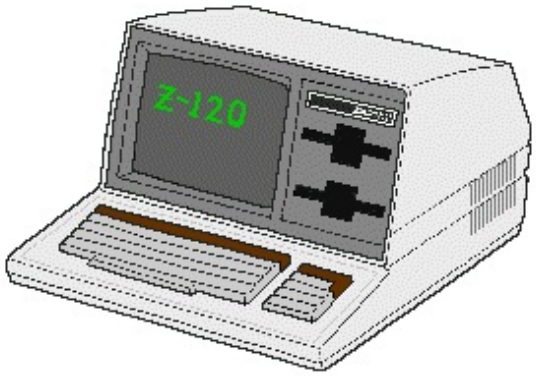
Z-100 LifeLine
Since 1989

May 2022

#WEB

This was originally published in issue #79, February 2002



Configuring the Z-100 Appendix I

by Steven W. Vagts
Editor, "*Z-100 LifeLine*"

Configuring the Z-100 Appendix I

Introduction:

The Z-100 Series of Desktop Computers may be configured a number of ways through dip switches and jumpers located on circuit boards inside the computer. The information presented here has been updated over the years and will allow you to custom configure your Computer to meet your needs. You may wish to place a copy in your User's Manual.

Please refer to the article "**Z-100 Disassembly**" also here on the "*Z-100 LifeLine*" Website to remove the Z-100's cabinet top and disassemble the computer to gain access to these configuration switches.

Z-100 RGB Pinouts

Pictorial I-1 illustrates the different signals you can get through the J9 connector for RGB color monitors. Also see the section on **"Video Board Jumpers"**.

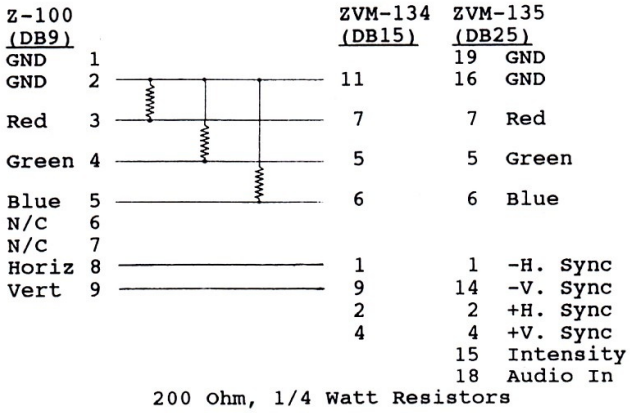
Pin	Signal
1	Ground
2	Ground
3	Red
4	Green
5	Blue
6	Not connected
7	Not connected
8	Horizontal Sync (+ or -)
9	Vertical Sync (+ or -)

