluminum foil.
3. Straighten any bent pins on the IC. The pins should be parallel to each other and at right angles to the case. Some ICs may have their pins spread out slightly (see illustration). If so, align the pins by gently pressing against a table top and bending as shown.
4. When installing the IC, align the notch and/or dot with the index mark on the board (see below). Be sure all the pins enter the holes of the socket, and then press the IC into its socket.



REMOVE THE IC

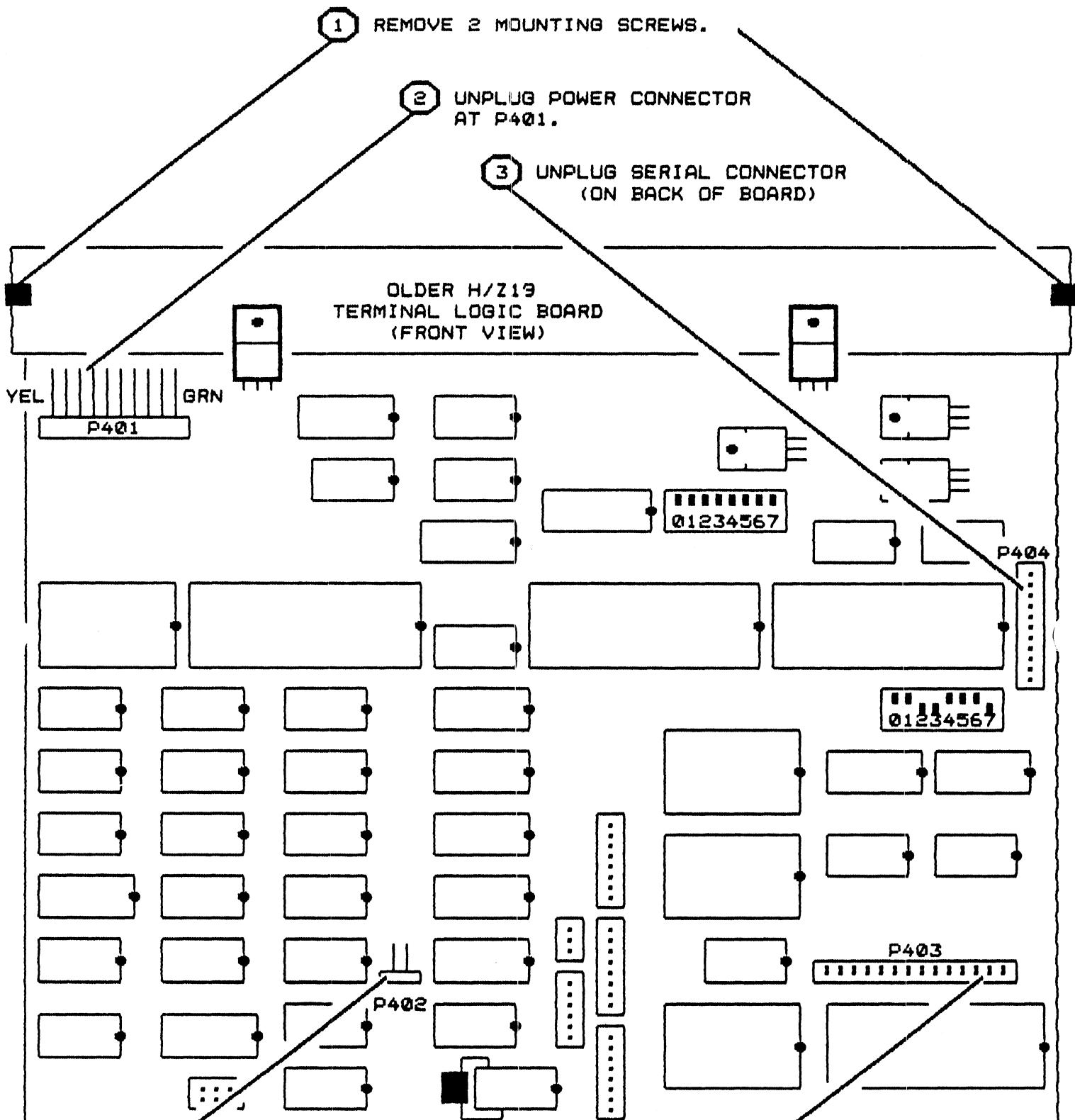


STRAIGHTEN THE LEADS



INSTALL IC WITH PIN 1 END AT INDEX MARK

USE THESE INSTRUCTIONS FOR AN OLDER H/Z19 WITH A 10-HOLE CONNECTOR AT P401.
FOR AN H/Z19A WITH AN 11-HOLE CONNECTOR AT P401, GO TO PAGE 17.



① REMOVE 2 MOUNTING SCREWS.

② UNPLUG POWER CONNECTOR
AT P401.

③ UNPLUG SERIAL CONNECTOR
(ON BACK OF BOARD)

④ UNPLUG SPEAKER CONNECTOR AT P402.

⑤ UNPLUG KEYBOARD CONNECTOR AT P403.

⑥ REMOVE TERMINAL LOGIC BOARD AND LAY ON TABLE.

U451 (TOP VIEW)

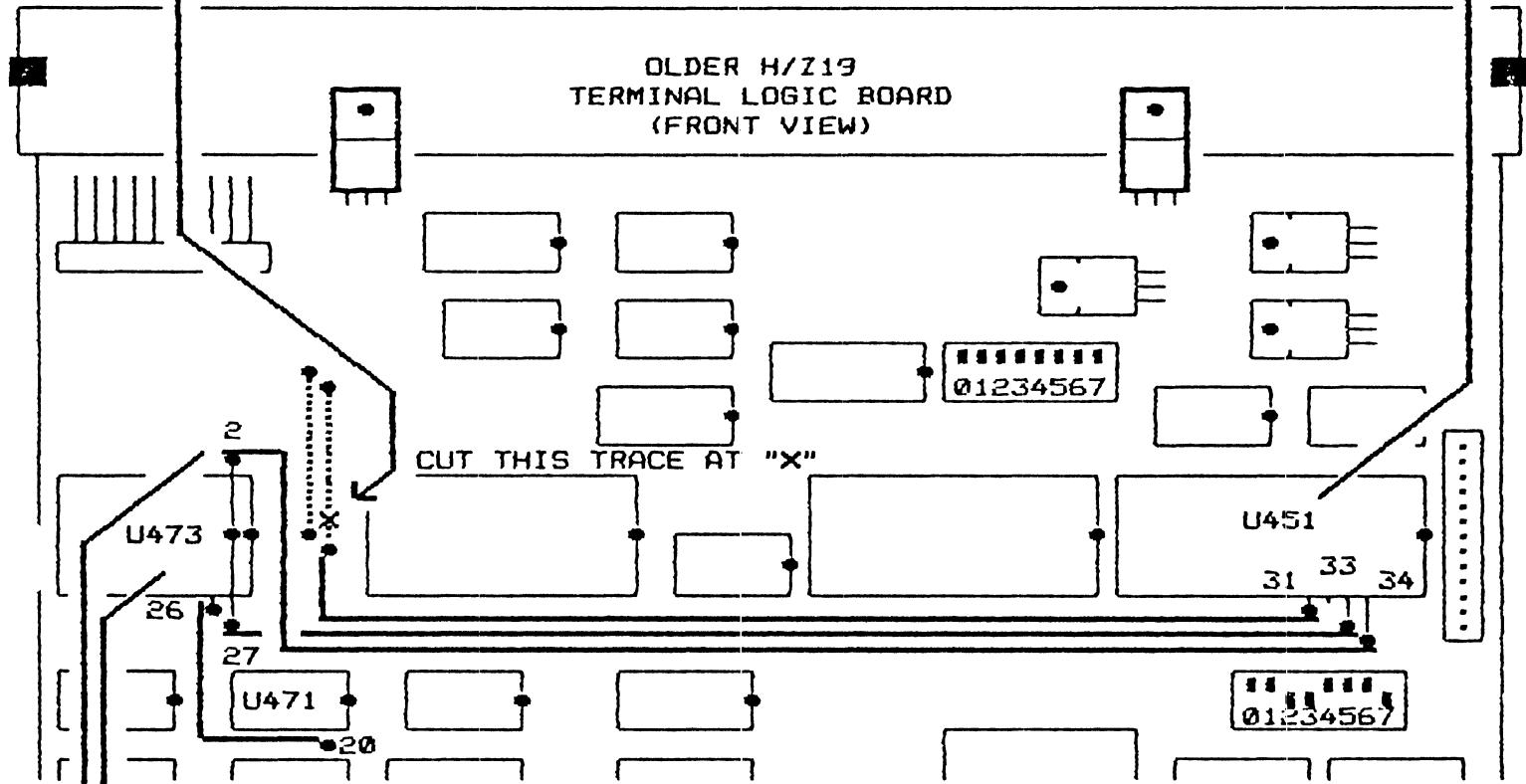
31 33 34

1 REMOVE THE IC AT U451.
BEND OUT PINS 31, 33, AND 34.
REPLACE U451 SO THESE PINS
DO NOT ENTER THE SOCKET.

- 2 A. FIND THE TWO FOIL TRACES JUST TO THE RIGHT OF U473.
CUT THE RIGHT TRACE NEAR THE BOTTOM HOLE AT THE "X".

B. SOLDER A WIRE FROM U451 PIN 31 TO THE HOLE AT THE
LOWER END OF THE TRACE YOU JUST CUT.

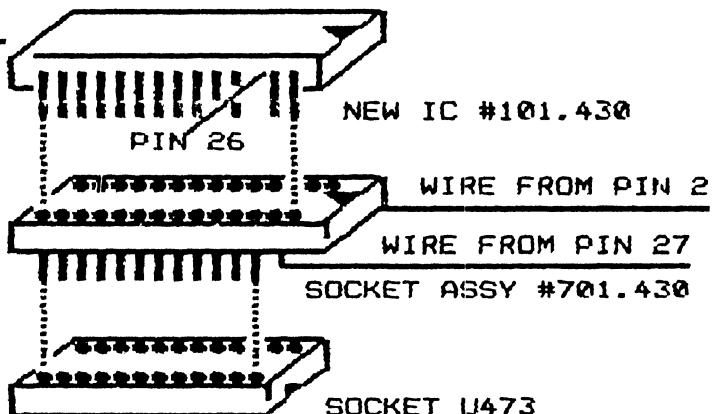
OLDER H/Z19
TERMINAL LOGIC BOARD
(FRONT VIEW)



- 3 A. REMOVE IC #444-29 FROM U473.
B. INSTALL SOCKET #701.430
AT U473. THE SIDE WITH THE
WIRES AND EXTRA PINS GOES
ON THE RIGHT END AS SHOWN.

C. BEND OUT PIN 26 OF THE
"SUPERFONT" IC #101.430

D. INSTALL "SUPERFONT" IC
AT U473 SO PIN 26 DOES
NOT ENTER THE SOCKET.

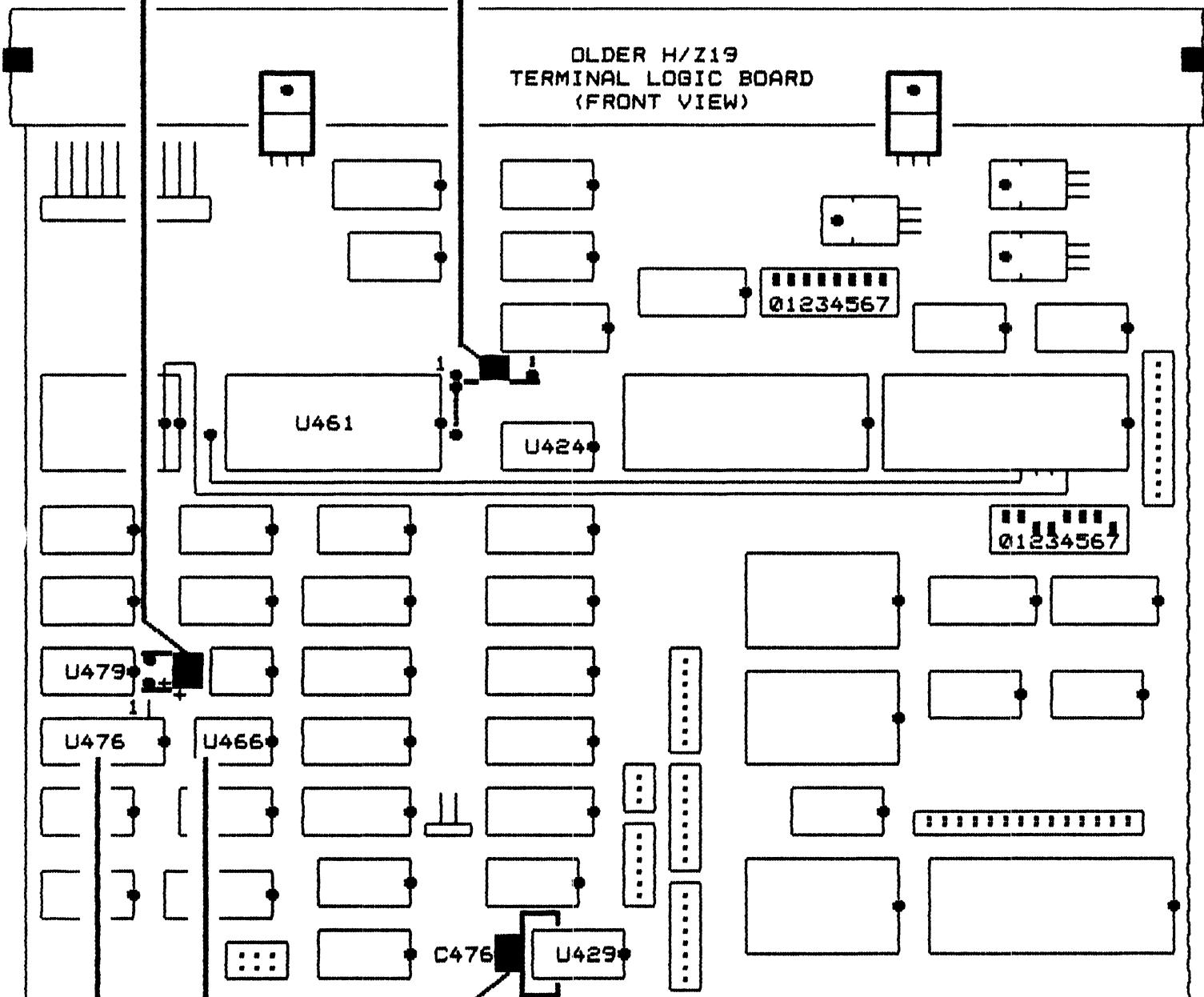


- 4 SOLDER THE WIRE FROM PIN 2 OF SOCKET ASSY #701.430 TO U451 PIN 34.
5 SOLDER THE WIRE FROM PIN 27 OF SOCKET ASSY #701.430 TO U451 PIN 33.
6 SOLDER ONE END OF A WIRE TO THE BENT-OUT PIN 26 OF IC #101.430.
SOLDER THE OTHER END TO THE PLATED-THRU HOLE JUST LEFT OF THE
PRINTED "20" JUST BELOW U471.

1 REPLACE THE CAPACITOR NEAR U479 WITH THE 10UF CAPACITOR SUPPLIED.
THE END MARKED "+" GOES IN THE BOTTOM HOLE, TOWARD U476 AS SHOWN.

- 2 SOLDER A 330PF CAPACITOR INTO THE HOLES SHOWN:
A. THE RIGHT HOLE IS JUST ABOVE THE "U" IN THE SILKSCREENED LEGEND "U424".
B. THE LEFT HOLE (GROUND) IS JUST RIGHT OF THE SILKSCREENED "1" FOR PIN 1 OF U461.

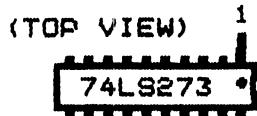
OLDER H/Z19
TERMINAL LOGIC BOARD
(FRONT VIEW)



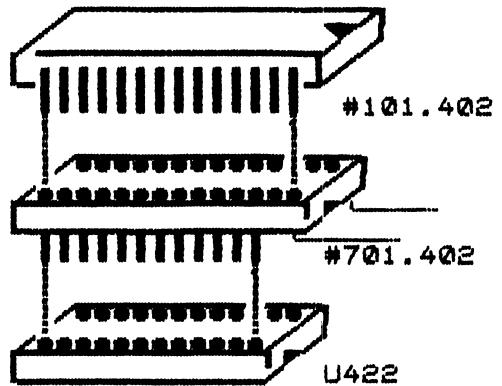
3 LOOK FOR C476 (470 PF; MAY BE ON BACK OF BOARD).
IF FOUND, REMOVE IT.

4 REMOVE THE 74LS00 AT U466. REPLACE IT WITH THE 74F00 SUPPLIED.

5 REMOVE 74L8273 AT U476. BEND OUT PIN 1 AS SHOWN,
AND REPLACE IT SO PIN 1 DOES NOT ENTER SOCKET.

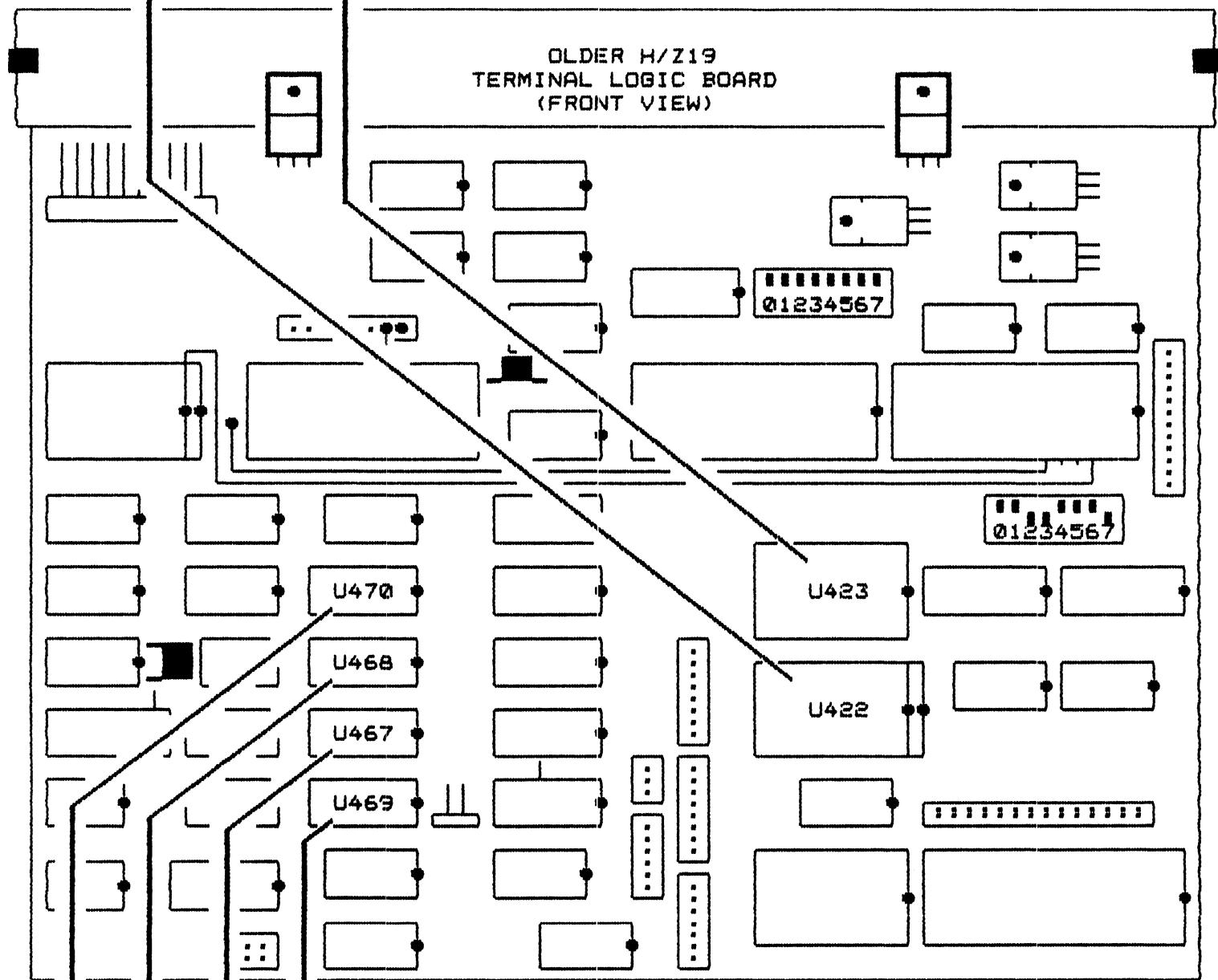


- 1 A. REMOVE 444-46 (OR 444-53) AT U422.
- B. INSTALL SOCKET #701.402 AT U422.
THE END WITH THE EXTRA WIRES
GOES ON THE RIGHT SIDE AS SHOWN.
- C. INSTALL "PROGRAM" IC #101.402
AT U422.



- 2 REMOVE ANY IC AT U423.

OLDER H/Z19
TERMINAL LOGIC BOARD
(FRONT VIEW)

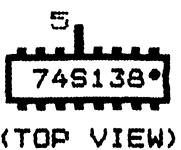


- 3 REMOVE 2114 AT U469. REPLACE WITH 2114C OR 5514.

- 4 REMOVE 2114 AT U467. REPLACE WITH 2114C OR 5514.

- 5 REMOVE 2114 AT U468. REPLACE WITH 2114C OR 5514.

