H89 CONVERSION TO 19,200 BAUD

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Conversion of the H89 to run at 19,200 baud has become very popular, and seems to go along nicely with conversion to a 4 MHz processor. KRES Engineering has had a lot of inquiry about running at 19,200 baud. Several of our systems have been converted to 19,200 baud and are running with no problem. As a service to you, our customer, we are providing these instructions. **BUT:**

KRES Engineering does NOT support the conversion of your system to 19,200 baud. Your Heath/Zenith service center may not service your computer if you have modified it in any way, and you may void your warranty. We have done no research as to whether the instructions provided here will work on all systems, if it is reliable, or if it will work with all software. You may be exceeding the timing specifications of some IC's. The modifications do require the use of a soldering iron, and partial dissasembly of your computer. As such, they should be attempted ONLY by individuals qualified to work on electronic equipment.

IF YOU DECIDE TO MODIFY YOUR SYSTEM TO WORK AT 19,200 BAUD, YOU ARE ON YOUR OWN. PLEASE DO NOT CONTACT US IF YOUR SYSTEM DOES NOT WORK, OR IF YOU HAVE PROBLEMS. WE WOULD, HOWEVER, WELCOME CONSTRUCTIVE FEEDBACK TO IMPROVE THESE INSTRUCTIONS, PROVIDED NO RESPONSE IS REQUIRED ON OUR PART.

To convert your system to run at 19,200 baud, you must make changes in four separate areas:

1. The terminal portion of your computer must be told to operate at 19,200 baud. This is done by switch settings on the terminal logic board inside your H89 (SW401).
2. The clock rate to the Z80 microprocessor on your terminal logic board must be increased to at least 3 MHz to allow enough time for the terminal to decode and respond the character strings and control sequences it receives.
3. The hardware on your CPU card must be set up to run at 19,200 baud. This is done by switch settings on the CPU card. The switch is read by the monitor ROM, and hardware automatically set depending on the value read from the switch (SW501).
4. The bootable disks you have must be configured to operate at 19,200 baud, since they will reconfigure system hardware for a specific baud rate.

If this sounds like something you can handle, **REALIZING THERE ARE POSSIBLE PITFALLS AND KRES WILL NOT BAIL YOU OUT IF YOU RUN INTO TROUBLE**, read on. Otherwise be content with your 4 MHz system. The upgrade to 4 MHz will give you the largest increase in the overall speed of your computer; a 19,200 baud screen is just "frosting on the cake".

Before you plunge into these modifications, read and reread them,

making sure you feel comfortable that you can complete all steps; then proceed. The usual step by step check-off-the-boxes type documentation in the rest of KRES' documentation will not be used here. If you need that level of instructions, do NOT attempt these modifications.

BEFORE PROCEEDING DISCONNECT THE COMPUTER LINE CORD FROM THE AC OUTLET. HAZARDOUS VOLTAGES ARE PRESENT INSIDE YOUR H89

If you are running Heath/Zenith CP/M, the first thing we will do is convert one of your bootable disks to run at 19,200 baud. Locate a non write protected bootable disk you don't really care for, and won't mind losing if something goes wrong. After booting that disk, run CONFIGUR, and set the terminal for 19,200 baud. When you exit CONFIGUR by typing "Y" for the last time to make changes to memory and disk, your computer will seem to die. CP/M has changed the computer section of your H89 to run at 19,200 baud, but the terminal section of your H89 is still running at 9600 baud. The two can no longer "talk" to each other, and you get garbage, or nothing on the screen. When the red light on your disk drive has turned off, simply remove the disk and save it to use later. The next time that disk is booted, it will set up your H89 to run at 19,200 baud, so if you don't complete the rest of these modifications and get the system up at 19,200 baud, you cannot boot that disk again without re-sysgening the disk.

If you are running HDOS, we will modify the CRT baud rate on your disk later.

For the next two steps, you must remove the terminal logic board from your computer. In most systems, you must also remove the CPU card so that you can gain access to the several connectors that are on your terminal logic card. As you remove the connectors, remember to note their orientation so you may reinstall them properly. In addition to the apparent connectors, there is one particularly difficult to get at and difficult to remove connector from the keyboard at the bottom edge of the terminal logic board on the side near the power supply. Don't forget to unplug the little two wire cable from your speaker.

1. CONVERSION OF TERMINAL LOGIC CARD TO 19,200 BAUD

Before you change the setting of SW401, write down exactly the way the switch is set NOW, so if things go wrong you can return to your old system.