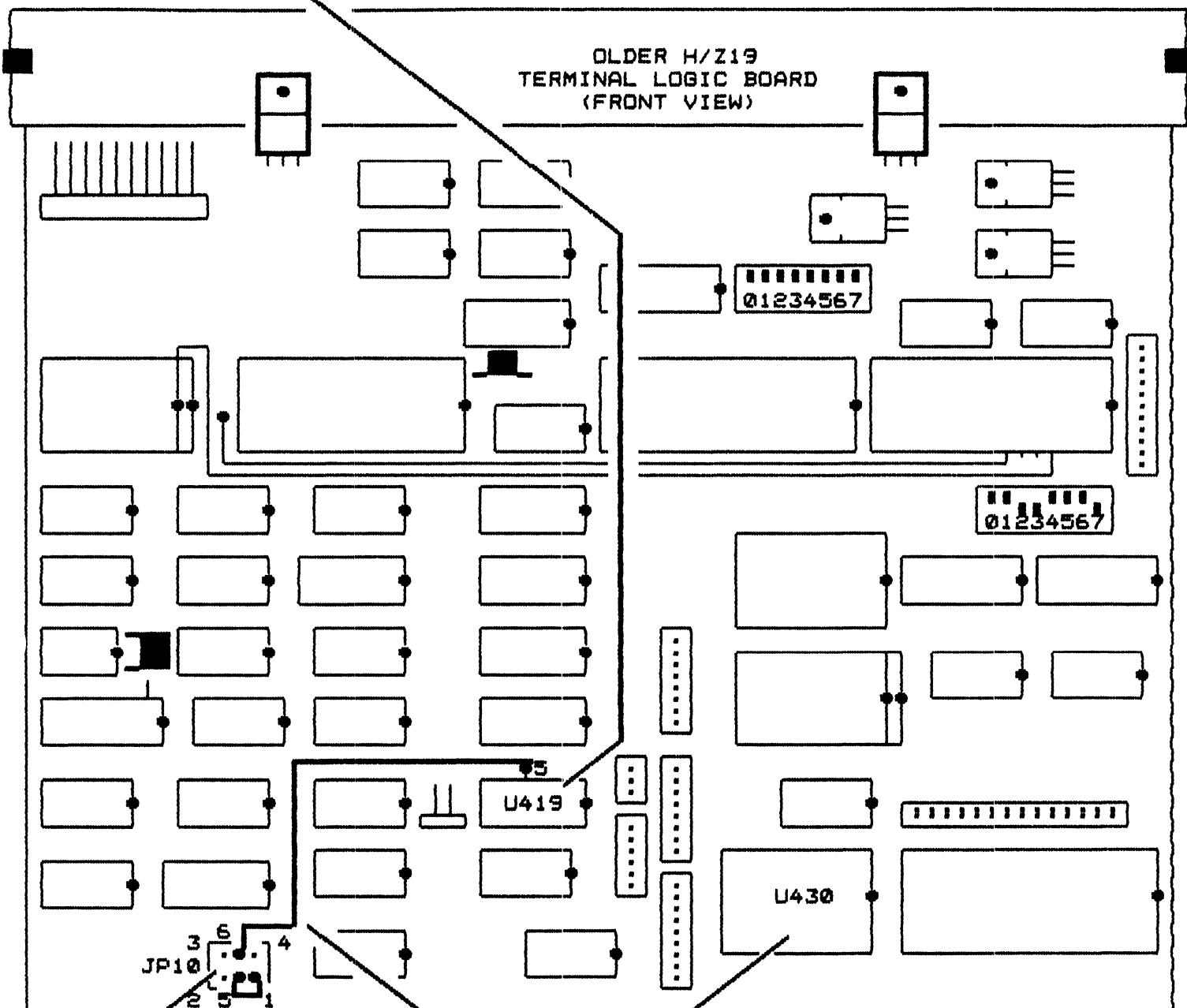
- 6 REMOVE 2114 AT U470. REPLACE WITH 2114C OR 5514.



1 REMOVE 74LS138 AT U419. FIND THE NEW 74S138, AND BEND PIN 5 OUT AS SHOWN. INSTALL IT AT U419 SO PIN 5 DOES NOT ENTER THE SOCKET.

(TOP VIEW)

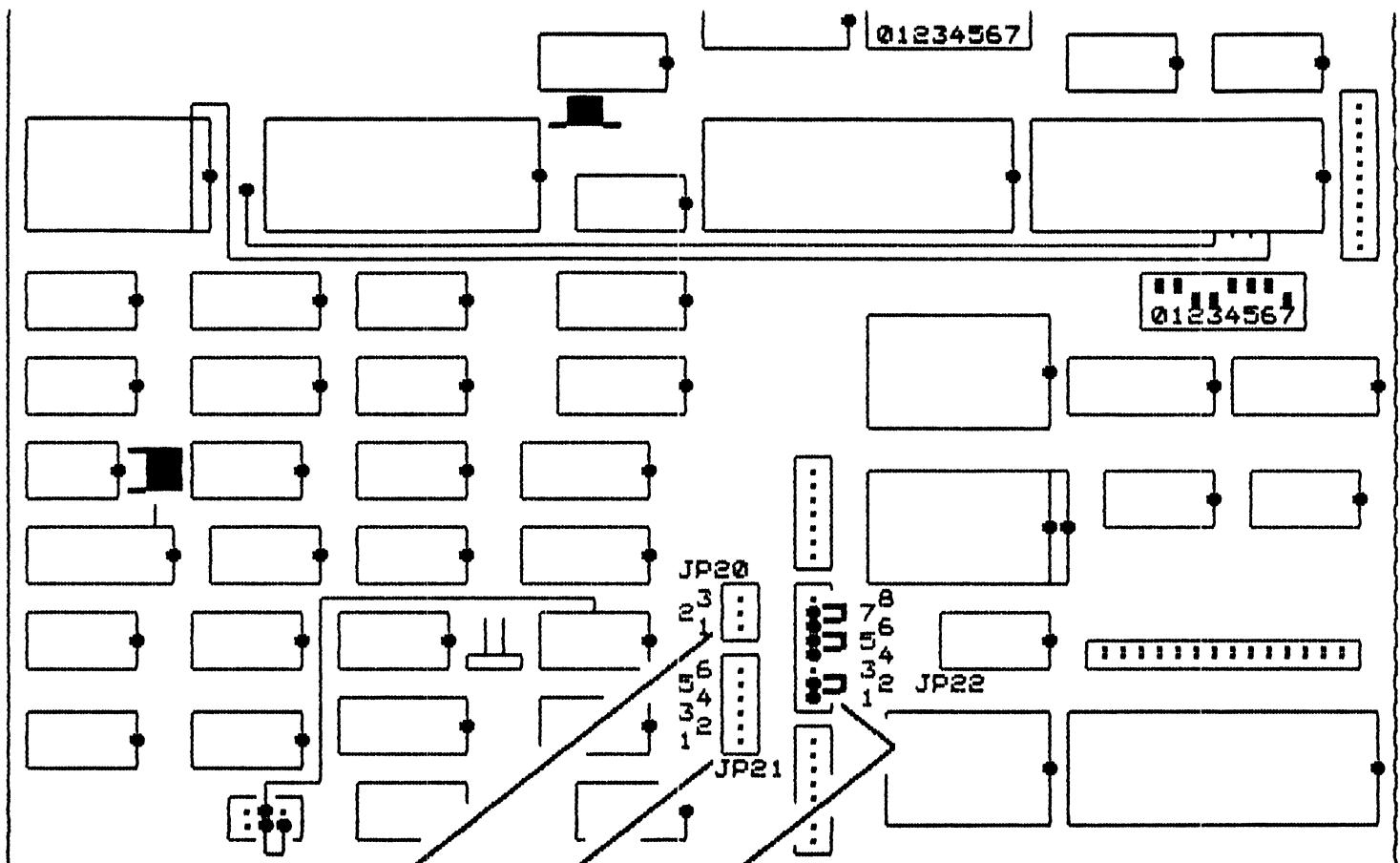
OLDER H/Z19
TERMINAL LOGIC BOARD
(FRONT VIEW)



2 REMOVE 444-37 AT U430. REPLACE IT WITH "KEYBOARD" IC #101.422.

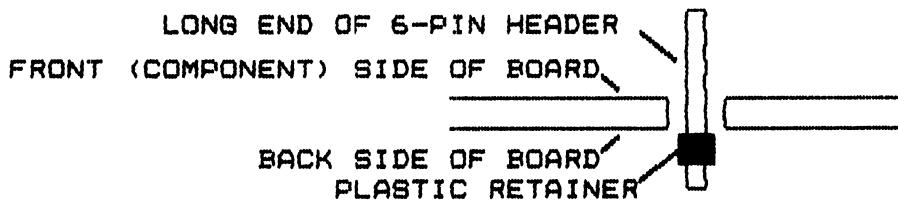
- 3
- SOLDER ONE END OF A 5" PIECE OF WIRE TO PIN 6 OF JP10.
 - SOLDER THE OTHER END OF THIS WIRE TO THE BENT-OUT PIN OF U419 (74S138 PIN 5).
 - POSITION THIS WIRE FLAT AGAINST THE BOARD.

- 4
- CUT AND REMOVE THE CONNECTION BETWEEN JP10 PINS 2-5. THERE MAY BE A PIECE OF WIRE, FOIL ON THE BOARD, OR BOTH.
 - SOLDER A JUMPER WIRE BETWEEN JP10 PINS 1-5.



- ① A. CAREFULLY CUT AND REMOVE ANY JUMPERS BETWEEN JP22 PINS 2-3, 3-4, AND 7-8. THERE MAY BE A PIECE OF WIRE, FOIL ON THE BOARD, OR BOTH.
- B. SOLDER A JUMPER BETWEEN JP22 PINS 1-2.
- C. " " " JP22 PINS 4-5.
- D. " " " JP22 PINS 6-7.

- ② A. CUT AND REMOVE ALL JUMPERS BETWEEN ADJACENT PINS AT JP21.
- B. CLEAR SOLDER FROM THE HOLES WITH THE SOLDER WICK SUPPLIED.
- C. INSTALL A 6-PIN HEADER IN THE HOLES AT JP21 (SEE BELOW). THE PLASTIC BODY GOES ON THE BACK SIDE OF THE BOARD.
- D. SOLDER THE PINS TO THE BOARD FROM THE FRONT SIDE.

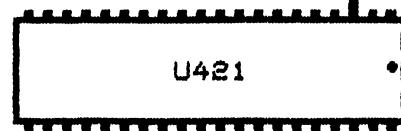


- ③ LIKEWISE, REMOVE ANY JUMPERS AT JP20 BETWEEN PINS 1-2 OR 2-3. SOLDER A 3-PIN HEADER INTO THE HOLES AT JP20.

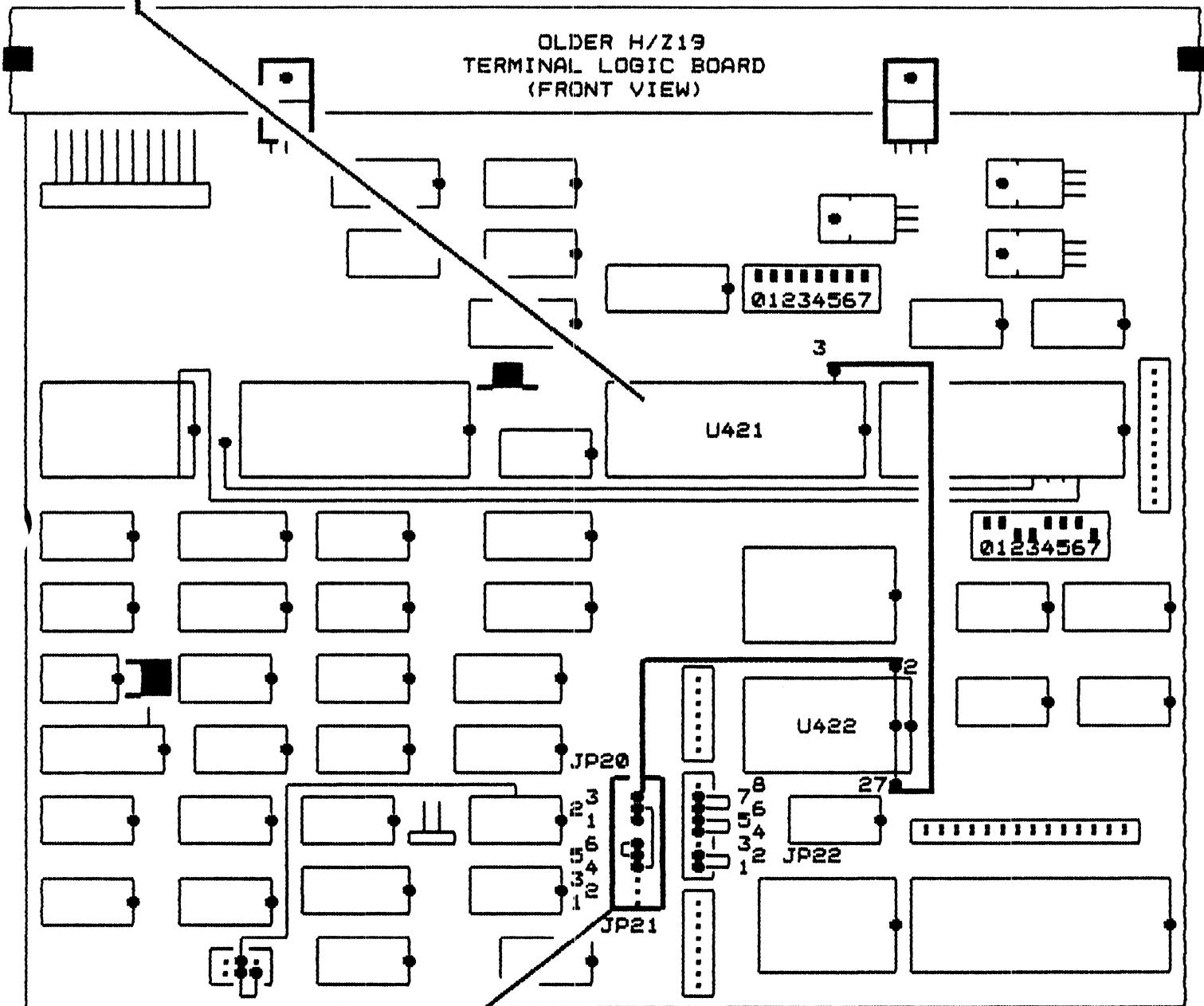
- ④ IF YOU HAVE AN OHMMETER, CHECK TO BE ABSOLUTELY SURE THERE ARE NO SHORTS BETWEEN ADJACENT PINS EXCEPT AS SHOWN ABOVE.

- 1** A. REMOVE THE Z80 IC AT U421, AND BEND OUT PIN 3 AS SHOWN.
 B. INSTALL U421 SO PIN 3 DOES NOT ENTER THE SOCKET.
 C. SOLDER THE WIRE FROM SOCKET U422 TO U421 PIN 3.

3



OLDER H/Z19
TERMINAL LOGIC BOARD
(FRONT VIEW)

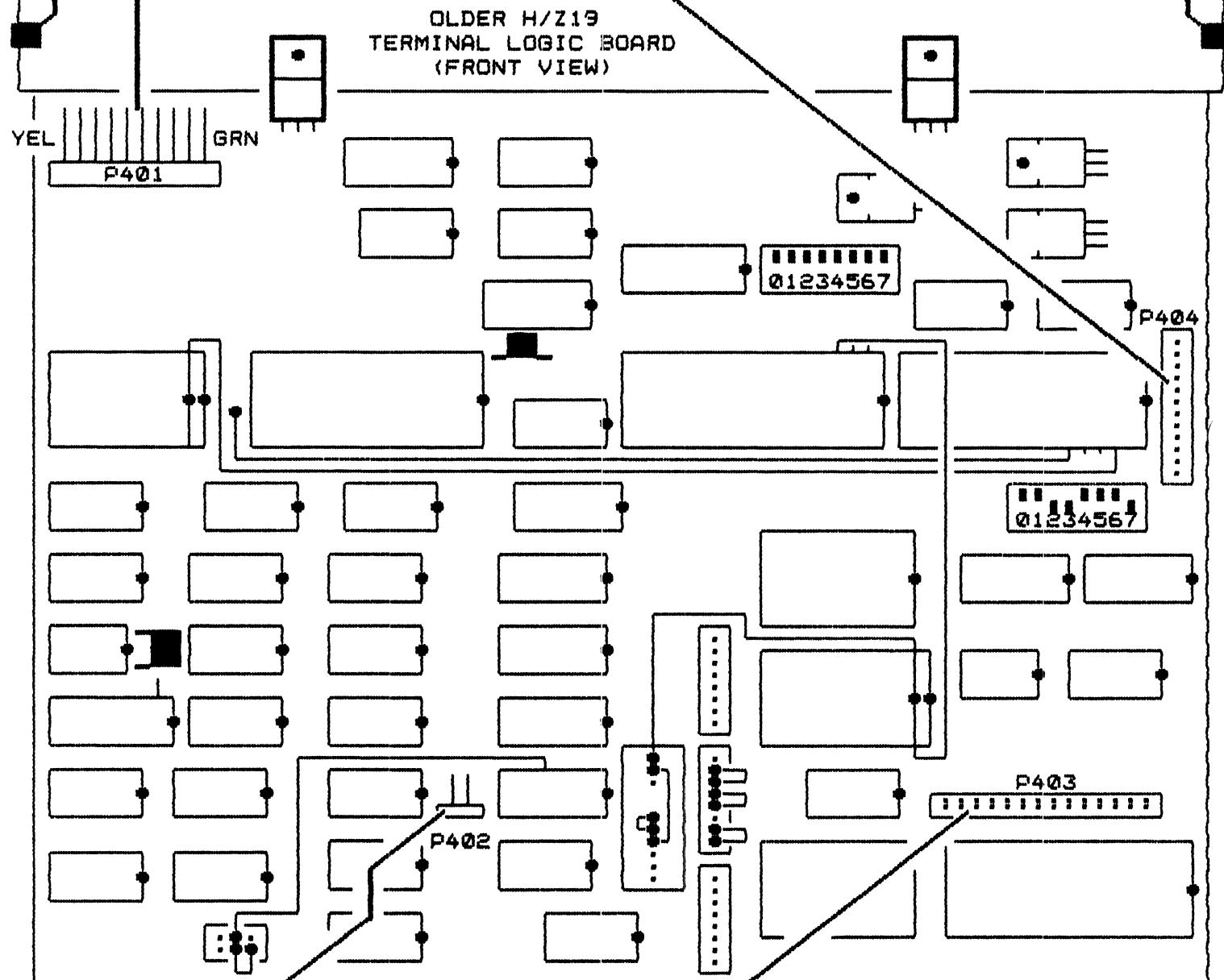


- 2** PLUG THE 10-PIN CONNECTOR FROM SOCKET U422
ONTO JP20 AND JP21 AS SHOWN.

① PUT TERMINAL LOGIC BOARD BACK IN MACHINE.
REPLACE THE MOUNTING SCREWS (1 AT EACH END).

② PLUG POWER CONNECTOR ONTO P401.
BE SURE IT IS NOT OFFSET BY A PIN.

③ PLUG IN SERIAL CONNECTOR P404 (ON BACK).
BE SURE IT IS NOT OFFSET BY A PIN,
AND THE BROWN WIRE IS ON TOP.



④ PLUG IN THE SPEAKER
CONNECTOR AT P402.

⑤ PLUG IN KEYBOARD CABLE AT P403.
BE SURE IT IS NOT OFFSET BY A PIN.

THIS COMPLETES INSTALLATION OF THE "SUPerset".
CHECK YOUR WORK CAREFULLY; THEN GO TO "TESTING", PAGE 24.

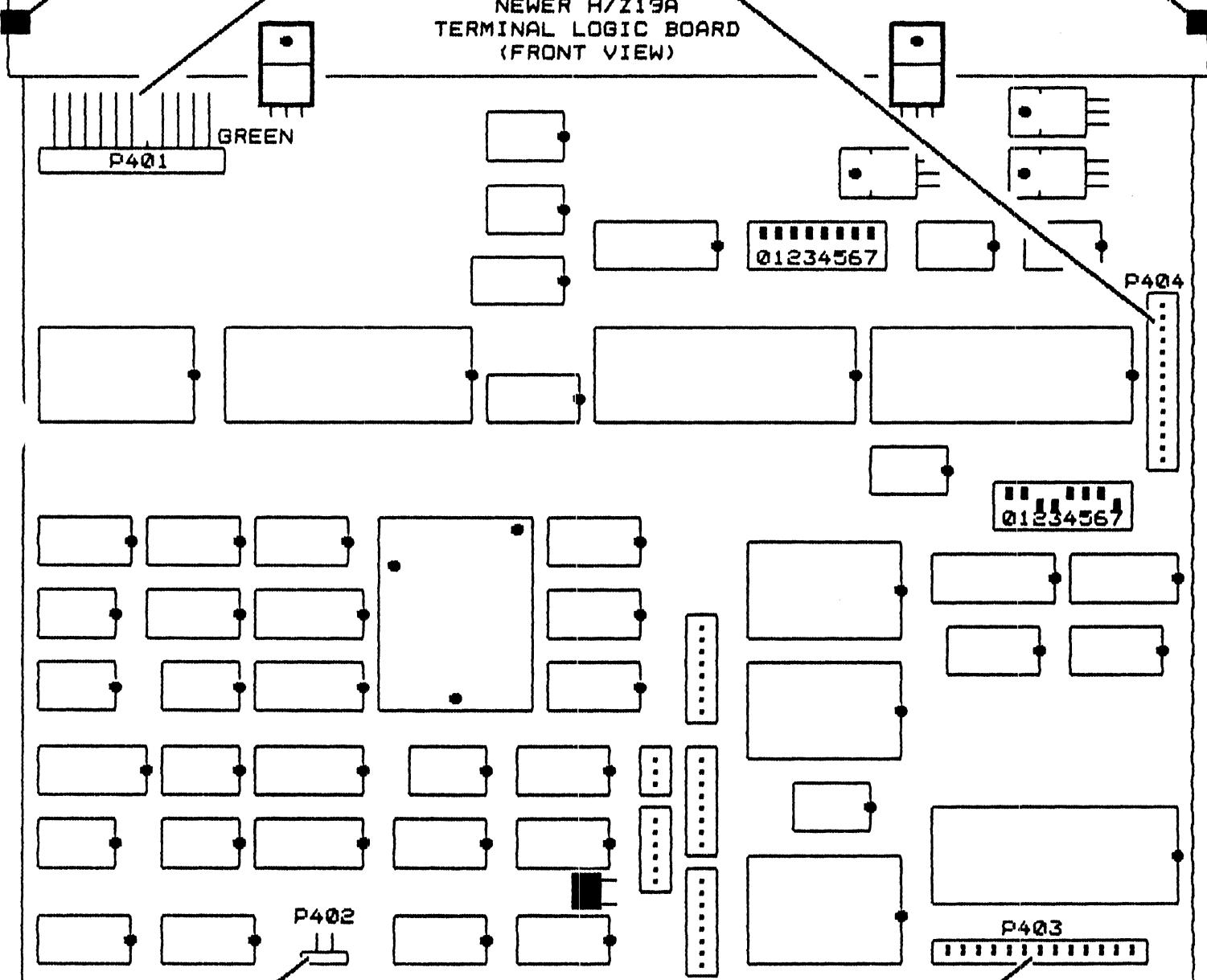
USE THESE INSTRUCTIONS FOR A NEWER H/Z19A WITH AN 11-HOLE CONNECTOR AT P401.
FOR AN H/Z19 WITH A 10-HOLE CONNECTOR AT P401, GO TO PAGE 9.

1 REMOVE 2 MOUNTING SCREWS (ONE AT EACH END),
AND 6 SCREWS ON THE BACK (IF NECESSARY).

2 UNPLUG POWER CONNECTOR
AT P401.

3 UNPLUG SERIAL CONNECTOR
(ON BACK OF BOARD).

NEWER H/Z19A
TERMINAL LOGIC BOARD
(FRONT VIEW)



4 UNPLUG SPEAKER CONNECTOR AT P402.

5 UNPLUG KEYBOARD CONNECTOR AT P403.

6 REMOVE TERMINAL LOGIC BOARD AND LAY ON TABLE.

U452 (TOP VIEW)

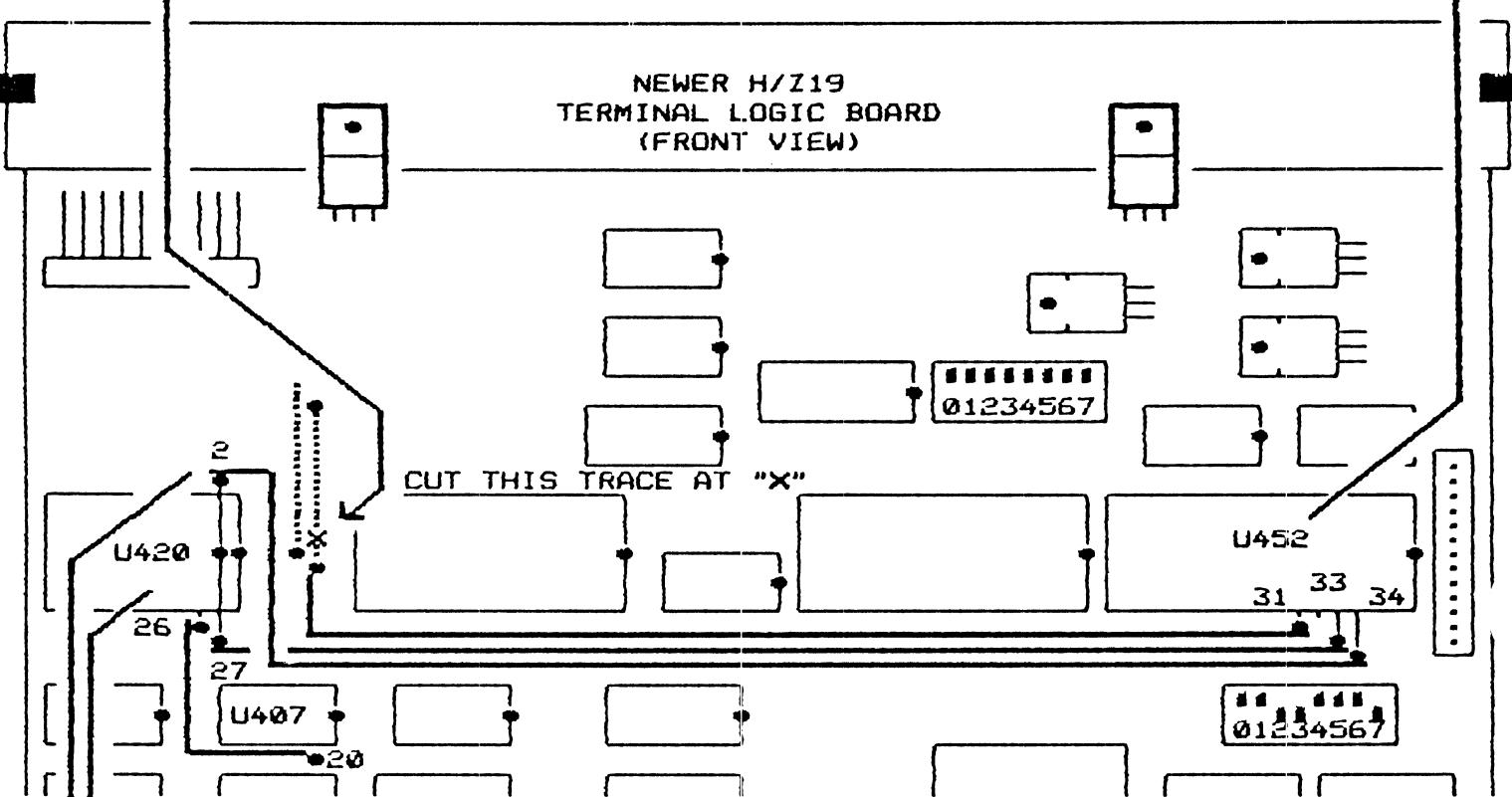
31 33 34

1 REMOVE THE IC AT U452.
BEND OUT PINS 31, 33, AND 34.
REPLACE U452 SO THESE PINS
DO NOT ENTER THE SOCKET.

- 2 A. FIND THE TWO FOIL TRACES JUST TO THE RIGHT OF U420.
CUT THE RIGHT TRACE NEAR THE BOTTOM HOLE AT THE "X".

B. SOLDER A WIRE FROM U452 PIN 31 TO THE HOLE AT THE
LOWER END OF THE TRACE YOU JUST CUT.

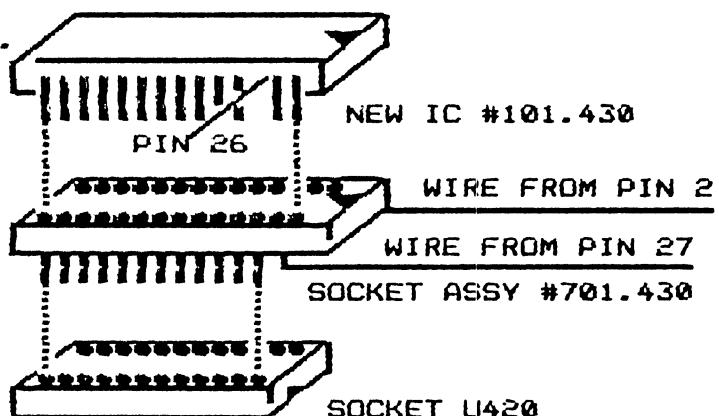
NEWER H/Z19
TERMINAL LOGIC BOARD
(FRONT VIEW)



- 3 A. REMOVE IC #444-29 FROM U420.
B. INSTALL SOCKET #701.430
AT U420. THE SIDE WITH THE
WIRES AND EXTRA PINS GOES
ON THE RIGHT END AS SHOWN.

C. BEND OUT PIN 26 OF THE
"SUPERFONT" IC #101.430

D. INSTALL "SUPERFONT" IC
AT U420 SO PIN 26 DOES
NOT ENTER THE SOCKET.



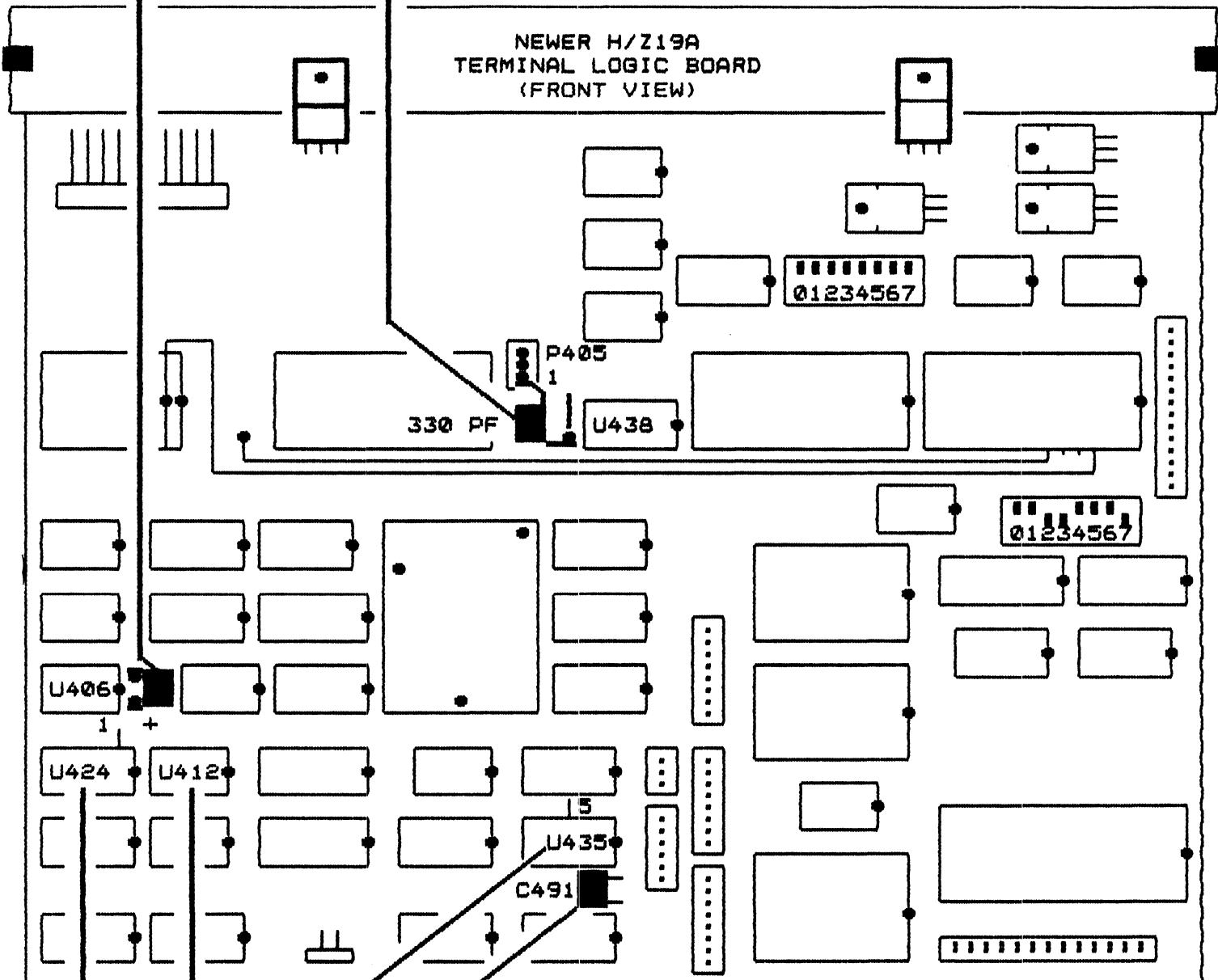
- 4 SOLDER THE WIRE FROM PIN 2 OF SOCKET ASSY #701.430 TO U420 PIN 34.

- 5 SOLDER THE WIRE FROM PIN 27 OF SOCKET ASSY #701.430 TO U452 PIN 33.

- 6 SOLDER ONE END OF A WIRE TO THE BENT-OUT PIN 26 OF IC #101.430.
SOLDER THE OTHER END TO THE PLATED-THRU HOLE JUST LEFT OF THE
PRINTED "20" JUST BELOW U407.

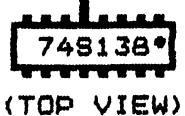
1 REPLACE THE CAPACITOR CLOSEST TO U406 WITH THE 10 UF PART SUPPLIED. THE END MARKED "+" GOES IN THE LOWER HOLE, TOWARD U424 AS SHOWN.

- 2 SOLDER A 330 PF CAPACITOR INTO THE HOLES SHOWN:
A. THE RIGHT END GOES INTO HOLE 1 OF P405.
B. THE OTHER END GOES TO THE HOLE JUST LEFT OF THE SILKSCREENED LEGEND "9" NEAR U438.



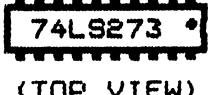
1 REMOVE THE 470 PF CAPACITOR AT C491.

2 REMOVE 74LS138 AT U435. FIND THE NEW 74S138, AND BEND OUT PIN 5 AS SHOWN. INSTALL IT AT U435 SO PIN 5 DOES NOT ENTER SOCKET.



(TOP VIEW)

3 REMOVE THE 74LS00 AT U412. REPLACE IT WITH THE 74F00 SUPPLIED.

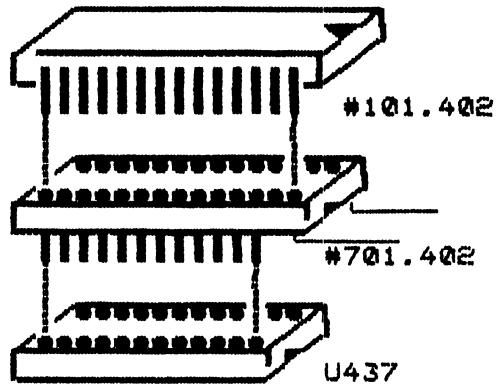


(TOP VIEW)

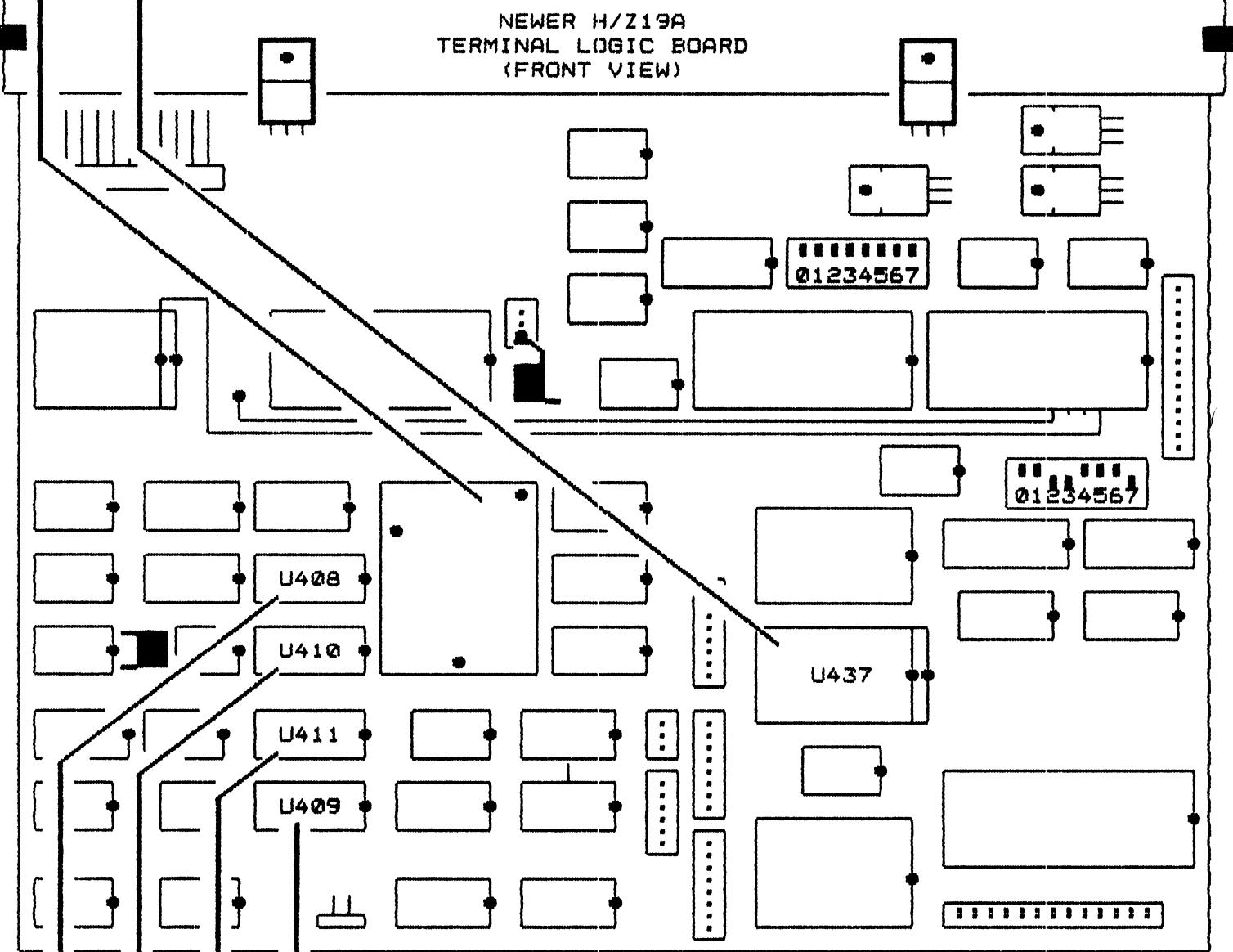
4 REMOVE THE 74LS273 AT U424. BEND OUT PIN 1 AS SHOWN, AND REPLACE IT SO PIN 1 DOES NOT ENTER THE SOCKET.

1 REMOVE THE 3 SCREWS, AND THE METAL SHIELD OVER ICS U426 AND U427.

- 2 A. REMOVE IC #444-46 AT U437.
B. INSTALL SOCKET #701.402 AT U437. THE END WITH THE EXTRA WIRES GOES ON THE RIGHT SIDE AS SHOWN.
C. INSTALL "PROGRAM" IC #101.402 AT U437.



NEWER H/Z19A
TERMINAL LOGIC BOARD
(FRONT VIEW)



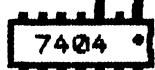
3 REMOVE 2114 AT U409. REPLACE WITH 2114C OR 5114.

4 REMOVE 2114 AT U411. REPLACE WITH 2114C OR 5114.

5 REMOVE 2114 AT U410. REPLACE WITH 2114C OR 5114.

6 REMOVE 2114 AT U408. REPLACE WITH 2114C OR 5114.

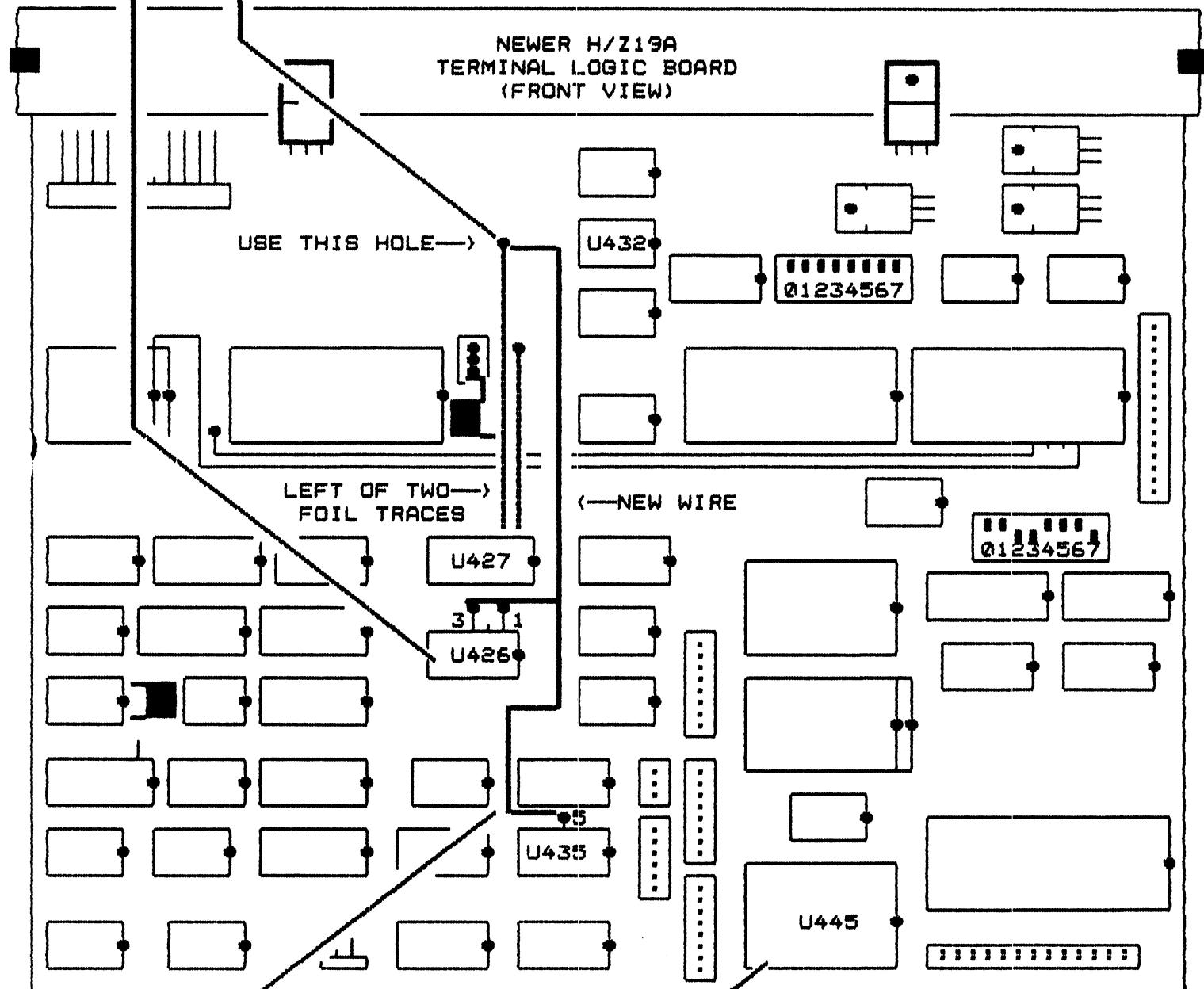
3 1



(TOP VIEW)

- 1 REMOVE THE 7404 AT U426. BEND OUT PINS 1 AND 3 AS SHOWN. REPLACE THE 7404 SO PINS 1 AND 3 DO NOT ENTER THE SOCKET.

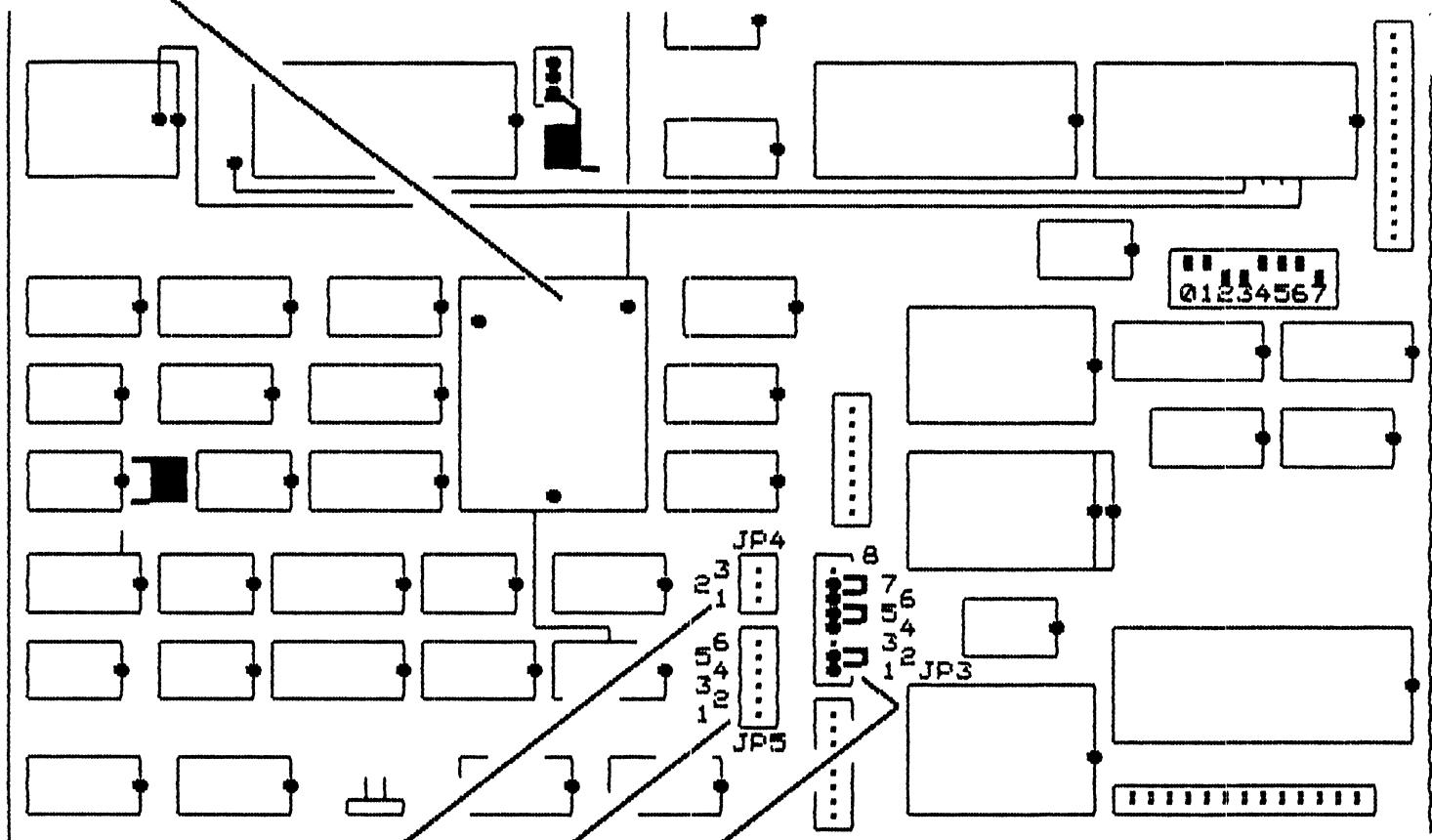
- 2 FIND THE TWO FOIL TRACES COMING OUT FROM UNDER U427.
FOLLOW THE LEFT TRACE UPWARD UNTIL IT ENDS.
A. SOLDER ONE END OF A 4" PIECE OF WIRE INTO THIS HOLE.
B. SOLDER THE OTHER END OF THIS WIRE TO PINS 1 AND 3 OF U426.