You tell the terminal logic board to run at 19,200 baud by the switch setting at SW401. This switch is read by the terminal logic board monitor ROM, and hardware initialized accordingly. Thus, the switch settings will vary with the monitor ROM present. Our Heath/Zenith documentation does NOT list a 19,200 baud setting for SW401, but by extending the table past 9600 baud, we would find:

BAUD RATE	SWITCH SECTION 0	1	2	3
9600	0	0	1	1
19200	1	0	1	1

Your documentation may show something different; be sure to check it before you proceed. The extension of the Heath Escape Sequence then past 9600 baud is:

BAUD	ESCAPE SEQUENCE
9600	ESC r L
19200	ESC r M

Again, consult your documentation for changes.

If you have one of the replacement ROM's for the Terminal Logic Board, such as the Software Wizardry ULTRAROM, SUPER 19 or WATZMANN ROM, consult the documentation included with the ROM to set the switches for 19,200 Baud operation. Some of these also give patches to your operating system for handshaking. Carefully read what the documentation suggests.

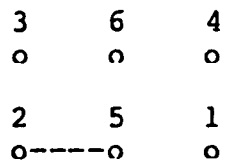
Once you have set the switches properly, and followed any additional hints in the documentation for replacement ROM's if you have one, you have completed the first of four steps. Seems trivial so far. Hopefully it is not an omen that the decimal equivalent of the binary switch setting you just made on with the standard Heath ROM is thirteen.

2. CONVERSION OF THE Z80 CLOCK TO 3 MHZ

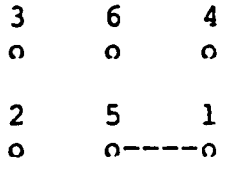
This is the step that is a little more tricky, and is going to require a soldering iron. And maybe an X-ACTO knife. If you just built your 14th Heathkit, you'll have no problem. If you are reaching for the phone to dial a friend and ask him what a soldering iron is, and if you can borrow his, be content with 9600 baud.

Follow these instructions if you have an older H89 (not an H89A) without all the shielding inside.

Look at the lower left hand corner of the terminal logic board. You will find a jumper area with two rows of pads. The area is labelled JP10 on our board (some may be labelled TP10 or something similar). The pads are numbered:



Right now there is either a wire jumper or a trace jumper between 2 and 5. Remove the wire jumper, or cut the trace jumper. Reinstall a wire jumper between 5 and 1:



If you cannot find this area, you have a terminal logic board unfamiliar to KRES, and we have no idea how to convert you board to 3

MHz. If you cannot find this area, but are wondering what the little metal shield is doing in the center of your board, you have an H89A, and should follow instructions in the next section.

This completes the conversion of the clock rate to 3 MHz. You should replace the Z80 microprocessor on the terminal logic board with a Z80A, since the Z80 is a 2 MHz part, while the Z80A is a 4 MHz part. No, there is no easy way to get a usable 4 MHz clock instead of the 3 MHz clock.

Follow these instructions if you have an H89A with all the shielding inside.

These modifications are done to the TOP (component side) of the card and do not require you to pull the large shield off the back of the card. They require no trace cuts, and should be easy to remove if something goes wrong.

Locate the small metal shield in approximately the center of the terminal logic card. Using a small screw driver, remove the shield. Remove the 7404 IC at U426 (the first IC above the crystal and resistors). Carefully bend pins 1 and 3 up so they are sticking straight out from the side of the body. Then reinsert the IC into the socket. Take a short (2") piece of fine wire, such as wire wrap wire, and wrap one end around pin one, then over to and around pin 3. Leave the excess wire continuing off of the other side of pin 3. Put a small dab of solder on each of the two pins to make a good electrical connection with the wire. Route the wire over to pin 13 of the 74LS161 IC at U427 immediately above the IC you just made the modification to. Lay the wire onto pin 13, put a dab of solder on the IC pin where the wire contacts, then cut off the excess. The total wire run should be about 1/2 inch long. You may now reinstall the shield.

This completes the conversion of the clock rate to 3 MHz. You should replace the Z80 microprocessor on the terminal logic board with a Z80A, since the Z80 is a 2 MHz part, while the Z80A is a 4 MHz part. No, there is no easy way to get a usable 4 MHz clock instead of the 3 MHz clock.