- 3 REMOVE 444-37 AT U445. REPLACE IT WITH "KEYBOARD" IC #101.422.

- 4 A. SOLDER ONE END OF A 4" PIECE OF WIRE TO PIN 5 OF U435.
B. SOLDER THE OTHER END OF THIS WIRE TO PINS 1 AND 3 OF U426.

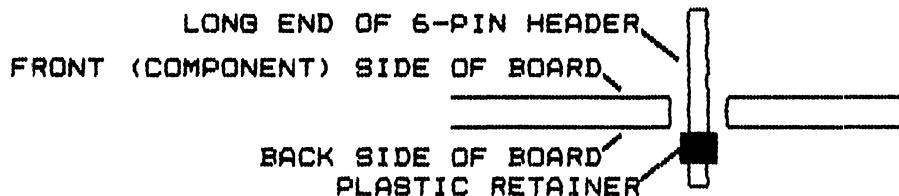
- 1 REPLACE THE SHIELD AND ITS MOUNTING SCREWS OVER U426 AND U427.
BE SURE YOUR NEW WIRES DO NOT TOUCH THE SHIELD.



- 2 CHECK THE JUMPERS AT JP3. IF NOT AS SHOWN:

- CUT AND REMOVE ALL JUMPERS AT JP3.
- SOLDER A JUMPER BETWEEN JP3 PINS 1-2.
- SOLDER A JUMPER BETWEEN JP3 PINS 4-5.
- SOLDER A JUMPER BETWEEN JP3 PINS 6-7.

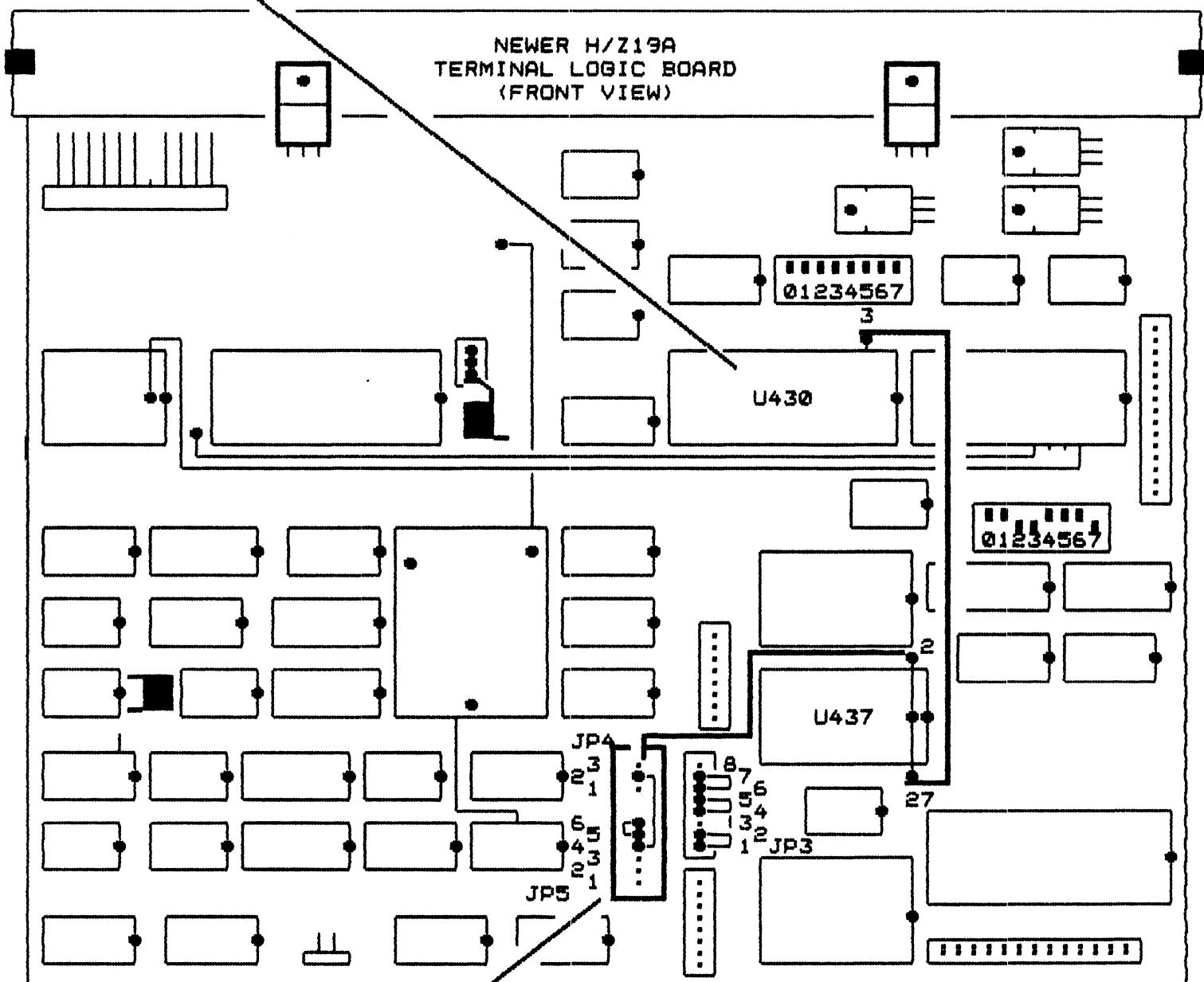
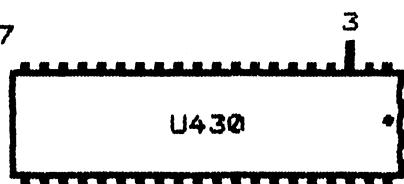
- 3
- CUT AND REMOVE ALL JUMPERS AT JP5 BETWEEN ADJACENT PINS.
 - REMOVE SOLDER FROM THE HOLES WITH THE SOLDER WICK SUPPLIED.
 - INSTALL A 6-PIN HEADER IN THE HOLES AT JP5 (SEE BELOW).
THE PLASTIC BODY GOES ON THE BACK SIDE OF THE BOARD.
 - SOLDER THE PINS TO THE BOARD FROM THE FRONT SIDE.



- 4 LIKEWISE, REMOVE ANY JUMPERS AT JP4 BETWEEN PINS 1-2 OR 2-3.
SOLDER A 3-PIN HEADER INTO THE HOLES AT JP4 AS SHOWN ABOVE.

- 5 IF YOU HAVE AN OHMMETER, CHECK TO BE ABSOLUTELY SURE THERE ARE
NO SHORTS BETWEEN ADJACENT PINS EXCEPT AS SHOWN ABOVE.

- 1** A. REMOVE THE Z80 IC AT U430, AND BEND OUT PIN 3 AS SHOWN.
 B. INSTALL U430 SO PIN 3 DOES NOT ENTER THE SOCKET.
 C. SOLDER THE WIRE FROM SOCKET U437 PIN 27 TO U430 PIN 3.



- 2** PLUG THE 10-PIN CONNECTOR FROM SOCKET U437
ONTO JP4 AND JP5 AS SHOWN.

1 PUT THE BOARD BACK IN THE MACHINE, AND REPLACE THE MOUNTING SCREWS.

2 PLUG THE POWER CONNECTOR ONTO P401.

3 PLUG IN SERIAL CONNECTOR P404 (ON BACK).
BE SURE IT IS NOT OFFSET BY A PIN,
AND THE BROWN WIRE IS ON TOP.

NEWER H/Z19A
TERMINAL LOGIC BOARD
(FRONT VIEW)

P401

GREEN WIRE

P402

P403

4 PLUG IN THE SPEAKER CONNECTOR AT P402.

5 PLUG IN THE KEYBOARD CONNECTOR AT P403.
BE SURE IT IS NOT OFFSET BY A PIN.

THIS COMPLETES INSTALLATION OF THE "SUPERSET".
CHECK YOUR WORK CAREFULLY. THEN GO TO "TESTING", PAGE 25.

TESTING AND REPAIRS

To test your SUPERSET in an H19 or Z19 terminal, assemble everything normally, but leave the top cover open.

If you have an H89 or Z90 computer, you can test your installation before putting the CPU board back. This is done by plugging cable connector J514 (that originally went to P514 on the CPU board) onto P401 of the TLB board instead. There are several possibilities:

- Older H89 or Z90: - P514 and P401 are both 10-pin connectors.
- There is a yellow wire in pin 10 of J513.

THEN: - Plug J513 directly onto P401.

- Newer H89-A or Z90-A: - P514 and P401 are both 11-pin connectors with one pin removed or blocked.
- There is no wire in pin 11 of J513.

THEN: - Remove the shielded wire from pin 11 of the 6" cable that connected P401 to P513, and plug this wire into pin 11 of J513.
- Plug J513 directly onto P401.

- All other cases: - P514 and P401 have different numbers of pins, or special CPU or graphics boards are installed.

THEN: - Install the CPU board normally. You could rearrange the wires at J513 for testing, but it's more trouble than it's worth.

- It is OK to leave the I/O and accessory cards unplugged while testing the terminal. If you have a Heath/Zenith (or Magnolia) soft-sector disk controller, you won't get the "H:" (or "MMS:") prompt with it removed.

QUICK TESTS

Turn on the terminal (computer). The CRT filament should warm up and glow orange, and you should get a cursor in the upper left corner of the screen. A digital clock/calender will appear in the lower right corner, being updated every second. The rest of the screen should be blank. Push the "OFF-LINE" key so it latches down, and type on the keyboard. It should act like a typewriter; whatever you type appears on the screen.

Type enough characters to fill most of the screen. The "REPEAT" key will help do this quickly. The screen should be rock-stable, and centered vertically and horizontally. If not, adjust the vertical height, vertical linearity, horizontal width, and horizontal centering controls on the video board as necessary (see your Heath/Zenith manuals for details).

Type the alphabet in uppercase letters, and then again in lowercase letters right under it. Now type "ESC F" and re-type the lowercase letters again. They should display as the standard Heath graphics characters. There are two exceptions: The graphic "j" (which used to be +) is now * like the Z29 and Z100; and the graphic "g" (which was the _ sign) is now # the 1/4-dot fill symbol.

Now type "ctl-ESC" (short for hold down the CTRL key and then hit ESC). A menu should appear on the right side of the screen. The screen should be stable, with no trace of flicker or instability. You can page through the menus by hitting any key on the numeric keypad.

Select an item in the menu by typing the appropriate key (upper/lower case matters). For instance, step to "MAIN MENU 1". Type a lowercase "h" for the "set options". The main menu disappears, and the "SET OPTIONS" menu appears. Now type a "5" to select a "white screen" (typewriter "5", not the keypad "5"). The menu disappears, and the screen now displays dark characters on a white background.

You will also see local function keys (in parentheses) in the menus. A local function key is one that takes effect immediately, without requiring the off-line key or menus. Type "ctl-ESC" again to display the menu. Type the "SPACE" bar to select the "character set" menu. Note that you can select the GT-PROM character set with either "L" or local function key "ctl-f3".

Type "ctl-f3" (hold down CTRL and then hit the "f3" key). This selects the GT-PROM character set, which has bolder text characters, and different graphics characters. Now try "ctl-f2" for the VT-100 set. Here you will find thin-line graphics plus special symbols for CR, LF, VT, etc. Now hit "ctl-f4" to select the special character set, which contains Greek letters and math symbols. Last, type "ctl-f1" to return to the standard Heath set.

Hold down the "LINE FEED" and "REPEAT" keys. The text should scroll quickly off the top of the screen, leaving it blank. Type some more characters, and then hit the right "SHIFT" and "RESET" keys. The screen should be instantly erased, but the clock and calendar stay valid.

If no problems are encountered, your installation was a success! If you have any problems, turn off the power and recheck your work carefully. Look for ICs installed backwards or missing, ICs that get "hot", connectors installed wrong, etc. If you can't find the problem, check the list of possible problems below.

IN CASE OF DIFFICULTY

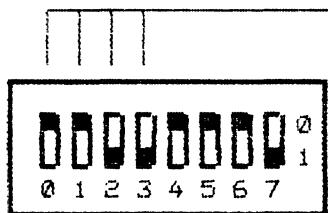
1. Random characters on screen when first turned on, or while right-shift-RESET are depressed, but OK after reset.
 - Occurs in very old H19s; looks odd, but not a problem.
2. Everything works, but the black "dashes" are still present.
 - Pin 1 of the 74LS273 is still in its socket. Bend it out so it doesn't touch anything. In rare cases, you may have to add a wire between pin 1 and +5 volts.
 - Pin 5 of the 74S138 not connected correctly.
3. Everything works, but I get white "dashes" as I type.
 - The wiring to pin 5 of the 74S138 is wrong. Check, and fix.
4. Menus don't appear when I type ctrl-ESC.
 - Z80 not running at 3 MHz. Recheck wiring at U426 (newer H19-A) or JP10 (older H19).
 - 50/60Hz switch (S402 #7) in wrong position.
 - new keyboard decoder #101.422 not installed.
5. Menus appear, but flicker badly.
 - 330pF capacitor not installed correctly.
 - wiring to pin 5 of the 74S138 is wrong.

6. Completely dead; CRT does not light up, no clicks from keyboard.
 - Connectors P401, P514, or P515 installed wrong.
 - 101.401 Program ROM installed wrong.
 - Program ROM too slow (used original part instead of new one).
 - Jumpers for Program ROM #101.401 wrong. Be sure you found all the old jumpers; sometimes there is both a piece of wire AND foil on the board. Look on BOTH sides of the board. Remove only jumpers between ADJACENT pins, not wiring between non-adjacent pins.
7. As I type, random characters appear anywhere on screen.
 - 470pF capacitor not removed.
 - 74F00 not installed, or in wrong place.
 - 74S138 not installed, or in wrong place.
 - slow or bad 5514 or 2114C video RAMs (or using old 2114s).
8. Random characters appear only on upper (or lower) half of screen.
 - Slow or bad video RAMs. Locate the bad IC by swapping pairs of ICs and see if the problem moves to different regions of the screen.
 - 74F00 not installed correctly.
 - 470pF capacitor not removed.
9. Screen all white; but keys "click" and cursor moves normally.
 - character generator ROM installed wrong.
10. Can't get all 4 character sets, or get them with the wrong ESC sequences.
 - wires from CharGen ROM #101.412 to 8250 (U451 or U452) connected wrong.
11. System OK, then "crashes" (no key clicks, screen freezes). Operation is restored by right-shift-RESET.
 - Loose connections, bad solder joints, and ICs not in their sockets. Flex the board slightly while operating to see if it promotes failures.
 - Slow Z80 (U421 in older H19, U430 in newer H19A). Replace with 4MHz Z80A.
 - Slow 6845 (U461 in H19, U417 in H19A). Replace it with a 68A45 or 68B45.
 - Slow 2112s (U424-U425 in H19, U438-U439 in H19A). Install a faster part, or modify the chip select logic at U419 (H19) or U435 (H19A) as follows:
 - a. Get the old 74LS138; cut off pin 9 close to the case.
 - b. Remove the new 74S138; bend out pins 5,7,9,10,11,12,13,14, and 15.
 - c. Mount 74S138 on top of 74LS138; solder pins 1,2,3,4,6,8, and 16.
 - d. Plug the "piggybacked" pair into socket U419 (H19) or U435 (H19A).
 - e. Solder one end of a short piece of wire to pin 9 of the 74S138.
 - f. Follow the foil trace on the BACK side of the board from pin 9 of U419 (H19) or U435 (H19A) about 2" left to a plated-thru hole. Solder the other end of the wire to this hole.
 - If all else fails, you can run the TLB at 1.5MHz instead. On an older H19, connect JP10 pins 3-6 (instead of JP10 1-5); On newer H/Z19-Aa, don't connect the wire to the plated-thru hole above U427; instead, solder it to U27, pin 12. At 1.5MHz, you will have to stay at 9600 baud, and the menus will not be displayed.
12. Vertical "shake" or "shimmy"; clock runs fast or slow.
 - DIP switch SW402 #7 (50/60 Hz select) in wrong position.
 - 330 pF capacitor not installed correctly.
13. Slight vertical "jitter" in interlace mode.
 - Interlace mode always does this. It is most noticeable with white tubes, fluorescent room lighting, high brightness, and large amounts of reverse video. It's best with a green or amber tube, and reduced brightness levels. The only sure cure is to replace the CRT tube with a longer persistence phosphor.

DIP SWITCH SETTINGS

The functions of switch S401 on the terminal logic board have been altered to accept new baud rates and word lengths. Switch S402 has not been altered, but is included here for completeness. The switches are shown in their normal default positions.

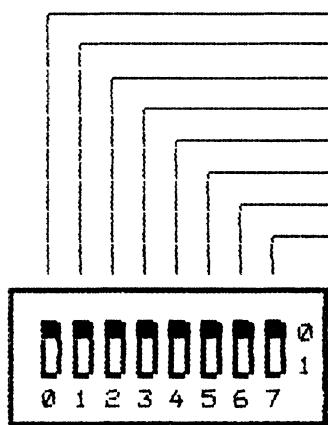
SWITCH S401 - Primary Power-up Configuration



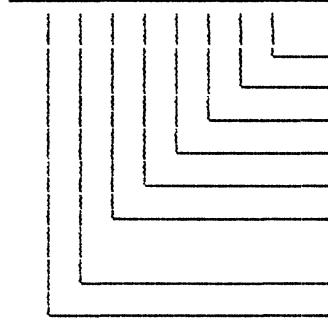
- 0 = Parity disabled
1 = Parity enabled
- 0 = Odd parity
1 = Even parity
- 0 = 8-bit word length
1 = 7-bit word length
- 0 = Half duplex
1 = Full duplex

SWITCH#	BAUD RATE
0 0 0 0	- 75
1 0 0 0	- 110
1 1 1 1	- 134.5
0 1 0 0	- 150
1 1 0 0	- 300
0 0 1 0	- 600
1 0 1 0	- 1200
0 1 1 0	- 1800
1 1 1 0	- 2000
0 0 0 1	- 2400
1 0 0 1	- 3600
0 1 0 1	- 4800
1 1 0 1	- 7200
0 0 1 1	- 9600
1 0 1 1	- 19200
0 1 1 1	- 38400

SWITCH S402 - Secondary Power-up Configuration



- 0 = Cursor is blinking underline
- 0 = Key click enabled
- 0 = Discard characters past end of line
- 0 = no LF on CR
- 0 = no CR on LF
- 0 = Heath/Zenith ESCape sequences
- 0 = Unshifted keypad
- 0 = 60 Hz AC line



- 1 = 50 Hz AC line
- 1 = Shifted keypad
- 1 = ANSI mode ESCape sequences
- 1 = Auto CR on LF
- 1 = Auto LF on CR
- 1 = Wrap characters past end of line
to start of next line
- 1 = Key click disabled
- 1 = Cursor is non-blinking box

OPERATION

This chapter describes the SUPERSET from a user's point of view. I'll assume you're already familiar with normal H/Z-19 operation, and just cover the changes caused by the SUPERSET. If this is a rash assumption, then you should be reading that great American classic, the "owner's manual".

BACKGROUND

The H/Z-19 is an ASCII terminal; it sends and receives data using the American Standard Code for Information Interchange (pronounced "ASS'key"). ASCII defines 128 characters. 95 are "printable"; when received, they print something on the screen and advance the cursor. The other 33 are "control" codes; they aren't displayable, but do cause something to happen. RETURN, LINE FEED, BACKSPACE, DELETE, ESC, and TAB are control codes important enough to have their own keys.

The rest of the control codes are sent by holding down the CTRL key and then pressing A-Z @ [\] ^ or _ . Like the SHIFT keys, CTRL "shifts" the function of other keys. For example, ETX is "End of TeXt", better known to CP/M fans as control-C. To save space, I'll abbreviate this as "ctl-C".

THE KEYBOARD

Every key on the H19 already has an assigned function, so how do you add more? The trick is the CTRL key! Holding down the CTRL key tells the SUPERSET you want to perform a "local function", i.e. send a command directly to the SUPERSET. Here are the local functions:

Local Function	Description
ctl-@, ctl-A thru ctl-Z, ctl-[, ctl-\, ctl-], ctl-^, and ctl-_	send control codes to computer (same as H19)
ctl-ESC	display "Magic Menu" of available functions
ctl-shift-ESC	unlock keyboard
ctl-DELETE	"hard" reset terminal to power-up state
ctl-SCROLL	disables Hold Screen mode
ctl-shift-SCROLL	enables Hold Screen mode
ctl-f1	select H19 character set
ctl-f2	" VT-100 "
ctl-f3	" GT-PROM "
ctl-f4	" Special "
ctl-shift-f1	select H29 character set (with SUPERFONT)
ctl-shift-f2	" VT-100 extended " "
ctl-shift-f3	" APA-Graphics " "
ctl-shift-f4	" IBM PC monochrome " "
ctl-f5	toggle interlace on/off
ctl-shift-f5	" white screen on/off
ctl-BLUE	" transparent screen on/off
ctl-shift-BLUE	" native keyboard on/off
ctl-RED	restore modes (and screen with SUPERCLOCK)
ctl-shift-RED	swap screen with Page 2 (with SUPERCLOCK)
ctl-WHITE	send time to computer
ctl-shift-WHITE	send date to computer

Local function keys ALWAYS work, regardless of the terminal's status or modes. They are not affected by the OFF-LINE key or any of the possible modes (ANSI mode, keyboard status, transparent screen, etc.). They do not send any characters to your computer, except when you specifically ask for it, like "send control code" or "send time".

MAGIC MENUS

Local function **ctl-ESC** displays a series of on-screen "help" menus. The menus list every mode and command that your SUPERSET recognizes. Additionally, you can enter most commands directly from the menus, avoiding the need to go "off-line". This virtually eliminates the need for the plastic "cheat sheet" when trying to use the terminal.

The first **ctl-ESC** shows Main Menu 1: Modes of Operation. Select any mode in the menu by simply typing its corresponding key. Type "F" to enable graphics, for example. Note that upper/lower case matters. The graphics mode is enabled, the menu disappears, and the screen is restored to its previous state.

If you don't want to change anything, just hit RETURN. If the function you want isn't shown, any key on the keypad will advance you to the next page in the main menu. After the last page, the menus start over with the first.

Some functions will call up sub-menus. For example, "r" (set baud rate) displays the baud rate menu. It shows that "L" will select 9600 baud. Type the desired key, or just hit RETURN to exit without changes.

The keys shown in the menus are also the ESC sequences needed to perform the commands. Thus "ESC r L" is also the correct ESC sequence to transmit to the terminal to select 9600 baud.

The "set time", "set date", and "position cursor" commands appear in the menus, but can't be selected from them (you must go off-line, or have them sent by the computer). The ANSI mode can be selected, but ANSI ESC sequences are not shown.

If a command has a local function key, it is shown in parentheses. Local function keys work immediately even while displaying the menus; thus you should not use the **ctl-RED** "swap screen" or it may save a piece of the menu as well!

I call them "magic" menus because they work instantly, and can save/restore the screen without additional RAM. I CHALLENGE you to figure out how I did it!

LOCAL EDITING KEYS

Under most circumstances, you work with the OFF-LINE key up. Keys you type are sent to your computer, but have no direct effect on the screen. The screen only changes if your computer sends characters back to change it. If the program running is pretty smart, that's OK. You can enter data, correct it, and move the cursor around because the program understands how to do it.

But dumb programs don't know how to move the cursor, or do any of the other fancy things a smart terminal can do. This makes such programs harder to use.

Have you ever typed a complex PIP command and hit return, only to find that you left out a period? Have you ever cursed Microsoft BASIC's clumsy line editor? Have you ever wondered why you can't just move the cursor to the error, fix it, and then re-execute the command? Well, that's what local editing lets you do!

If you hold down the CTRL key and hit any key on the numeric keypad, no code will be sent to your computer. Instead, the terminal moves the cursor, or inserts or deletes characters or lines just as if you were using a text editor.

Local Edit Keys	Description
ctl-ERASE	erase screen from cursor position to end
ctl-shift-ERASE	erase entire screen, and move cursor to home
ctl-[(keypad 8)	cursor up
ctl-] (keypad 4)	cursor left
ctl-^ (keypad 6)	cursor right
ctl-\ (keypad 2)	cursor down
ctl-DC (keypd 9)	delete character at cursor
ctl-DL (keypd 3)	delete line at cursor
ctl-IC (keypd 7)	toggle "insert character" mode on/off
ctl-IL (keypd 1)	insert a blank line at cursor
ctl-0 (keypad 0)	type a "0" on-screen
ctl-. (keypad .)	type a "." on-screen
ctl-HOME (kpd 5)	home cursor to upper left corner
ctl-ENTER	move cursor to left end of line
ctl-RETURN	send line from cursor to end, w/o trailing spaces

Suppose you typed the following PIP command and hit return; PIP would respond with the error message:

```
A>pip existing.doc=existingbak<ret>
```

```
CANNOT READ: EXISTINGB
```

```
A>
```

Nuts: You forgot the period between "existing" and "bak". To fix it, type ALL THE FOLLOWING KEYS on the numeric keypad with the CTRL key held down:

1. Move the cursor to the "b" in "existingbak" with the keypad arrow keys.
2. Hit IC (keypad 7) to toggle the "insert character" mode ON.
3. Hit the keypad "." key to insert a period.
4. Hit IC again to toggle the "insert" mode back OFF.
5. Move the cursor back to the 1st "P" in "PIP".
6. Hit ctl-RETURN.

The final ctl-RETURN sends every character from the cursor to the end of the line to your computer, just as if you had typed them all yourself. Trailing spaces are not sent, and a RETURN is sent at the end of the line. PIP will see a perfectly valid command this time, and execute it just fine.

The same holds true for editing a BASIC program on-screen. Suppose you want to copy line 1000 to 2000:

1. Type "LIST 1000" to display the line.
2. Hold down the CTRL key, and move the cursor to the "1" in "1000".
3. Push the OFF-LINE key so it latches down.
4. Type "2" to change the line to "2000".
5. Push the OFF-LINE key so it pops up.
6. Hold down the CTRL, and move the cursor back to the "2" in "2000".
7. Hit ctl-RETURN to send the line to BASIC.

If you list your program, there will be a new line 2000, which is exactly the same as line 1000. Notice you had to go off-line to type the "2". That's because keys in the main keyboard would just send control codes with the CTRL key down. You could just as well LIST a whole subroutine, go off-line and edit it to your heart's content, and then transmit your changes selectively back into BASIC line-by-line. It's complicated to describe, but straightforward to actually do.

While the line is being sent by a **ctl-RETURN**, a 2nd cursor shows the character being sent (though not usually visible at high baud rates). Not all programs can accept data this fast; if you get a long "beeeeeeeep" when you transmit a line, it means somebody can't keep up. Try enabling transmit speed limiting. If that doesn't help, then handshaking is required.

The SCROLL Key

The SCROLL key was pretty useless on a standard H/Z-19. Most of the time it did nothing. If the "Hold Screen" mode was enabled, the SCROLL key was required to allow the screen to scroll.

The SUPERSET fixes this. With Hold Screen mode off (i.e. normal) the SCROLL key alternately sends a **ctl-S**, then a **ctl-Q** (XOFF and XON respectively). In CP/M and HDOS, this alternately starts and stops the display. You can thus "type filename" and use the SCROLL key to start and stop typing text as you read it.

The SCROLL key can get out of sync with the operating system (sends a **ctl-Q** when CP/M was expecting a **ctl-S**, and vice versa). If so, just hit SCROLL a second time. In CP/M for instance, you stop the display with the SCROLL key, then start it again with the **SPACE** bar. The next SCROLL key sends its **ctl-Q**, which is ignored by CP/M because the display was already started. The next SCROLL key again sends **ctl-S** to stop the display.

The Hold Screen mode has also been improved. It is used to prevent received characters from causing the screen to scroll up. Hold Screen mode is enabled by local function key **ctl-shift-SCROLL**.

Hold Screen counts line feeds; if a line feed would cause text to scroll off the top of the screen, the SUPERSET holds the display. It uses handshaking to stop the computer from sending more data. If the clock/calendar is being displayed, the message "SCROLL" appears on the 25th line.

The SCROLL key will allow one more line feed to be received; shift-SCROLL will allow 24 more line feeds. Ctl-SCROLL will disable the Hold Screen mode entirely, so scrolling takes place normally.

Hold Screen mode won't work unless your computer and/or software supports hardware or software handshaking. If it does not, the terminal may appear to "hang up", or sound a continuous "beeeeeeeep".

CHARACTER SETS

The character sets are pretty much self-documenting, but here are some hints. The stock Heath H19 character set has a few improvements. The graphic "j" is now the missing 2x2 checkerboard pattern (like the Z29 and Z100). Graphic "g" is now a 1/4-dot fill (3/4-dot fill in reverse video). This is useful for bar charts and area fills, used by software like Spectre Technologies "Rembrandt".

The SUPERFONT's extended VT-100 set has two novel features. First, the graphics characters actually spell out the names of the ASCII control codes. This is very useful for software debugging when used with transparent mode.

Second, the reverse-video attribute selects double-wide characters; <space> thru <underline> which includes 0-9, A-Z, and most punctuation. Each character has a left- and a right-half. The character itself displays its own left half. The right half is either the lower-case version of the same letter (if ASCII character 64-95, add 32); or a graphic version (if ASCII 32-63, add 64 and enable graphics). Example: "Aa" displays "A"; "5u" with graphics enabled is "5".

The IBM PC set emulates the monochrome display adapter (not the more common color/graphics adapter). It combines text, Greek letters, and line graphics all in the same set. It lets you run the H19 as a "slave" on a multi-user PC, or on an H-1000 to improve PC compatibility. It forms nice looking characters in a 7x9 dot matrix instead of 5x7, and is "bolder" because it uses dot pairs.

The APA graphics set has no text characters, so it looks bizarre without special software. But resolution is adequate for a 40-character x 16-line text display (or 60 characters with a proportional font). I would dearly love to get someone to write a text/graphics editor to use it.

The bits are mapped in a 4-high by 2-wide matrix. Look at the hex value of the ASCII character received; the high digit is the left 4 bits, and the low digit is the right 4. For example, ASCII "A" is 41 hex; the "4" is 0100 binary which defines the left 4 bits. Top bit is off, 2nd from top is on, 3rd and 4th off. The "1" in "41" is 0001, so on the right half of the character only the lower bit is on. ASCII is a 7-bit code, so use reverse video to turn the top-left bit on (which also reverses the rest of the bits, to make life interesting).

SERIAL DATA FORMAT

ASCII is a 7-bit code, while the H8, H89, Z90 etc. are 8-bit computers. The usual solution is to ignore the 8th bit. The computer sets it to zero on characters it sends, and ignores it on those it receives.

The H/Z-19 terminal is normally set for 8-bit data, even though it is not used. On the SUPERSET, the 8th bit can be put to good use. 8-bit data is enabled by setting DIP switch S401 #5 "up" (see "DIP switch settings").

RECEIVE: Characters with their 8th bit set are displayed with the current attribute; in reverse video, blinking, or as a character in an extended set (with SUPERFONT). Control codes with the 8th bit set are displayed as their corresponding graphics character. You can thus display reverse video and graphics without preceding them with an ESC sequence. You can also "type filename.txt" to see if a file (like those created by Wordstar) has characters with the 8th bit set.

In transparent mode, all normal control code processing is suspended, so every 8-bit character received displays a unique character on-screen (1 of 256).

TRANSMIT: The keyboard normally sends only 7-bit data. If the native keyboard mode is enabled, the keyboard sends function keys as a single 8-bit code (see "Native Keyboard Mode" for a list of the actual codes).

Occasionally a program may send characters with the high bit set by accident (or more likely by sloppy design). Such characters will appear in reverse video or graphics. For example, my copy of ZCPR displays the "?" in its error messages in reverse video ("type no-such" displays "NO-SUCH?").

If this is troublesome, set S401 #5 "down" to select 7-bit words. This will force the 8th bit to 0 on all characters received or transmitted.

ESCAPE CODES

This chapter describes the SUPERSET from a programmer's viewpoint. It assumes that you are already familiar with normal H/Z-19 operation, and have a copy of its manuals. Therefore, only new or modified ESCape sequences are described.

CHARACTER SET

Heath: ESC <space> <Code>

ANSI: not available

The H/Z19 has 128 characters (95 alphanumeric and 33 graphic), displayable in normal and reverse video. The SUPERSET expands this to four 128-character sets. Changing sets alters every character on the screen, and all future characters received. The sets only change what you see on the screen; they have no effect on screen dumps or any other terminal operation. The sets are independent of each other and cannot be mixed; for instance, GT-PROM text with H19 graphics.

The H-19 set is selected at power-up or shift-RESET. No other command (including ESC z) alters the selected character set. The ESC sequence is the same as the Super-19 and works with Textpro and other Super-19 compatible software.

Heath: ESC <space> <Code>

<u>Code</u>	<u>Title</u>	<u>Description</u>
D	H-19	Standard H19 text and graphics character set. The : ; . - + and ! are moved slightly to improve appearance when drawing boxes. The + (graphic "j") is replaced by % (same as Z-100), and the _ sign (graphic "g") is replaced by # (1/4-dot fill).
L	GT-PROM	NORCOM "T-PROM" enhanced text character set, which provides a BOLDER display font; and the "G-PROM" enhanced graphic set, which displays dots in a 5x2 cell (though not all combinations).
H	VT-100	DEC VT-100 text characters, with VT-100 "special graphics set". This is a fine-line equivalent to the H19's double-weight line graphics.
P	MATH/GREEK	Modified H/Z text characters, with the Greek alphabet and math symbols as the graphics set.

The character sets are shown in Appendix A. The optional SUPERFONT expands the number of character sets from 4 to 8. Additionally, each of the four new sets has 256 characters instead of 128. The four additional sets are:

C	H29	Heath H29 terminal, which adds super- and subscripts.
G	VT-100+	double-wide characters, displayable control characters.
K	APA-graphics	160w x 100h resolution all-point-addressable graphics.
O	IBM-PC	PC monochrome display adapter character set.

Character set size is set automatically when it is selected; it's not necessary to use an "ESC e" or "ESC s" command (see NORMAL/EXTENDED CHARSET below). When an extended set is selected, the additional 128 characters are accessed by the attribute bit normally used for reverse video (see ATTRIBUTE CONTROL below). "ESC p" causes subsequent characters to be displayed from the upper half of the character set; "ESC q" causes subsequent characters to come from the lower half.

Example:

The following BASIC program writes all of the displayable characters in 1) non-graphic, normal video; 2) graphic, normal video; 3) graphic, reverse video; 4) non-graphic, reverse video. After momentarily pausing, it changes the character set from SPECIAL, to VT-100, to GT-PROM, and exits in the H-19 set.

Notice that the entire screen changes character sets at once; no new characters need to be written. The program ends back in the H19 set.

```
10 E$ = Chr$(27):      REM E$ = <ESC>
15 Print E$;"v";:      REM auto-wrap mode active
20 Print E$;" P";:      REM switch to SPECIAL set
30 Gosub 200:          REM write characters out
40 Print E$;"F";:      REM enter graphics mode
50 Gosub 200
60 Print E$;"p";:      REM enter reverse video mode
70 Gosub 200
80 Print E$;"G";:      REM exit graphics mode
90 Gosub 200
100 Print E$;"q";:     REM exit reverse video mode
110 Gosub 300:          REM pause
120 Print E$;" H";:     REM switch to VT-100
130 Gosub 300
140 Print E$;" L";:     REM switch to GT-PROM
150 Gosub 300
160 Print E$;" D";:     REM return to H19
170 Stop:               REM stop program
180 REM
190 REM Print all displayable characters
200 REM
210 For X = 33 to 128:  REM print all displayable
220   Print Chr$(X);:    REM characters
230   Next X
240 Print: Print:        REM move to next line
250 Return
260 REM
270 REM Pause for a moment
300 REM
310 For X = 1 to 10000
320   Next X:           REM dummy loop for pause
930 Return
940 End
```

NORMAL/EXTENDED CHARSET

Heath: normal 128-char set	ESC a
extended 256-char set	ESC s

ANSI: not available

Use these commands only with the optional SUPERFONT. Normal sets have 128 characters (H19, VT-100, GT-PROM, and Special). The SUPERFONT adds extended 256-character versions (H29, VT-100+, APA-graphics, and IBM-PC respectively).

The command "ESC a" is the default, and selects a 128-character set with the reverse video and blink attribute working normally. "ESC s" selects the corresponding 256-character set. If you were using the H19 set for example, "ESC s" switches to the H29 set, and "ESC a" switches back to the H19.

The upper 128 characters are selected by the attribute bit normally used for reverse video. "ESC p" displays subsequent characters in the top half of the set; "ESC q" displays the lower half. For example, an H19 reverse-video "P" becomes the H29's superscript "P"; a reverse-video "p" becomes a subscript "p".

These commands are Super-19 compatible, and work with software designed for it. If you do not have the SUPERFONT and are running Magnolia CP/M, don't select the extended character set. It will set the DTR line low, and "hang" the system.

ATTRIBUTE CONTROL

Heath: enable attribute	ESC p
disable attribute	ESC q
attribute=blink	ESC x <
attribute=reverse	ESC y <
attributes on	ESC x :
attributes off	ESC y :

ANSI: enable attribute	ESC [7 m
disable attribute	ESC [m or ESC [0 m

An "attribute" affects how a character is displayed. The standard H19 has only one attribute (reverse video), which is always on (available). "ESC p" enables the attribute, so all subsequent characters will be displayed in reverse video. "ESC q" disables the attribute; subsequent characters display in normal video.

The SUPERSET has two attributes; reverse video, and blink. Reverse video is the default attribute, selected by "ESC y <". The blink attribute "ESC x <" causes all characters received between the "ESC p" and "ESC q" to blink between normal and reverse video. This can display a flashing "WARNING" message, for example.

A third attribute is available with the SUPERFONT. The 256-character sets use the attribute to select between the upper and lower halves of the set. "ESC p" displays subsequent characters in the upper 128; "ESC q" displays the lower 128.

The H19 has only one bit of memory per character available for attributes. Thus only one attribute at a time can be active; reverse video, blink, or extended character set. If an extended set is selected with attributes on, characters in the upper half will also be reversed or blinking. The command "ESC y :" turns the reverse video and blink attributes off; "ESC x :" turns them on.

WHITE SCREEN

Heath: white screen	ESC h 5
normal screen	ESC i 5

ANSI: not available

A normal H19 displays bright characters on a black background. Researchers claim that a bright screen with dark characters is more readable and causes less eyestrain. Now you can find out for yourself.

"ESC i 5" is the default, dark background with bright characters. "ESC h 5" selects a bright screen with dark characters. Operation is otherwise unaffected; it has no effect on reverse video or transmit character/line/screen functions.

Note: A properly adjusted H19 looks VERY good. But white screen operation will make any deficiencies in your CRT plainly visible; geometric distortion, power supply ripple, phosphor burns, bad grounding, ringing, etc.

INTERLACE MODE

Heath: interlace	ESC h 9
normal	ESC i 9

ANSI: not available

The H19 normally displays its data using 250 horizontal scan lines, repeated 60 times per second. This is coarse enough that you can see the individual lines making up each character.

Interlace mode doubles this to 499 scan lines, repeated 30 times per second. This improves appearance by "filling in" the gap between scan lines, and is preferred for photographing the screen. The Super-19 command "ESC h 9" enables interlace mode, and "ESC i 9" disables it.

Since interlace mode repeats each screen half as often, a noticeable "flicker" can be observed, particularly with white tubes and high brightness. The flicker is greatly reduced at low brightness levels, and by using a longer-persistence (green or amber) tube.

The SUPERSET's interlace mode is improved over the Super-19 and Ultra-ROM by more accurate timing control. Clock accuracy is unimpaired by interlace mode.

SCREEN-SAVER

Heath: screen-saver on	ESC h :
screen-saver off	ESC i :

ANSI: not available

The screen-saver automatically blanks the screen after 15 minutes of inactivity. This prolongs the life of your display, especially long-persistence phosphors. The screen is restored by receiving any character from the computer, or by hitting any key on the keyboard. The CTRL, left SHIFT, and REPEAT keys are good choices because they don't otherwise do anything by themselves.

ON-SCREEN CLOCK

Heath: set time	ESC X <hh> <mm> <ss> <CR>
	ESC : <hh> <mm> <ss> <CR>
read time	ESC e responds with "<hh><mm><ss>"
	ESC ; responds with "ESC:<hh>:<mm>:<ss>"
display clock	ESC c
no clock display	ESC d

ANSI: not available

A clock is displayed in the lower right-hand corner on the 25th line. The clock keeps 24-hour or 'military' time: midnight is 00:00:00, 3:15 am is 03:15:00, and 7:45 pm is 19:45:00. The clock can be set from the keyboard as follows:

1. press the off-line key so it stays down
2. press the ESC (escape) key
3. press the upper-case X key (shift-X)
4. enter 2 digits for the hour (00-23)
5. enter 2 digits for the minutes (00-59)
6. enter 2 digits for the seconds (00-59)
7. hit the SPACE bar to start the clock
8. press the off-line key so it pops up

The clock stops while the time is entered. The display is updated as you type the hour, minutes and seconds. Any displayable non-digit is ignored, so you can type a colon between the hour, minutes, and seconds; "ESC X 10:30:00" is a valid entry. Any control key aborts the command. Any key after the 6th digit ends the sequence and starts the clock. The SPACE bar was used for convenience.

The commands for setting the clock are shown in the ctl-ESC menus for reference only; you cannot set the time from the menu. However, the clock can be set by the computer. This BASIC line sets the clock to 18:34:00, or 6:34 pm.

```
PRINT CHR$(27);"X183400"
```

The clock is accurate to ± 10 sec/day, and keeps time as long as the terminal is turned on (even through RESET). The optional SUPERCLOCK improves accuracy to ± 1 min/month, and has a battery so the clock stays accurate continuously.

The clock/calendar display can be disabled (for a blank 25th line) by "ESC d", and enabled by "ESC c". The clock need not be disabled to use the 25th line; it is automatically removed when the 25th line is enabled. If the clock is enabled, the clock display will reappear when the 25th line is disabled.

The time can be read regardless of whether it is displayed or not. "ESC e" sends the time in HUG/Watzman format as a 6-digit number; 13:38:47 is sent as "133847". "ESC ;" sends the time in Super-19 format as an ESC sequence with colons; thus 13:38:47 is sent as "ESC:13:38:47". Note that if the computer echoes this sequence to the terminal, it can reset the clock back a second.

You can send the time via local function key "ctl-WHITE". The time is sent with colons, i.e. 13:38:47 is sent as "13:38:47". This lets you insert the time into any text being edited with a single keystroke.

There are no ANSI codes for any of the clock functions.

ON-SCREEN CALENDAR

Heath: set date	ESC ! <mm> <dd> <yy> <CR>
send date	ESC ~ responds with "ESC!<hh>:<mm>:<ss>"
display calendar	ESC c
no calendar display	ESC d

ANSI: not available

The calendar is displayed in the lower right-hand corner on the 25th line, just left of the clock. The commands are the same as the Super-19. The date can be set from the keyboard as follows:

1. press the off-line key so it stays down
2. press the ESC (escape) key
3. press the ! key (vertical bar, or shift-backslash)
4. enter 2 digits for the month (01-12)
5. enter 2 digits for the date (01-31)
6. enter 2 digits for the year (00-99)
7. press the off-line key until it pops up

The display is updated as you type. Until the last digit, any displayable non-digit is ignored, so a slash may be typed between the month, day, and year; thus "ESC ! 12/25/87 <ret>" is a valid entry. Any control key, or the 6th digit typed ends the command.

The command for setting the calendar is displayed by the "ctl-ESC" menus for reference only; you cannot set the date from the menus. However, the date can be set by the computer with this sequence. This BASIC line sets it to 12/25/87:

```
PRINT CHR$(27);!"122587"
```

The calendar displays dates in "American" format; month/day/year. At midnight the day is automatically incremented, although no carry is generated at the end of the month; 2/28/87 increments to 2/29/87, and 12/31/87 goes to 12/32/87. The date is maintained as long as the terminal is turned on (even through RESET).

The optional SUPERCLOCK provides a battery backup so the clock/calendar remains accurate even with the power off. It also keeps a proper calendar, and handles carrys for 28, 29 (leap year), 30, and 31-day months, and years to 1999.

The clock/calendar display can be disabled (for a blank 25th line) by "ESC d", and enabled by "ESC c". The calendar need not be disabled to use the 25th line; it is automatically removed when the 25th line is enabled. If the clock is enabled, the calendar will reappear when the 25th line is disabled.

The calendar can be read two ways, regardless of whether it is currently being displayed or not. "ESC ~" sends the date in Super-19 format, as an ESC sequence with colons. For example, 12:25:87 would be sent as "ESC!12:25:87".

Second, you can send the date via local function key "ctl-shift-WHITE". The date is transmitted with slashes; 12/25/87 is sent as "12/25/87". This lets you insert the date into any text being edited with a single keystroke.