3. CONVERSION OF THE CPU CARD TO 19,200 BAUD

Before you change the setting of SW501, write down exactly the way the switch is set NOW, so if things go wrong you can return to your old system.

You tell the CPU board to run at 19,200 baud by the switch setting at SW501. This switch is read by the CPU monitor ROM, and hardware set accordingly. Thus, the switch settings will vary with the monitor ROM present. Our Heath/Zenith documentation does NOT list a 19,200 baud setting for SW501, but by setting switch section 6 (next to the bottom section) to the left, or the "1" or "on" position, you will set the baud rate to 19,200. This works with our MTR-90, and should work with MTR-88 and MTR-89 as well.

If you have the KRES KMR-100, you do not need to worry about the switch settings for baud rate. The ROM automatically detects baud rate when you power up, and will set it to the proper rate without

switch settings. This is true of the current UltiMeth monitor ROM's.

If you have a monitor ROM from another manufacturer, consult the documentation included with the ROM for switch settings for 19,200 Baud operation, if any are required, or if 19,200 baud is supported at all.

You may now put your system back together, and once you are sure all cables are back in their proper place, and oriented properly, try turning the system on. You should get the beep(s) (most units beep twice) and any sign-on and prompt as you did before. If you do not, try going off line, then typing to the screen. If that works, then the terminal is still operational; the Z80(A) is operating at 3 MHz. You may have set the switches for baud rate improperly. Go back and recheck YOUR documentation and verify the switches are set properly.

4. CONFIGURATION OF OPERATING SYSTEM TO 19,200 BAUD

HEATH ZENITH CP/M

Assuming you have followed all the above steps, and your computer still works, you should now be able to boot the disk you created at the beginning of this modification procedure. When it comes up, if you get a garbled or no message on the screen, yet all the disk accesses seem to be the same as they are on a normal boot, then you do not have the same baud rate set on the H89 and the DISK. Go back and recheck. If you get a normal boot, go back and rerun CONFIGUR and look at the baud rate set. It should be 19,200. If it is, you are done, and your computer will now update the screen faster than before.

For the other bootable disks in your library, you may either re-sysgen them from this new disk, or follow the following steps to change their baud rate. You will be booting a 9600 baud disk on a 19,200 baud system, then toggling the system down to 9600 baud AFTER you boot, then changing the disk to 19,200 baud, then changing the system back to 19,200 baud. Although it sounds like a lot of work, you only have to do it once for each disk.

1. Boot using an old 9600 baud disk. When the sign-on message comes up, it will be garbled. Ignore this, and wait for all disk accesses to stop, and the red drive light to turn off.
2. Go off line, and hit the following three keys one at a time:

ESC r L

Note that the second letter is lower case, and the third is UPPER CASE. This is the escape code sequence to toggle the terminal portion of your H89 to 9600 baud, with the standard Heath/Zenith terminal logic board ROM. If you have any other ROM, consult the manufacturer's documentation for instructions on changing baud rate.

3. Go back on line again and type return. You should be back in CP/M. You may now operate your computer (at 9600 baud) as you did before. Run CONFIGUR and change the CRT baud rate to 19200. When you exit CONFIGUR by typing "Y" for the last time to make changes to memory and disk, your computer will seem to die. CP/M has changed the computer section of your H89 to run at 19,200 baud, but the terminal section of your H89 is still running at 9600 baud.
4. Go off line again, and hit the following three keys one at

a time:

ESC r M

Again, for other ROM's, consult the manufacturer's documentation.

5. Go back on line and type return. You should be back in CP/M again, but at 19,200 baud. Every time after this you boot the disk, the entire system will be at the same speed, 19,200 baud (assuming the disk was not write protected when you ran CONFIGUR). As the final test reset your computer, and reboot. All should be well, except the screen is updating much faster.

HDOS

The HDOS operating system is easier to change than CP/M. Until you are familiar with the procedure, take a disk you do not care about. Type your usual boot command from the monitor ROM as you have always done. After some disk accesses, the computer will seem to die. Hit the BREAK key (note that nothing will seem to happen, and you may have to hit it more than once), then tap the space bar several times, and you will get the ACTION BOOT message on the screen. Respond as usual to boot the system. The disk (again, assuming it was not write protected) is now permanently set to 19,200 baud, and next time you boot will be as normal, except for the faster screen update.

MAGNOLIA MICROSYSTEMS HDOS

Magnolia CP/M does not change the initialization of the 8250 UART and you will need make no modification to the disk.