There are no ANSI codes for any of the calendar functions.

HARD/SOFT RESET

```
Heath: reset terminal      ESC z
      set "hard" ESC z      ESC i ;
      set "soft" ESC z      ESC h ;
```

```
ANSI: hard reset terminal  ESC [ z
```

The "ESC z" command resets the terminal to either of two states. A "hard" ESC z resets the terminal to its power-on configuration, as set by the DIP switches. The screen is cleared, the cursor homed, and any characters received during the reset (immediately after the ESC z) are lost. Any baud rate changes are lost. All modes which have no DIP switch setting (reverse video, graphics, interlace, white screen, transmit speed limiting, etc.) are reset. This "hard" ESC z is the default, or is activated by an "ESC i ;" command.

The SUPERSET provides a second set of "software" DIP switches. The configuration can be saved in them at any time by an "ESC R <Fn>" command (see SAVE/RESTORE MODES). The modes saved in these switches are:

```
reverse video: on/off
    graphics: on/off
type of cursor: on/off/steady/blinking/block/underline
    insert mode: on/off
        keyboard: shifted/unshifted/alternate/native
    hold screen: on/off
        key click: on/off
at end of line: wrap/discard
    auto LF on CR: on/off
    auto CR on LF: on/off
    ESC sequences: Heath/ANSI
```

A "soft" ESC z is activated by an "ESC h ;" command. Any subsequent ESC z resets the terminal to the last saved configuration. The screen is cleared and the cursor homed. Characters received during the reset are handled normally. Any modes NOT listed above are left unchanged; baud rate, interlace mode, white screen, transmit speed limiting, character set, attributes, etc.

This is useful for programs like PIE or Textpro that send an "ESC z" when they exit. Setup the SUPERSET in the desired mode; for example white screen, no key click, and a new baud rate. Save this configuration with "ESC R 4", and enable a soft reset with "ESC h ;". Now when the program exits, the SUPERSET will be restored to the desired configuration.

SAVE/RESTORE/SWAP MODES

Heath: restore modes and screen	ESC R 1	(ctl-RED)
save modes and screen	ESC R 2	
restore modes	ESC R 3	
save modes	ESC R 4	
restore screen	ESC R 5	
save screen	ESC R 6	
swap modes and screen	ESC R 7	
swap screen	ESC R 8	(ctl-shift-RED)
swap modes	ESC R 9	

ANSI: not available

Most H19 modes can't be read by a remote computer (graphics on/off, keyboard shifted/unshifted, etc.). A program thus can't make full use of the terminal without destroying its previous configuration. For example, a subprogram may need to interrupt a main program, use the terminal, and then somehow restore the terminal screen and modes to their original state.

The SUPERSET maintains two sets of mode flags. The "ESC R <Pn>" commands allow the two sets of flags to be saved, restored, or swapped internally. <Pn> represents an ASCII digit 1-9 which defines the parameters acted upon. These commands are similar to the Ultra-ROM. See SOFT/HARD RESET for a description of the modes saved and restored.

SAVE/RESTORE SCREEN

Heath: restore modes and screen	ESC R 1	(ctl-RED)
save modes and screen	ESC R 2	
restore modes	ESC R 3	
save modes	ESC R 4	
restore screen	ESC R 5	
save screen	ESC R 6	
swap modes and screen	ESC R 7	
swap screen	ESC R 8	(ctl-shift-RED)
swap modes	ESC R 9	

ANSI: not available

If the SUPERCLOCK is installed, a second page of screen memory is available. The entire screen (including the 25th line, if enabled) can be saved, restored, or swapped with the 2nd page of memory. If the SUPERCLOCK is not installed, the "screen" portion of the command is ignored. The "modes" portion of the command functions as described above.

Local function keys are provided for two of the frequently used options. The ctl-RED key performs a "soft" reset to a previously saved state. Ctl-shift-RED provides a quick way to peek at previously saved data (a "help" screen, disk directory, etc.). The first ctl-shift-RED displays the saved data; a second ctl-shift-RED then restores the original screen.

WINDOWS

Heath: ESC m <topline><leftcol><#lines><#cols><page2line><page2col>

ANSI: not available

If the SUPERCLOCK is installed, a 2nd page of screen memory is available. The "ESC m" command uses it to copy user-defined "windows" between on-screen and off-screen memory. This lets you create your own windows that "pop-up" instantly and restore the screen when done, like the help menus.

"ESC m" defines a window to be swapped between on-screen and off-screen memory. Windows can be anything from a single character to the entire screen. Both on- and off-screen windows are the same size, but need not be in the same positions.

The "ESC m" command is followed by 0 to 6 parameters. A parameter is a printable ASCII character, <space> to <o>, representing a number 1 thru 80 respectively. The same method is used in the "ESC Y <line><column>" cursor position command. All parameters are optional; a <RETURN> or other out-of-range character will end the command early and execute it with defaults for the missing parameters.

CANCEL (ctl-X) aborts without action. If no parameters are supplied ("ESC m <RET>"), the entire screen is swapped with page 2 (including the 25th line, if enabled). This is in effect the same as a swap screen command, "ESC R 8".

The first four parameters define a rectangular region of the main screen. <topline> defines the top line of the window; the default is line 1 (the top line). <leftcol> is the leftmost column of the window; the default is column 1. <#lines> is the height of the window in lines (space=1, !=2, etc.); the default is from <topline> to end of screen. <#cols> is the width in columns (space=1, etc.); the default is from <leftcol> to column 80. If a window is specified past the edge of the screen, the defaults are used.

The last two parameters define the top right corner of an identically-sized region of page-2 memory. <page2line> is the top line; the default is the same line specified by <topline>. <page2col> is the leftmost column; the default is the same as <leftcol>. If the page 2 parameters define a window past the edge of the screen, the defaults are used.

Example 1: Pull-Up Menus

This program displays labels for the function keys on the 25th line. When a function key is hit, a "pull-up" menu appears above the chosen key with additional information.

First, set up a menu screen. The top line of each menu item will become the 25th line, and the text below it will be the pull-up menu. The menus are saved on page 2. To display a menu item, swap it to the screen with an "ESC m ..." command. To restore the screen, the same "ESC m ..." command swaps it back.

Example 2: Moving Objects

"ESC m" commands are normally used in pairs; first to display part of page 2, and second to save it and restore the screen. This is a powerful technique; a "sprite" can be defined on page 2, and moved rapidly across a stationary background. Display it; pause; save it; then repeat with the sprite in a new location. The second example uses this method to show a bouncing "smile" face.

```

10 REM Program to demonstrate pop-up "windows" with the SUPERCLOCK
20 WIDTH 255: ES=CHR$(27): PRINT ES;"p"
30 PRINT ES;"Y1("; f1-FONT      f2-STYLE      f3-MARGINS  ": REM our menu
40 PRINT ES;"Y2("; Select FONT: Select STYLE: Set MARGINS: "
50 PRINT ES;"Y3("; 1-H19      1-normal      1-left      "
60 PRINT ES;"Y4("; 2-VT-100     2-reverse     2-right     "
70 PRINT ES;"Y5("; 3-GT-PROM    3-interlace   3-top      "
80 PRINT ES;"Y6("; 4-IBM PC     4-bottom     "
90 REM
100 PRINT ES;"R6";ES;"E";:           REM save it on page 2, and clear screen
110 PRINT ES;"y1";ES;"x1";:           REM enable and clear 25th line
120 PRINT ES;"m8# H1(";:REM window to 25th line="8" column 4="#" one line=" "
130 REM                               40 cols wide="H" from page2 line 18="1" col 9="("
140 REM
150 PRINT ES;"q";"Hit f1, f2, f3, or control-C to end"
160 AS=INKEY$:IF AS<>CHR$(27) THEN 160:REM wait for an ESC
170 AS=INKEY$:IF LEN(AS)=0 THEN 170: REM then get next key
180 REM
190 ON ABS(ASC(AS)-82) GOTO 220,270,320: REM is it f1,f2, or f3?
200 GOTO 160
210 REM                               display f1 menu
220 PRINT ES;"m4#$-2(";:           REM show 5-line 14-char FONT menu
230 AS=INKEY$:IF LEN(AS)=0 THEN 230: REM wait for a key
240 PRINT ES;"m4#$-2(";:           REM save FONT menu
250 GOTO 160
260 REM                               display f2 menu
270 PRINT ES;"m50#.25";:           REM show 4-line 15-char STYLE menu
280 AS=INKEY$:IF LEN(AS)=0 THEN 280: REM wait for a key
290 PRINT ES;"m50#.25";:           REM save STYLE menu
300 GOTO 160
310 REM                               display f3 menu
320 PRINT ES;"m4>$-2C";:           REM show 5-line 14-char MARGINS menu
330 AS=INKEY$:IF LEN(AS)=0 THEN 330: REM wait for a key
340 PRINT ES;"m4>$-2C";:           REM save MARGINS menu
350 GOTO 160

10 REM display a bouncing "smile" face
20 REM
30 WIDTH 255: ES=CHR$(27): PRINT ES;"j";ES;"H";ES;"F";ES;"p";ES;"R6";
40 PRINT "r      "
50 PRINT " ^ ^ ~ ";               REM display smile face
60 PRINT " eaaaad "
70 PRINT " _      ";ES;"qr";CHR$(13);"_";ES;"G";ES;"k";
80 REM
90 X=32: Y=32: STEPX=4: STEPY=2
100 PRINT ES;"m";CHR$(Y);CHR$(X);#"  ";: REM save face
110 IF LEN(INKEY$)>0 THEN END
120 X=X+STEPX: Y=Y+STEPY:             REM move it
130 PRINT ES;"m";CHR$(Y);CHR$(X);#"  ";: REM display in new spot
140 IF X>103 OR X<33 THEN STEPX=-STEPX: PRINT CHR$(7);
150 IF Y>51 OR Y<33 THEN STEPY=-STEPY: PRINT CHR$(7);
160 GOTO 100:                         REM "bounce" off edges loop

```

The window command takes approximately 30 milliseconds per 2000 characters, allowing 30 complete screen swaps per second. Speed is proportional to the size of the window being swapped, so fast animation is quite practical.

TRANSMIT SPEED LIMITING

Heath: limit speed	ESC h 3
full speed	ESC i 3

ANSI: not available

The SUPERSET normally sends data as fast as the current baud rate allows. When transmitting long strings of characters, this may be too fast for the host computer to keep up. This usually shows up with the Transmit Current Line, Transmit 25th line, Transmit Edited Line, and Transmit Page functions.

The Super-19 command "ESC h 3" limits transmission speed for these commands to 60 characters/sec. Characters are still sent at the full baud rate; idle time is simply inserted between the characters. Transmit speed limiting is disabled (the default) by "ESC i 3". Also see HANDSHAKING to limit speed via hardware handshaking.

TRANSMIT PAGE

Heath: ESC #

ANSI: ESC [p

Transmits lines 1-24 to the computer. A moving cursor indicates the character being sent. If reverse video or graphic characters are encountered, the are preceded by the appropriate Heath or ANSI ESC sequences. A single <return> is sent at the end of the page, and the bell sounds.

Most programs cannot accept such a large block of data at full speed. Transmit page sends at least 1921 characters, and can send up to 19,201 (ANSI mode, with every other character reverse video graphics). If transmit speed limiting is on, transmission is limited to 60 characters/sec. Otherwise the page is sent at the full baud rate, limited only by hardware handshaking.

The following commands will "capture" the screen in a disk file under CP/M. PIP creates the file SCREEN.PIC and then puts everything into it that comes from the console until the final control-Z (end of file).

- | | |
|----------------------------|----------------------------------|
| 1. ctl-ESC h 3 | enable transmit speed limiting |
| 2. PIP SCREEN.PIC=CON: | tells PIP to create |
| 3. ctl-ESC # | tell Superset to transmit screen |
| 4. (wait for final "beep") | screen sent to PIP |
| 5. ctl-Z | tells PIP to end the file |

TRANSMIT 25TH LINE

Heath: ESC]

ANSI: ESC [q

Transmits the 25th line to the computer. A moving cursor indicates the character being sent. Reverse video and graphic characters are preceded by appropriate ESC sequence. A <return> is sent at the end of the line. If the 25th line is disabled, only the carriage return is sent.

If transmit speed limiting is on, transmission is limited to 60 chars/sec. Otherwise the line is sent at the full baud rate, limited only by hardware handshaking.

TRANSMIT EDITED LINE

Heath: ESC ?

(local function ctrl-RETURN)

ANSI: not available

Transmits the characters from the cursor position to the end of the line. Trailing spaces are not sent. A moving cursor indicates the character being sent. Reverse video, blinking, or characters in the upper half of an extended set are sent with their 8th bit high. Graphic characters are sent as their equivalent control code. The line ends with a <return>.

If transmit speed limiting is on, transmission is limited to 60 chars/sec. Otherwise the line is sent at the full baud rate, limited only by hardware handshaking.

This command is useful for performing local editing. For instance, a CP/M command can be re-executed by holding down the control key and moving the cursor back to the first character of the command. Then type ctrl-RETURN to transmit this line to CP/M.

The Transmit Edited Line is also useful when prompting an operator for input. Simply echo every key he types back to the terminal, until a <return>. Then your program moves the cursor to the start of the command and sends "ESC ?" to read the line. This method lets the user edit his input line with not only Backspace, but insert, delete, and cursor controls as well.

TRANSMIT CURRENT LINE

Heath: ESC ^ (last character is the caret, or shift-6)

ANSI: ESC [1 p

The entire line the cursor is currently on is transmitted to the computer. A moving cursor indicates the character being sent. If there are graphics or reverse video on the line, the appropriate escape sequences are also sent. All trailing spaces are sent. The line is ended with a carriage return.

The following are examples of a screen dump program in BASIC. It prints a copy of the screen on your printer (text only; not reverse video or graphics).

for CP/M:

```
100 REM Print Screen using SUPERSET transmit line
110 ES$ = CHR$(27);
120 PRINT ES$;"j";: REM save cursor position
130 PRINT ES$;"H";: REM home cursor to top line
140 FOR L = 1 TO 24: REM loop for 24 lines
150 PRINT ES$;"^";: REM transmit line
160 LS$=INPUT$(80): REM get sent line
170 LPRINT LS$: REM print line out to printer
180 IF I<24 THEN PRINT: REM move cursor to next line
190 NEXT I: REM continue with loop
200 PRINT ES$;"k";: REM put cursor in original position
```

for HDOS:

```
100 REM Print Screen using SUPERSET transmit line
105 OPEN "O",1,"LP;" REM output file #1 is LP.DVD
110 ES$ = CHR$(27);
120 PRINT ES$;"j";: REM save cursor position
130 PRINT ES$;"H";: REM home cursor
140 FOR L = 1 TO 24: REM loop all 24 lines
150 PRINT ES$;"^";: REM request transmit line
160 LS$=INPUT$(80): REM get sent line
170 PRINT #1,LS$: REM print line out to printer
180 IF I<24 THEN PRINT: REM move cursor to next line
190 NEXT I: REM continue with loop
200 PRINT ES$;"k";: REM put cursor in original position
205 CLOSE #1
```

To use these programs as subroutines in your own programs:

1. add '210 RETURN' at the end of the routine.
2. increase the line numbers to a number after the end statement of your program.
3. add 'GOSUB nnnn' in your program where you want to dump the screen. The nnnn represents the first line number of the screen dump routine.

The line is sent at the current baud rate,, which may be so fast that BASIC misses characters. If so, the speed can be slowed down by enabling transmit speed limiting (ESC h 3). The line will then be sent at 60 characters/sec.

TRANSMIT CURRENT CHARACTER

Heath: ESC _ (last character is the underline, shift-dash)

ANSI: ESC [2 p

The character at the current cursor position is transmitted to the computer. If a graphic character, it is transmitted as the corresponding control code. For example a Heath graphic "a" (-) is transmitted as a control-A. If a reverse video character, the character is sent with its 8th bit set.

Examples: The character "A" is transmitted as an ASCII "A" (101 octal, 41 hex). The graphics 'i' (gray box in the H19 character set) is transmitted as a control-I (011 octal, 09 hex). A reverse video "space" (white box) is transmitted as 240 octal, A0 hex.

If the terminal is set to communicate with 7-bit words, it will not be possible to detect reverse video. Also, HDOS and CP/M both remove the 8th bit on received characters. You must either use CP/M's CONIO BDOS function, or read the console UART directly to detect reverse video.

The following BASIC example uses the transmit character function to get a character, in reverse-video or graphics, by-passing the operating system. When it is running, it prints a test line containing graphic characters. With the arrow keys, move the cursor to any location on the screen. Pressing the period key twice prints the character where you left the cursor.

```
10 PRINT "Transmit character at cursor demonstration."
20 PRINT: PRINT "Use the arrow keys to move the cursor"
30 PRINT "to the character you wish to transmit, and"
40 PRINT "press the period ('.') key twice."
41 REM
42 REM shift the keypad
43 REM
50 E$ = CHR$(27);: PRINT E$;"x6";
60 PRINT: PRINT "Test line "E$"Fih~r"E$"G"E$"pX"E$"c";
70 CS = INPUT$(2): IF CS = ".." THEN 90
80 PRINT CS;: GOTO 60
90 REM
91 OUT &0351,0: REM for H89 or H8 with H8-4
92 REM OUT &0373,$025: REM for H8 with H8-5
100 PRINT E$CHR$(95);: REM transmit character
110 REM
111 C=INP(&0350): REM for H89 or H8 with H8-4
112 C=INP(&0372): REM for H8 with H8-5
120 CS=CHR$(C)
130 PRINT E$": PRINT "The Character was ";
140 IF C>127 THEN PRINT E$"p";
150 IF (C AND 127)<32 THEN PRINT E$"F";:C=C+96:CS=CHR$(C);
160 PRINT CS:E$"G"E$"y6": REM clean up
170 OUT &0351,1: REM for H89 or H8 with H8-4
171 REM OUT &0373,&027): REM for H8 with H8-5
180 END
```

SET BAUD RATE

Heath: ESC r <parameter>

ANSI: ESC [<parameter> r

The SUPERSET adds 3 new baud rates to the terminal: 75, 134.5, and 38,400 baud. Note that using a higher baud rate won't necessarily speed up your screen response; a CP/M computer running at 2 MHz only sends about 1,100 characters/sec. The greatest benefit is achieved when the computer is also speeded up.

Heath <u><parameter></u>	Baud Rate	ANSI mode <u><parameter></u>
G	75	0
A	110	1
B	150	2
C	300	3
D	600	4
E	1200	5
F	1800	6
G	2000	7
H	2400	8
I	3600	9
J	4800	10
K	7200	11
L	*	9600 *
M	19,200	13
N	# 38,400 #	14
O	# 134.5 #	15

key: # represents a new baud rate
* represents the standard baud rate

FULL/HALF DUPLEX

Heath: half duplex ESC x >
full duplex ESC y >

ANSI: half duplex ESC [> 14 h
full duplex ESC [> 14 l (last character is lowercase 'L')

This function selects full duplex or half duplex operation. Full duplex is the standard mode used by Heath/Zenith software. In full duplex, keys typed on the keyboard are simply sent to the computer; they do not appear on the screen unless the computer "echoes" them back to the terminal.

Half duplex is sometimes useful when communicating with another system using a modem. In half duplex, each key typed on the keyboard appears on the screen AND is sent to the computer. If the computer echoes the key, it will therefore appear on the screen twice.

HANDSHAKING

```
Heath: disable XON/XOFF    ESC x =
        enable XON/XOFF   ESC y =  
  
ANSI: disable XON/XOFF    ESC [ > 13 h
        enable XON/XOFF   ESC [ > 13 l   (last is lowercase 'L')
```

"Handshaking" lets the terminal and computer warn each other when they aren't ready to receive. The H/Z-19 had XON/XOFF receive handshaking, but it was buggy and seldom used. There was no transmit handshake (no limit on how fast data was sent to the computer), so transmit screen sent data too fast to be useful.

The SUPERSET only needs handshaking to avoid missing received characters while the menus are displayed; for slow commands like save/restore/swap screen; or at 38400 baud with super-fast computers (8MHz H-1000 etc). There is a 128-character input buffer, for data received but not yet processed. If the buffer reaches 80 characters, the SUPERSET tells the computer to stop sending. When it gets below 32, the SUPERSET says to resume sending. If your computer ignores handshaking and the buffer exceeds 128, a long "beeeeeep" warns that characters were lost.

If software XON/XOFF handshaking is enabled (the default), an "XOFF" is sent (ASCII DC3, ctrl-S, hex 13) by the SUPERSET to stop sending, and an "XON" (ASCII DC1, ctrl-Q, hex 11) to start again. This is the method used by CP/M and HDOS.

Many programs don't support XON/XOFF; e.g. in Wordstar, ctrl-S moves the cursor left. For such programs XON/XOFF handshaking can be disabled with "ESC x =". The SCROLL key and hold screen mode still function with XON/XOFF disabled.

signal name	pin	direction	description
DTR Data Terminal Ready	20	output: high	= terminal is on low = terminal is off or disconnected
RTS Request To Send	4	output: high	= terminal is ready to receive low = terminal not ready to receive
DSR Data Set Ready	6	input: high	= enables CTS sensing low = disable CTS (always OK to send)
CTS Clear To Send	5	input: high	= enables terminal to send data low = disables transmission of data

Hardware handshaking is always enabled, but has no effect if not implemented by your computer. The RTS output tells the computer when it can send data. The CTS input tells the terminal when it can send data. To add hardware handshaking to the Heath CP/M BIOS, you must edit BIOS.ASM and create a new BIOS. At the label:

```
CRTOS1: CALL    UOS
        JZ      CRTOSB
        MVI    A,6      (*)      add the lines with the asterisks.
        CALL   PINX    (*)
        ANI    10H     (*)
        JZ      CRTOSB  (*)
```

Rather than add CTS handshaking, you can expand the type-ahead buffer. This lets slow languages like BASIC use "transmit line" without missing keys. Near the end of BIOS.ASM, find the label CRTBUF: and change the value from 40 to 80:

```
CRTBUF: DB      80      (*)      was 40, change it to 80.
```

NATIVE KEYBOARD

Heath: enter ESC x ? (local function ctl-shift-BLUE)
exit ESC y ? (local function ctl-shift-BLUE)

ANSI: enter ESC [> 15 h
exit ESC [> 15 l (last is lowercase 'L')

In this mode each key sends a unique code. The keypad sends control codes with the 8th bit set. Function keys send the code they normally send after ESC, but with the 8th bit set. Switch SW401 #6 must be =0 for the 8th bit to be sent.

	<u>Key</u>	Transmitted Code			
	<u>Pressed</u>	<u>Hex</u>	<u>Octal</u>	<u>Decimal</u>	<u>Explanation</u>
function key:	ERASE	CA	312	202	"J" + 8th bit
	BLUE	D0	320	208	"P" + 8th bit
	RED	D1	321	209	"Q" + 8th bit
	WHITE	D2	322	210	"R" + 8th bit
	f1	D3	323	211	"S" + 8th bit
	f2	D4	324	212	"T" + 8th bit
	f3	D5	325	213	"U" + 8th bit
	f4	D6	326	214	"V" + 8th bit
	f5	D7	327	215	"W" + 8th bit
function key:	shift-ERASE	C5	305	197	"E" + 8th bit
	shift-BLUE	A0	244	164	"S" + 8th bit
	shift-RED	A1	245	165	"X" + 8th bit
	shift-WHITE	A2	246	166	"&" + 8th bit
	shift-f1	A3	247	167	"'" + 8th bit
	shift-f2	A4	250	168	"(" + 8th bit
	shift-f3	A5	251	169	")" + 8th bit
	shift-f4	A6	252	170	"*" + 8th bit
	shift-f5	A7	253	171	"+" + 8th bit
keypad:	0	80	200	128	Control-A + 8th bit
	1	81	201	129	Control-B + 8th bit
	2	82	202	130	Control-C + 8th bit
	3	83	203	131	Control-D + 8th bit
	4	84	204	132	Control-E + 8th bit
	5	85	205	133	Control-F + 8th bit
	6	86	206	134	Control-G + 8th bit
	7	87	207	135	Control-H + 8th bit
	8	88	210	136	Control-I + 8th bit
	9	89	211	137	Control-J + 8th bit
	.	8A	212	138	Control-K + 8th bit
	ENTER	8B	213	139	Control-L + 8th bit
keypad:	shift-0	90	220	144	Control-P + 8th bit
	shift-1	91	221	145	Control-Q + 8th bit
	shift-2	92	222	146	Control-R + 8th bit
	shift-3	93	223	147	Control-S + 8th bit
	shift-4	94	224	148	Control-T + 8th bit
	shift-5	95	225	149	Control-U + 8th bit
	shift-6	96	226	150	Control-V + 8th bit
	shift-7	97	227	151	Control-W + 8th bit
	shift-8	98	230	152	Control-X + 8th bit
	shift-9	99	231	153	Control-Y + 8th bit
	shift-.	9A	232	154	Control-Z + 8th bit
	shift-ENTER	9B	233	155	ESCAPE + 8th bit

TRANSPARENT MODE

Heath: enable	ESC x @	(local function ct1-BLUE)
disable	not available	(local function ct1-BLUE)
ANSI: enable	ESC [> 16 h	
disable	not available	

In transparent mode, every character received produces a unique character on the screen. If a control code, it is displayed as a graphic symbol. If the high bit is set, the character is displayed in reverse video.

This is useful for diagnostic purposes, because it lets you see EVERY code being received by the terminal. Since RETURN and LINE FEED are just another displayable character, you should set the terminal to auto-wrap (ESC v) before entering the transparent mode. Otherwise any characters after the 80th will simply "pile up" at the end of the line.

The symbols displayed for control codes will vary with the character set (see Appendix A). The optional SUPERFONT VT-100+ character set is particularly easy to interpret because it has special graphic symbols for all 33 control codes.

This mode disables ALL (without exception) escape code processing. Since every possible code is displayed, there is no way for the computer to command an exit from this mode. It can only be exited by local function key ct1-BLUE, terminal reset ct1-DELETE, or system reset right-shift-RESET.

If 7-bit words are selected at SW401 #6, the 8th bit will be ignored. CP/M and HDOS also zero the 8th bit before sending a character. So they too will not send reverse video without special software. In CP/M this means using the direct console I/O (CONIO) BDOS call, or sending characters directly to the 8250 UART.

If you enable both transparent screen and native keyboard modes, each key will display a unique character. The f1 key for example sends an "S" with the 8th bit set (B3 hex), which displays a reverse-video "S" if 8-bit words are enabled.

CURSOR TYPES

Heath: cursor off	ESC y 5	
cursor on	ESC x 5	
underline	ESC y 4	
block	ESC x 4	
blink	ESC y ;	
non-blink	ESC x ;	
ANSI: cursor on	ESC [> 5 l	(last is lowercase "L")
cursor off	ESC [> 5 h	
underline	ESC [> 4 l	(last is lowercase "L")
block	ESC [> 4 h	
blink	ESC [> 11 l	(digit "1", digit "1" lowercase "L")
non-blink	ESC [> 11 h	

The standard H19 cursor options include cursor on/off, and block/underline cursor. The SUPERSET adds a blinking/non-blinking option. This provides five possibilities: no cursor, non-blinking block, blinking block, non-blinking underscore, and blinking underscore cursor.

ESCAPE CODE SUMMARY

The following lists all ESCape commands recognized by the SUPERSET. The left column is for Heath/Zenith (VT-52) mode; the right column is for ANSI mode. The symbol "*" identifies new or improved commands.

The ASCII ESCape character (27 decimal, 1B hex, 033 octal) must precede the sequence of characters shown. An ESCape sequence can be aborted by the ASCII CANcel (24 decimal, 18 hex, 030 octal). <parameter> means one of several codes is possible. For ANSI codes, "n" is an optional repetition parameter; it tells how many times the command is to be repeated.

<u>Heath/Zenith</u>	<u>Function</u>	<u>ANSI</u>
<space><set>	* Select character set (Super-19)	
<space>D	* Heath H19 with Z100 extensions	
<space>H	* DEC VT-100 with special graphics	
<space>L	* NORCOM GT-PROM	
<space>P	* special math and Greek	
<space>C	* Heath H29 (with SUPERFONT)	
<space>G	* VT-100 graphics (with SUPERFONT)	
<space>K	* APA graphics (with SUPERFONT)	
<space>O	* IBM PC (with SUPERFONT)	
#	Transmit page	[p or [Op
\$	* shifted BLUE key (Super-19)	* [\$
%	* shifted RED key (Super-19)	* [%
&	* shifted WHITE key (Super-19)	* [&
'	* shifted f1 key (Super-19)	* ['
(* shifted f2 key (Super-19)	* [(
)	* shifted f3 key (Super-19)	* (])
*	* shifted f4 key (Super-19)	* [*
+	* shifted f5 key (Super-19)	* [+]
/K	Response to ESC Z (identify as VT52)	
:hh:mm:ss	* Set clock (Super-19)	
:hh:mm:ss	* response to Super-19 Read clock (ESC ;)	
:mm:dd:yy	* response to Super-19 Read date (ESC ~)	
:	* Read clock (Super-19)	
<	Enter ANSI mode	[?2h
=	Enter Heath/Zenith mode	=
>	Enter alternate keypad mode	>
?	Exit alternate keypad mode	
?<parameter>	* Transmit edited line	
?<parameter>	Output from keypad in alternate mode	O<parameter>
?M	ENTER key	OM
?n	. key	On
?p	0 key	Op
?q	1 key	Oq
?r	2 key	Or
?s	3 key	Os
?t	4 key	Ot
?u	5 key	Ou
?v	6 key	Ov
?w	7 key	Ow
?x	8 key	Ox
?y	9 key	Oy

<u>Heath/Zenith</u>	<u>Function</u>	<u>ANSI</u>
G	Enter insert character mode	[4h
A	Cursor up (n times)	[nA
B	Cursor down (n times)	[nB
C	Cursor right (n times)	[nC
D	Cursor left (n times)	[nD
E	Clear screen (except 25th line)	[2J
E	SHIFT-ERASE key	[J
F	Enter graphics mode	[10m
G	Exit graphics mode	[11m
H	Move cursor to home position	[H or [f
I	Reverse index (reverse linefeed)	M
J	Erase from cursor to end of screen	[OJ
J	ERASE key (unshifted)	[J
K	Erase from cursor to end of line	[K or [OK
L	Insert line at cursor pos. (n times)	[nL
M	Delete line at cursor pos. (n times)	[nM
N	Delete character at cursor (n times)	[nP
O	Exit insert character mode	[4l
R<parameter>	* Save/restore/swap modes (and screen with SUPERCLOCK) R1 * Restore modes (and screen) R2 * Save modes (and screen) R3 * Restore modes R4 * Save modes R5 * (restore screen) R6 * (save screen) R7 * swap modes (and screen) R8 * (swap screen) R9 * swap modes	
P	BLUE key	[OP
Q	RED key	[OQ
R	WHITE key	[OR
S	f1 key (DEC f1 key)	[OS
T	f2 key (DEC f2 key)	[OT
U	f3 key (DEC f3 key)	[OU
V	f4 key (DEC f4 key)	[OV
W	f5 key	[OW
Xhhmmss<RET>	* Set clock. hhmmss=hours,minutes,seconds	
Y<line><col>	Position cursor Line = <space> thru <8> Col=<space> thru <c>	[<line>;<col>f or [<line>;<col>H
Z	Identify as VT52; response is ESC / K	
[Enter hold screen mode	[3h
\	Exit hold screen mode	
]	Transmit 25th line	* [q
^	* Transmit current (cursor) line	[1p
-	* Transmit character at cursor	[2p
a	* Extended 256-character set	
b	Erase from beginning to cursor	[1J
c	* Enable clock display	
d	* Disable clock display	
e	* Send time to host	

<u>Heath/Zenith</u>	<u>Function</u>	<u>ANSI</u>
h<parameter>	* Super-19 set modes h1 * full duplex h2 * hardware handshaking h3 * limit transmit speed h5 * white screen h7 * wrap long lines h9 * interlace on h: * screen saver on h; * enable soft reset (ESC z)	
i<parameter>	* Super-19 reset modes i1 * half duplex i2 * software handshaking i3 * full transmit speed i5 * black screen i7 * discard long lines i9 * interlace off i: * screen saver off i; * enable hard reset (ESC z)	
j	Save current cursor position	[s
k	Restore current cursor position	[u
l	Erase entire line	[2K
m<p1><p2><p3><p4><p5><p6>	Swap Window (SUPERCLOCK) * 0-6 parameters, like ESC Y<Pn1><Pn2> p1 - top line on screen p2 - left column on screen p3 - height in lines p4 - width in columns p5 - top line on Page 2 p6 - left column on Page 2	
n	Cursor position report Heath response is ESC Y<line><col> ANSI response is ESC[<line>;<col>R	[6n
o	Erase from beginning of line to cursor	[1K
p	Enter reverse video mode	[7m
q	Exit reverse video mode	[0m
r<parameter>	Set baud rate r@ * 75 baud * [0r rA 110 baud [1r rB 150 baud [2r rC 300 baud [3r rD 600 baud [4r rE 1200 baud [5r rF 1800 baud [6r rG 2000 baud [7r rH 2400 baud [8r rI 3600 baud [9r rJ 4800 baud [10r rK 7200 baud [11r rL 9600 baud [12r rM 19200 baud [13r rN * 38400 baud [14r rO * 134.5 baud [15r	

<u>Heath/Zenith</u>	<u>Function</u>	<u>ANSI</u>
s	* Normal 128-character set	
t	Enter keypad shifted mode	
u	Exit keypad shifted mode	
v	Wrap characters past 80 to next line	[?7h
w	Discard characters past 80th column	[?71
x<parameter>	Set modes	
x1	Enable 25th line	[>1h
x2	Disable keyboard click	[>2h
x3	Enter hold screen mode	[>3h
x4	Set block cursor	[>4h
x5	Disable cursor	[>5h
x6	Enter keypad shifted mode	[>6h
x7	Enter keypad alternate mode	[>7h
x8	Enable auto LF on CR	[>8h
x9	Enable auto CR on LF	[>9h or [20h
x;	* Set non-blinking cursor	[>11h
x=	* Set hardware handshaking	[>13h
x>	* Enable half duplex	[>14h
x?	* Enable native keyboard mode	[>15h
x@	* Enable transparent mode	[>16h
y<parameter>	Reset modes	
y1	Disable 25th line	[>11
y2	Enable keyboard click	[>21
y3	Exit hold screen mode	[>31
y4	Set underline cursor	[>41
y5	Enable cursor	[>51
y6	Exit keypad shifted mode	[>61
y7	Exit keypad alternate mode	[>71
y8	Disable auto LF on CR	[>81
y9	Disable auto CR on LF	[>91 or [201
y;	* Set blinking cursor	[>111
y=	* Set software handshaking	[>131
y>	* Disable half duplex	[>141
y?	* Disable native keyboard mode	[>151
z	Reset to power up configuration	[z
{	Enable keyboard	[21
	* Set Date (Super-19)	
}	Disable keyboard	[2h
~	* Read Date (Super-19)	

QUESTIONS AND ANSWERS

Here are some of the common questions asked about the SUPERSET. If you have a question (or an answer) that is not listed, let us know.

Q: How does the SUPERSET reduce power consumption?

A: The standard H/Z-19 TLB draws about 1150mA from the +8 volt supply. Heath used NMOS memories, which are cheap but take a lot of power. Nowdays, there are CMOS equivalents which take virtually no power. The CMOS parts supplied save about 300mA, which is about as much power as removing an I/O board.

Q: What is "baud rate"?

A: The baud rate is the number of bits per second sent or received by the terminal. The standard baud rate is 9600. There are 10 bits per character, so this is 960 characters per second. There are 2000 characters on the screen, so it takes about 2 seconds to change them all. 9600 baud is as fast as a standard H/Z-19 can go without missing characters.

Q: Can I increase the baud rate to speed up my terminal?

A: Yes. 19200 baud is twice as fast, and 38400 baud is four times faster. You can select 19200 temporarily by typing "ctl-ESC r M"; or permanently by setting DIP switch SW401 section #0. For 38400, type "ctl-ESC r N" or set SW401 section #1. See the section on DIP SWITCH SETTINGS for details.

Q: How do I select 19200 baud on an H/Z89 computer?

A: This is more complicated. You'll have to change the terminal, the computer, and the software all at once. For CP/M, run Heath's CONFIGUR program, change the Console baud rate from 9600 to 19200, and save it on disk. Upon exiting CONFIGUR, the baud rate will change and you will get garbage on the screen. Now change the terminal baud rate temporarily using the instructions above. Your CP/M prompt will come back and work again.

For HDOS, insert a non-bootable disk (one just INITialized for instance), and try to boot it at the "H:" prompt. Of course, it won't boot. When the drive light goes out, temporarily set the baud rate to 19200 with "ctl-ESC r M". Now replace the disk with a bootable disk, go back ON-LINE and hit the "space" bar until the system responds. This disk is now set for 19200 baud.

Run a few programs, and you will notice that the screen responds faster. When you are satisfied with the results, you can permanently change the baud rate on the TLB as described above. Then change the computer permanently by setting DIP switch SW501 on the CPU board (set section #6 to 1=ON=left).

Q: Once I set the DIP switches for 19200 baud, I get "ffff xfgxsf" when I boot my disks. What happened?

A: Once you have permanently set SW401 and SW501 for 19200 baud, you can only boot disks CONFIGURED for a 19200 baud Console. If you forget, the disk will boot OK but print garbage instead of a sign-on message. You can temporarily fix this by typing "ctl-ESC r L" to go back to 9600 baud. Then run CONFIGUR to set the disk to boot at 19200 baud.

Q: At 19200 baud my screen is faster, but not twice as fast. Why?

A: The screen update rate is set by the software, the computer clock speed, or the baud rate; whichever is slowest. At 9600 baud, the baud rate is the weak link. At 19200, the 2MHz Z80 on your computer board is the weak link. If you also speed up your CPU board to 4MHz, then you'll see the 2:1 improvement.

Q: How do I get to 38400 baud?

A: This is awkward, because the CPU board's MTR-90 doesn't have a DIP switch setting for 38400 baud (though I have a "patched" version that does for \$18). CP/M can CONFIGURE for 38400 baud, but you must boot at a lower rate and change manually to 38400 baud after boot-up. However, it should be possible to auto-execute a file that switches the terminal to 38400 baud.

Now for HDOS. Make a new system disk and boot it. Before you type spaces to set the baud rate, switch the SUPERSET to the new baud rate (i.e. `ctl-ESC r N`). Now type spaces and continue the boot process. HDOS should automatically set the baud rate to 38400.

HDOS 2.0 system disks previously set at 9600 must be patched to 38400. Use a disk utility program like DUMP (HUG #885-1062) for hard sector disks or UDUMP (HUG #885-8004) for others. Examine address 05 on track 0, sector 0. The value 0C specifies 9600 baud. Patch it to 06 for 19200, or 03 for 38400 baud.

Q: What causes the "flicker"?

A: The screen memory is shared between the Z80 microprocessor and 6845 CRT controller. Normally, the CRT takes precedence. But when the Z80 needs to read or write a character to the screen, it "steals" the memory away from the CRT. The result is a black dash on the screen. The effect is most severe with large amounts of reverse video or at high baud rates. Speeding up the Z80's clock shortens the dashes, but they are still there.

Q: How did you get rid of it?

A: The SUPERSET solves the problem by using very fast screen memory chips. The memory is switched back and forth between Z80 and CRT controller at a 3MHz rate (by connecting the Z80 clock to the 74S138 multiplexer). When the clock is high, the screen memory is used by the Z80, which latches its data at the falling edge. When the clock is low, the screen memory is used by the CRT controller, which latches data on the rising edge.

Q: How about custom character sets?

A: The SUPERFONT doubles the number of character sets to 8. In fact, it really contains 16 128-character sets, or 2048 total characters! It is quite easy to design your own fonts for foreign languages, special graphics, underlining, boldface, double-width characters, etc. If you would like a disk with the present character sets and instructions for editing, send us \$10 and specify the desired disk format. We can then program a SUPERFONT with your own fonts.

Q: Can I use my Ultra-ROM or Super-19 ROM?

A: No. The SUPERSET program ROM replaces them. But since it already has most features of the Super-19 and Ultra-ROM, you shouldn't miss them. If there is a feature of these ROMs that you'd like added to the SUPERSET, let us know.

Q: Can I use the Cleveland Codonics "Imaginator"?

A: No. The Imaginator uses subroutines in the standard Heath ROM that have moved, or are no longer there. We'd like to fix this, but don't have access to the Imaginator's source code.

Q: Can I use the Northwest Digital "Graphics-Plus"?

A: No. The Graphics-Plus installation removes all the chips used by the SUPERSET kit, and all video is generated by the graphics board itself.

Q: How about a Sigmasoft IGC (Integrated Graphics Controller)?

A: Yes, with a few modifications. Sigmasoft moves the character generator ROM to their IGC board, so that's where the Superset's character ROM must go. Locate the 2K character ROM socket on the IGC board, and cut all traces to pin 21. Connect one end of a jumper wire to pin 21 of this socket.

Locate the 34-pin ribbon cable connector nearby, in the back left corner. Connect the other end of this wire to the center pin in the row closest to the edge of the board.

Install the Superset's character ROM and 24-to-28 pin socket adapter in the 2K socket on the IGC. You may need to lengthen the wires from the socket adapter to reach the 8250 UART on the terminal board. That's it!

All functions of the Superset and IGC work together normally, except that the Superset replaces the IGC's 2-character set capabilities.

Q: Why didn't you make it VT-100 compatible instead of just VT-52?

A: Frankly, because I don't have sufficient documentation to know how a VT-100 works, and don't have any software to test it even if I did. If you can help in this area, please contact me.

Q: Why do the new ROMs have more pins than the original parts?

A: The original ROM had 4K bytes of memory; either one 4K part, or two 2K parts. The SUPERSET and SUPERFONT use 32K parts instead. They have extra address pins that must be connected. The socket adapters make this as painless as possible. With the SUPERSET, SUPERFONT, and SUPERCLOCK all installed, your H/Z-19 board has over 70K of memory; more than the H89 itself!

Q: How was this manual printed?

A: This manual was prepared on an H89, using the "Magic Wand" word processor. It was printed on an Okidata u92 printer using its "correspondence mode" for text. The pictures were created with "Magic Wand" by manually turning on the H19 graphics mode while editing, and printed by initializing the printer's downloadable font with H19 graphics.

Q: What about speed?

A: The SUPERSET is over twice as fast as a standard H/Z-19, even considering the 50% faster clock. Critical routines in particular (insert/delete character, erase line/page) are dramatically faster. Programmers, I CHALLENGE you to figure out how I clear the screen twice as fast as even an LDIR instruction!

Q: What else can I do to improve my H/Z-19?

A: The venerable H/Z19 stacks up well against modern terminals thanks to its advanced Z80. Just try to find terminals that can run at 9600 baud without missing characters. Other things in the works: more fonts (up to 32!); 7x9 dot fonts; 640x250 dot resolution graphics WITHOUT a graphics board; programmable sound generator; still faster Z80 clock speeds; new attributes (bright, dim, and italics); downloadable character sets in non-volatile RAM. We're just beginning!

The physical modifications are easy; the difficulty lies in overcoming the air of apathetic hopelessness that traps so many 8-bit computer users. One of the foundations of computer science is that ALL computers are equivalent; there is no program that runs on a MacIntosh or IBM PC that can't be written to run just as well on an 8-bit machine. H89 software lacks the flash and glamour of a PC only because it has less memory to work with. Today's technology has eliminated the memory shortage; it is up to YOU to decide what to do with it!

USING THE GT-PROM

The GT-PROM is a new character set which improves the graphics capability and appearance of text on Heath H19/H19A terminals and H89/H89A computers. It displays 128 symbols, including 95 ASCII characters and 33 graphics symbols.

All 95 of the ASCII characters have been enhanced to produce a pleasing and stylish display of text on the CRT screen. Twenty-four of the original graphic symbols have been modified, to sharpen vertical resolution and to improve the match between vertical and horizontal line widths. To make room for the new symbols, five "non-graphic" symbols from the old set were deleted (paragraph, plus/minus, division, right-arrow, and down-arrow). Also, five diagonal graphic symbols were replaced with symbols using a uniform square pixel shape. Graphic symbols that were unchanged or only slightly modified were left in their original locations, to minimize the effect on existing graphic programs.

The documentation includes a listing of a screen plot program in BASIC to demonstrate the value of the improved graphics resolution.

OPERATION

The correct appearance of all characters, and the relationships of displayed characters to key symbols are listed in the "character set" section of this manual. Remember, reverse video provides the inverse of each character. The format is as follows.

character display map		
	█	
	█ █	
█	█ █	
█	█ █	
█ █ █ █		
█	█ █	
█	█ █	
ASCII key symbol A 65 character number in decimal		
41h character number in hexadecimal		

The GT-PROM can produce a square "dot" in any of ten positions within a character cell (2 wide by 5 high). With an 80x25 character screen, this gives an effective graphics resolution of 160 horizontal by 125 vertical. The codes to produce each of the ten individual dots are shown in their respective boxes:

ASCII	Decimal	Hexadecimal	Octal
j k	106 107	6Ah 6Bh	152 153
j ~	125 126	7Dh 7Eh	175 176
j ^	124 94	7Ch 5Eh	174 136
r _	114 95	72h 5Fh	162 137
h g	104 103	68h 67h	150 147

DEMONSTRATION PROGRAM

On the next page is a listing of a demonstration program for the GT-PROM to give you an idea of what the extra resolution can do. It is written in Microsoft BASIC, and runs under CP/M 2.2. You should be able to get it to run without much difficulty using any similar BASIC interpreter.

The program displays a damped sinewave within a rectangular border. Notice the relative smoothness of the sinewave contour, and the uniform thickness of the horizontal and vertical borders.

You can easily modify the program to display other functions by changing lines 220-230 and 280-310. For example,

220 A=(I/K)*3.14159	280 XN=-1.5
222 R=SIN(3*A)	290 XX=1.5
224 X(I)=R*COS(A)	300 YN=-1
230 Y(I)=R*SIN(A)	310 YX=1

displays a function called a "trifolium" or a "3-leaved rose". And by entering,

220 X(I)=(I+1)/(K+1)	280 XN=0
230 Y(I)=(X(I)^-5)/(EXP(1/X(I))-1)	290 XX=1
	300 YN=0
	310 YX=22

you can display Planck's radiation function (Jahnke and Emde, Tables of Functions, Addendum VII).

The GT-PROM can also display the old low-resolution block graphics symbols. This makes it possible to compare the new and old resolutions by changing lines 1110 and 1120 as follows:

```
1110 P$(0)=CHR$(109): P$(1)=CHR$109): P$(2)=CHR$(110)
1120 P$(3)=CHR$(110): P$(4)=CHR$(110)
```

Now the program will use the original LOW resolution graphic symbols. Change lines 1110 and 1120 back to their original form to go back to the HIGHER resolution of the GT-PROM.

```

100 REM Demonstration program for H18 or H89 with GT-PROM
110 REM character generator. Runs on MBASIC under CP/M 2.2.
120 REM
130 REM
140 REM Roger Lembke
150 REM NORCOM, 9630 Hayes, Overland Park, KS 66212
160 REM
170 DIM X(100),Y(100)
180 REM Set up X and Y arrays to contain the function to
190 REM be displayed; in this case, a damped sinewave.
200 K=68
210 FOR I=0 TO K
220 X(I)=I*.3
230 Y(I)=EXP(-.13*X(I))*SIN(X(I))
240 NEXT I
250 REM Specify min and max limits of X and Y to define
260 REM the range of the display.
270 REM
280 XN=0: REM X min
290 XX=20.4: REM X max
300 YN=-.6: REM Y min
310 YX=.9: REM Y max
1000 REM
1010 REM The rest of this program can be used as a subroutine
1020 REM to plot any function stored in the X and Y arrays,
1030 REM as shown in lines 210-240. The X and Y limits for
1040 REM the plot must also be provided, as in lines 280-310.
1050 REM
1060 DIM NS(70,20),PS(4)
1070 GS=CHR$(27)+CHR$(70): AS=CHR$(27)+CHR$(71)
1080 N1=69: N2=95: XR=XX-XN: YR=YX-YN
1090 L1$=CHR$(96): L2$=CHR$(97)
1100 C1$=CHR$(101): C2$=CHR$(100): C3$=CHR$(102): C4$=CHR$(99)
1110 PS(0)=CHR$(104): PS(1)=CHR$(114): PS(2)=CHR$(124)
1120 PS(3)=CHR$(125): PS(4)=CHR$(106)
1130 FOR I=0 TO 70: FOR J=0 TO 20: NS(I,J)=" ": NEXT J,I
1140 FOR J=0 TO 20: NS(0,J)=L1$: NS(70,J)=L2$: NEXT J
1150 FOR I=0 TO 70: NS(I,0)=L1$: NS(I,20)=L2$: NEXT I
1160 NS(0,0)=C1$: NS(70,0)=C2$: NS(0,20)=C3$: NS(70,20)=C4$
1170 FOR I=0 TO K
1180 I1=INT(((X(I)-XN)/XR)*(N1-1)+1.5)
1190 I2=INT(((Y(I)-YN)/YR)*(N2-1)+1.5)
1200 I3=I2-5*INT(I2/5)-1: IF I3=-1 THEN I3=4 ELSE GOTO 1210
1210 I4=1+INT((I2-I3)/5): IF I4>1 THEN GOTO 1220 ELSE I4=1: I3=0
1220 NS(I1,I4)=PS(I3)
1230 NEXT I
1240 PRINT GS
1250 FOR J=20 TO 0 STEP -1
1260 FOR I=0 TO 70: PRINT NS(I,J);: NEXT I
1270 PRINT: NEXT J
1280 PRINT AS;: END

```

STANDARD Character Set D											
0000000000000000		0000000000000000		0000000000000000		0000000000000000		0000000000000000		0000000000000000	
0	32	!	33	"	34	#	35	\$	36	%	37
0	20h	!	21h	"	22h	#	23h	\$	24h	%	25h
0	<	40	>	41	&	42	*	43	+	44	-
0	28h	<	29h	>	2Ah	&	2Bh	*	2Ch	+	2Dh
0	46	1	49	2	50	3	51	4	52	5	53
0	30h	1	31h	2	32h	3	33h	4	34h	5	35h
0	56	9	57	:	58	:	59	<	60	<	61
0	39h	9	3Ah	:	3Bh	:	3Ch	<	3Dh	<	3Eh

STANDARD Character Set 0 HEATH HIS Graphics Mode

HEITH HIS GRAPHICS MODE

STADTWERK Charlottenburg

DEUC UT-1603 graphics module

STANFORD CHARTERED LTD.

HORICON ST.-FRÖHLICH TEST MODE

ੴ ਸਤਿਗੁਰ ਪ੍ਰਸਾਦਿ

ମହାକାଳ ଶିତ-ପ୍ରଦୀପ !

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HEITH + GREEK GRAPHICS NODE

STAHUFEN Character Set P

SUPERFOOT Character Set C

Heath High reverse video, text mode

0000 0000 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000	000000 0000 000000 0000 000000 0000	0000 0000 000000 0000 000000 0000									
160 Rsh	161 Rsh	" 162 Rsh	* 163 Rsh	\$ 164 Rsh	% 165 Rsh	& 166 Rsh	# 167 Rsh	@ 168 Rsh	@ 169 Rsh	@ 170 Rsh	@ 171 Rsh	@ 172 Rsh
0000 0000 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000	000000 0000 000000 0000 000000 0000	0000 0000 000000 0000 000000 0000									
< 168 Rsh	> 169 Rsh	+ 170 Rsh	* 171 Rsh	% 172 Rsh	& 173 Rsh	# 174 Rsh	@ 175 Rsh	@ 176 Rsh	@ 177 Rsh	@ 178 Rsh	@ 179 Rsh	@ 180 Rsh
0000 0000 0000 0000 0000 0000	0000 0000 0000 0000 0000 0000	000000 0000 000000 0000 000000 0000										
0 176 Rsh	1 177 Rsh	2 178 Rsh	3 179 Rsh	4 180 Rsh	5 181 Rsh	6 182 Rsh	7 183 Rsh	8 184 Rsh	9 185 Rsh	:	186 Rsh	= 187 Rsh

Heath High reverse video; text mode

SUPERFOUNT Character Set C

SUPERFONT Character Set 6 - riornal video, test

Character Set G - Normal video, Graphics Mode

SUPERFIGHT Character Set G

UT 160, reverse video (doubled)

SUPERFIGHT Character Sheet

‘କେବଳ ପାଦିଲା’ ଏହା ହେଉଥିଲା ।

P 208	P 246	0 209	9 241	R 210	r 242	S 211	s 243						
Dsh	Fsh	0h	0h	02h	F2h	03h	F3h						
000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000						
000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000						
000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000						
000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000						
T 212	t 244	U 213	v 245	W 214	u 246	X 215	w 247						
Dsh	F4h	0h	05h	06h	F6h	07h	F7h						
000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000						
000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000						
X 216	x 246	Y 217	y 247	Z 218	z 248	C 219	c 250						
Dsh	Fsh	0h	06h	0ah	Fah	0bh	Fbh						
000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000						
000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000						
\ 228	\ 252	1 221	1 253	- 222	- 254	- 223	- 255						
Dsh	Fch	00h	Fth	0eh	Feh	0fh	Ffh						
000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000	000000000000						

IBI PC: Normal video test mode

SUPERFORT Character Set 0 - IBM PC, Normal video, text mode

SUPERFÜLT Character Set 0 - IBM PC normal video, graphics mode

1	152	2	153	3	154	4	155	5	156	6	157	7	158	8	159
9	152	10	153	11	154	12	155	13	156	14	157	15	158	16	159
17	152	18	153	19	154	20	155	21	156	22	157	23	158	24	159
26	152	27	153	28	154	29	155	30	156	31	157	32	158	33	159
35	152	36	153	37	154	38	155	39	156	40	157	41	158	42	159
48	152	49	153	50	154	51	155	52	156	53	157	54	158	55	159
57	152	58	153	59	154	60	155	61	156	62	157	63	158	64	159
66	152	67	153	68	154	69	155	70	156	71	157	72	158	73	159
75	152	76	153	77	154	78	155	79	156	80	157	81	158	82	159
84	152	85	153	86	154	87	155	88	156	89	157	90	158	91	159
93	152	94	153	95	154	96	155	97	156	98	157	99	158	100	159
102	152	103	153	104	154	105	155	106	156	107	157	108	158	109	159
111	152	112	153	113	154	114	155	115	156	116	157	117	158	118	159
120	152	121	153	122	154	123	155	124	156	125	157	126	158	127	159
129	152	130	153	131	154	132	155	133	156	134	157	135	158	136	159
138	152	139	153	140	154	141	155	142	156	143	157	144	158	145	159
147	152	148	153	149	154	150	155	151	156	152	157	153	158	154	159
156	152	157	153	158	154	159	155	156	157	158	159	159	159	159	159
165	152	166	153	167	154	168	155	169	156	170	157	171	158	172	159
174	152	175	153	176	154	177	155	178	156	179	157	180	158	181	159
183	152	184	153	185	154	186	155	187	156	188	157	189	158	190	159
192	152	193	153	194	154	195	155	196	156	197	157	198	158	199	159
201	152	202	153	203	154	204	155	205	156	206	157	207	158	208	159
210	152	211	153	212	154	213	155	214	156	215	157	216	158	217	159
219	152	220	153	221	154	222	155	223	156	224	157	225	158	226	159
228	152	229	153	230	154	231	155	232	156	233	157	234	158	235	159
237	152	238	153	239	154	240	155	241	156	242	157	243	158	244	159
246	152	247	153	248	154	249	155	250	156	251	157	252	158	253	159
255	152	256	153	257	154	258	155	259	156	260	157	261	158	262	159
264	152	265	153	266	154	267	155	268	156	269	157	270	158	271	159
273	152	274	153	275	154	276	155	277	156	278	157	279	158	280	159
282	152	283	153	284	154	285	155	286	156	287	157	288	158	289	159
291	152	292	153	293	154	294	155	295	156	296	157	297	158	298	159
299	152	300	153	301	154	302	155	303	156	304	157	305	158	306	159
312	152	313	153	314	154	315	155	316	156	317	157	318	158	319	159
321	152	322	153	323	154	324	155	325	156	326	157	327	158	328	159
330	152	331	153	332	154	333	155	334	156	335	157	336	158	337	159
339	152	340	153	341	154	342	155	343	156	344	157	345	158	346	159
348	152	349	153	350	154	351	155	352	156	353	157	354	158	355	159
357	152	358	153	359	154	360	155	361	156	362	157	363	158	364	159
366	152	367	153	368	154	369	155	370	156	371	157	372	158	373	159
375	152	376	153	377	154	378	155	379	156	380	157	381	158	382	159
384	152	385	153	386	154	387	155	388	156	389	157	390	158	391	159
393	152	394	153	395	154	396	155	397	156	398	157	399	158	400	159
402	152	403	153	404	154	405	155	406	156	407	157	408	158	409	159
411	152	412	153	413	154	414	155	415	156	416	157	417	158	418	159
419	152	420	153	421	154	422	155	423	156	424	157	425	158	426	159
428	152	429	153	430	154	431	155	432	156	433	157	434	158	435	159
437	152	438	153	439	154	440	155	441	156	442	157	443	158	444	159
446	152	447	153	448	154	449	155	450	156	451	157	452	158	453	159
455	152	456	153	457	154	458	155	459	156	460	157	461	158	462	159
464	152	465	153	466	154	467	155	468	156	469	157	470	158	471	159
473	152	474	153	475	154	476	155	477	156	478	157	479	158	480	159
482	152	483	153	484	154	485	155	486	156	487	157	488	158	489	159
485	152	486	153	487	154	488	155	489	156	490	157	491	158	492	159
494	152	495	153	496	154	497	155	498	156	499	157	500	158	501	159
503	152	504	153	505	154	506	155	507	156	508	157	509	158	510	159
512	152	513	153	514	154	515	155	516	156	517	157	518	158	519	159
515	152	516	153	517	154	518	155	519	156	520	157	521	158	522	159
524	152	525	153	526	154	527	155	528	156	529	157	530	158	531	159
533	152	534	153	535	154	536	155	537	156	538	157	539	158	540	159
542	152	543	153	544	154	545	155	546	156	547	157	548	158	549	159
545	152	546	153	547	154	548	155	549	156	550	157	551	158	552	159
554	152	555	153	556	154	557	155	558	156	559	157	560	158	561	159
563	152	564	153	565	154	566	155	567	156	568	157	569	158	570	159
572	152	573	153	574	154	575	155	576	156	577	157	578	158	579	159
575	152	576	153	577	154	578	155	579	156	580	157	581	158	582	159
584	152	585	153	586	154	587	155	588	156	589	157	590	158	591	159
593	152	594	153	595	154	596	155	597	156	598	157	599	158	600	159
596	152	597	153	598	154	599	155	600	156	601	157	602	158	603	159
605	152	606	153	607	154	608	155	609	156	610	157	611	158	612	159
614	152	615	153	616	154	617	155	618	156	619	157	620	158	621	159
623	152	624	153	625	154	626	155	627	156	628	157	629	158	630	159
632	152	633	153	634	154	635	155	636	156	637	157	638	158	639	159
641	152	642	153	643	154	644	155	645	156	646	157	647	158	648	159
649	152	650	153	651	154	652	155	653	156	654	157	655	158	656	159
658	152	659	153	660	154	661	155	662	156	663	157	664	158	665	159
667	152	668	153	669	154	670	155	671	156	672	157	673	158	674	159
676	152	677	153	678	154	679	155	680	156	681	157	682	158	683	159
685	152	686	153	687	154	688	155	689	156	690	157	691	158	692	159
694	152	695	153	696	154	697	155	698	156	699	157	700	158	701	159
703	152	704	153	705	154	706	155	707	156	708	157	709	158	710	159
712	152	713	153	714	154	715	155	716	156	717	157	718	158	719	159
715	152	716	153	717	154	718	155	719	156	720	157	721	158	722	159
724	152	725	153	726	154	727	155	728	156	729	157	730	158	731	159
733	152	734	153	735	154	736	155	737	156	738	157	739	158	740	159
742	152	743	153	744	154	745	155	746	156	747	157	748	158	749	159
745	152	746	153	747	154	748	155	749	156	750	157	751	158	752	159
754	152	755	153	756	154	757	155	758	156	759	157	760	158	761	159
763	152	764	153	765	154	766	155	767	156	768	157	769	158	770	159
772	152	773	153	774	154	775	155	776	156	777	157	778	158	779	159
775	152	776	153	777	154	778	155	779	156	780	157	781	158	782	15

IEH PC, Reverse video; test node

SUPERFONT Character Set 0

SUPERFONT Character Set K

API Graphics; reverse video

decimal	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
character	<0>	<1>	<2>	<3>	<4>	<5>	<6>	<7>	<8>	<9>	<A>		<C>	<D>	<E>	<F>
hex	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
octal	000	001	002	003	004	005	006	007	010	011	012	013	014	015	016	017
binary	0000	0001	0010	0011	00100	00101	00110	00111	01000	01001	01010	01011	01100	01101	01110	01111

rev-video
(graphic)
character=(P)
decimal = 144
145 146 147 148

```

character=   33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F
decimal= 161 162 163 164

```

rev-video
character = A
decimal = 193

character	decimal	hex	octal	binary
	32	20	40	100000
	33	21	41	100001
	34	22	42	100010
	35	23	43	100011
	36	24	44	100100
	37	25	45	100101
	38	26	46	100110
	39	27	47	100111
	40	28	48	101000
	41	29	49	101001
	42	2A	50	101010
	43	2B	51	101011
	44	2C	52	101100
	45	2D	53	101101
	46	2E	54	101110
	47	2F	55	101111
	48	30	56	110000
	49	31	57	110001
	50	32	58	110010
	51	33	59	110011
	52	34	60	110100
	53	35	61	110101
	54	36	62	110110
	55	37	63	110111
	56	38	64	111000
	57	39	65	111001
	58	3A	66	111010
	59	3B	67	111011
	60	3C	68	111100
	61	3D	69	111101
	62	3E	70	111110
	63	3F	71	111111

character	graphic
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	A
B	B
C	C
D	D
E	E
F	F
G	G
H	H
I	I
J	J
K	K
L	L
M	M
N	N
O	O
P	P
Q	Q
R	R
S	S
T	T
U	U
V	V
W	W
X	X
Y	Y
Z	Z

(graph 6)
real value = 0.9999999999999999
character = P 9
decimal = 240 241 242 243 244

卷之三

卷之三

SI	M	SI	ZI	II	III	6	8	4	9	5	4	3	2	1	θ = 180°
(S)	(M)	(S)	(Z)	(I)	(I)	(6)	(8)	(4)	(9)	(5)	(4)	(3)	(2)	(1)	(θ)
(S)	(M)	(S)	(Z)	(I)	(I)	(6)	(8)	(4)	(9)	(5)	(4)	(3)	(2)	(1)	(θ)
(S)	(M)	(S)	(Z)	(I)	(I)	(6)	(8)	(4)	(9)	(5)	(4)	(3)	(2)	(1)	(θ)
(S)	(M)	(S)	(Z)	(I)	(I)	(6)	(8)	(4)	(9)	(5)	(4)	(3)	(2)	(1)	(θ)

```

program character;
var
  character : char;
begin
  character := 'A';
  writeln(character);
  character := 'B';
  writeln(character);
  character := 'C';
  writeln(character);
end.

```

character = 32 decimal = 32

ey-widens character = 19 decimal = 126 177 178 179 180

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
character =	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
decimal =	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	7010	7011	7012	7013	7014	7015	7016	7017	7018	7019	7020	7021	7022	7023	7024	7025	7026	7027	7028	7029	7030	7031	7032	7033	7034	7035	7036	7037	7038	7039	7040	7041	7042	7043	7044	7045	7046	7047	7048	7049	7050	7051	7052	7053	7054	7055	7056	7057	7058	7059	7060	7061	7062	7063	7064	7065	7066	7067	7068	7069	7070	7071	7072	7073	7074	7075	7076	7077	7078	7079	7080	7081	7082	7083	7084	7085	7086	7087	7088	7089	7090	7091	7092	7093	7094	7095	7096	7097	7098	7099	7100	7101	7102	7103	7104	7105	7106	7107	7108	7109	7110	7111	7112	7113	7114	7115	7116	7117	7118	7119	7120	7121	7122	7123	7124	7125	7126	7127	7128	7129	7130	7131	7132	7133	7134	7135	7136	7137	7138	7139	7140	7141	7142	7143	7144	7145	7146	7147	7148	7149	7150	7151	7152	7153	7154	7155	7156	7157	7158	7159	7160	7161	7162	7163	7164	7165	7166	7167	7168	7169	7170	7171	7172	7173	7174	7175	7176	7177	7178	7179	7180	7181	7182	7183	7184	7185	7186	7187	7188	7189	7190	7191	7192	7193	7194	7195	7196	7197	7198	7199	7200	7201	7202	7203	7204	7205	7206	7207	7208	7209	7210	7211	7212	7213	7214	7215	7216	7217	7218	7219	7220	7221	7222	7223	7224	7225	7226	7227	7228	7229	7230	7231	7232	7233	7234	7235	7236	7237	7238	7239	7240	7241	7242	7243	7244	7245	7246	7247	7248	7249	7250	7251	7252	7253	7254	7255	7256	7257	7258	7259	7260	7261	7262	7263	7264	7265	7266	7267	7268	7269	7270	7271	7272	7273	7274	7275	7276	7277	7278	7279	7280	7281	7282	7283	7284	7285	7286	7287	7288	7289	7290	7291	7292	7293	7294	7295	7296	7297	7298	7299	7300	7301	7302	7303	7304	7305	7306	7307	7308	7309	7310	7311	7312	7313	7314	7315	7316	7317	7318	7319	7320	7321	7322	7323	7324	7325	7326	7327	7328	7329	7330	7331	7332	7333	7334	7335	7336	7337	7338	7339	7340	7341	7342	7343	7344	7345	7346	7347	7348	7349	7350	7351	7352	7353	7354	7355	7356	7357	7358	7359	7360	7361	7362	7363	7364	7365	7366	7367	7368	7369	7370	7371	7372	7373	7374	7375	7376	7377	7378	7379	7380	7381	7382	7383	7384	7385	7386	7387	7388	7389	7390	7391	7392	7393	7394	7395	7396	7397	7398	7399	7400	7401	7402	7403	7404	7405	7406	7407	7408	7409	7410	7411	7412	7413	7414	7415	7416	7417	7418	7419	7420	7421	7422	7423	7424	7425	7426	7427	7428	7429	7430	7431	7432	7433	7434	7435	7436	7437	7438	7439	7440	7441	7442	7443	7444	7445	7446	7447	7448	7449	7450	7451	7452	7453	7454	7455	7456	7457	7458	7459	7460	7461	7462	7463	7464	7465	7466	7467	7468	7469	7470	7471	7472	7473	7474	7475	7476	7477	7478	7479	7480	7481	7482	7483	7484	7485	7486	7487	7488	7489	7490	7491	7492	7493	7494	7495	7496	7497	7498	7499	7500	7501	7502	7503	7504	7505	7506	7507	7508	7509	7510	7511	7512	7513	7514	7515	7516	7517	7518	7519	7520	7521	7522	7523	7524	7525	7526	7527	7528	7529	7530	7531	7532	7533	7534	7535	7536	7537	7538	7539	7540	7541	7542	7543	7544	7545	7546	7547	7548	7549	7550	7551	7552	7553	7554	7555	7556	7557	7558	7559	7560	7561	7562	7563	7564	7565	7566	7567	7568	7569	7570	7571	7572	7573	7574	7575	7576	7577	7578	7579	7580	7581	7582	7583	7584	7585	7586	7587	7588	7589	7590	7591	7592	7593	7594	7595	7596	7597	7598	7599	7600	7601	7602	7603	7604	7605	7606	7607	7608	7609	7610	7611	7612	7613	7614	7615	7616	7617	7618	7619	7620	7621	7622	7623	7624	7625	7626	7627	7628	7629	7630	7631	7632	7633	7634	7635	7636	7637	7638	7639	7640	7641	7642	7643	7644	7645	7646	7647	7648	7649	7650	7651	7652	7653	7654	7655	7656	7657	7658	7659	7660	7661	7662	7663	7664	7665	7666	7667	7668	7669	7670	7671	7672	7673	7674	7675	7676	7677	7678	7679	7680	7681	7682	7683	7684	7685	7686	7687	7688	7689	7690	7691	7692	7693	7694	7695	7696	7697	7698	7699	7700	7701	7702	7703	7704	7705	7706	7707	7708	7709	7710	7711	7712	7713	7714	7715	7716	7717	7718	7719	7720	7

decimals = 132 133 134 135 136

charater= a b c d
decimal = 224 225 226 227 228

(gräfische) charakter = $\frac{p}{q}$ decimal = 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127

character = P q r s t
decimal = 248 241 242 243 244