Pictorial I-1
J-9 Pinout

ZVM-134/135 Monitor Cable Pinouts

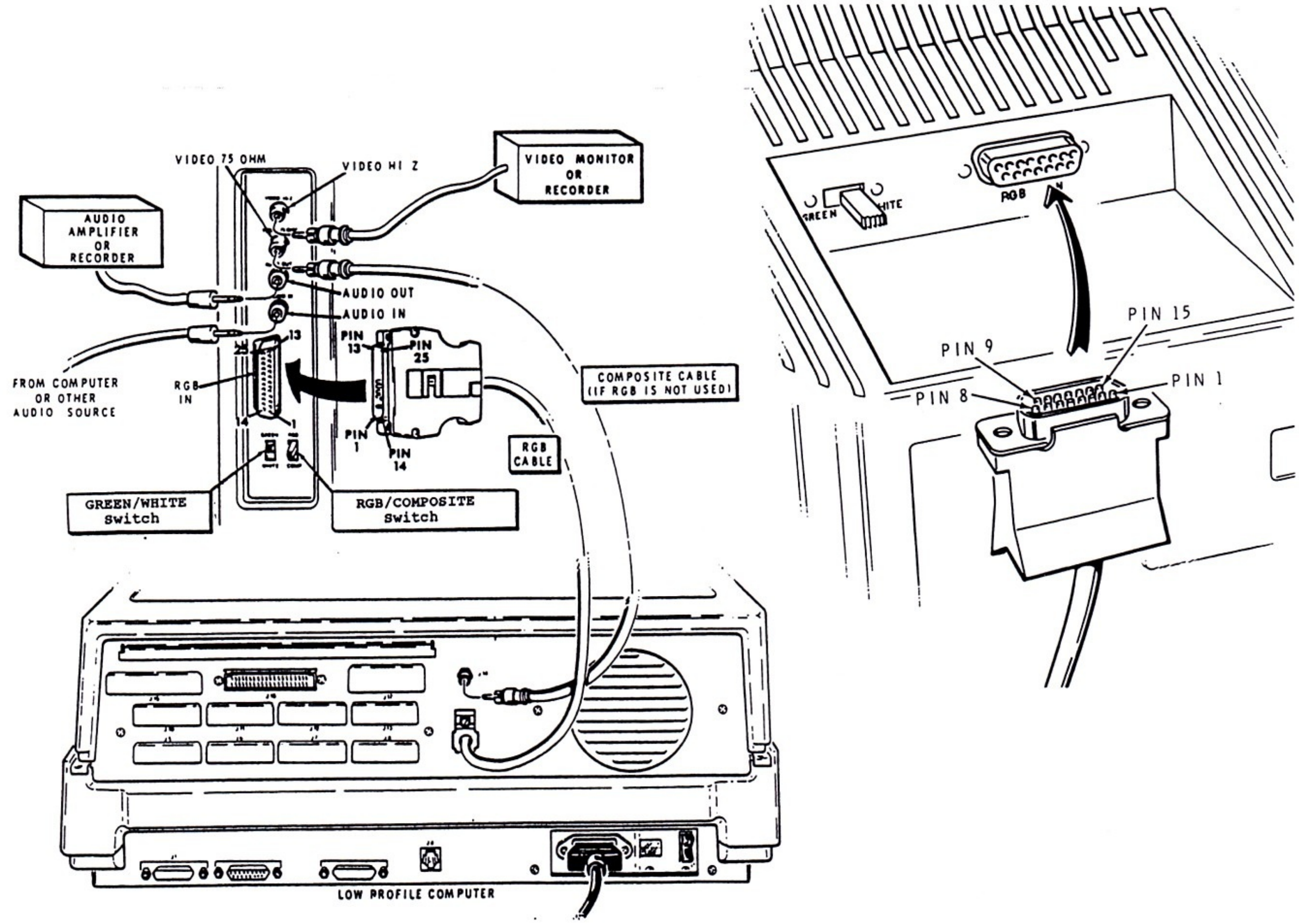
Note: The following cables also work with many other Zenith CGA monitors.

Video Cable Wiring



200 Ohm, 1/4 Watt Resistors

Pictorial I-2
Monitor Cable Pinouts



Pictorial I-3
Video Cable Connections

~~~~~~

Cabling Notes:

- The Composite Cable can be used if a RGB Cable is not available.
- The rear of the Z-100 ‘All-In-One’ does not have a composite jack at J14. That signal is already provided to the internal monitor and J14 contains an exterior brightness control. The J-9 RGB connector can still be used to feed a separate color monitor.

Synchronization (Sync) Signals

Not all monitors used on a Z-100 use the same sync signals. The normal monitor meant for use with the Z-100 uses negative video sync signals. Those monitors, meant for use with PC-compatible computers, use positive video sync signals.

Some, such as the ZVM-134 and ZVM-135 are able to use either negative or positive sync signals, but require different cables.

The Z-100 video logic board is able to provide either negative or positive video sync signals, to suit the monitor being used. The choice of signal is controlled by a pair of jumpers, J302 and J304, on the Z-100's video logic board (See Pictorial I-5).

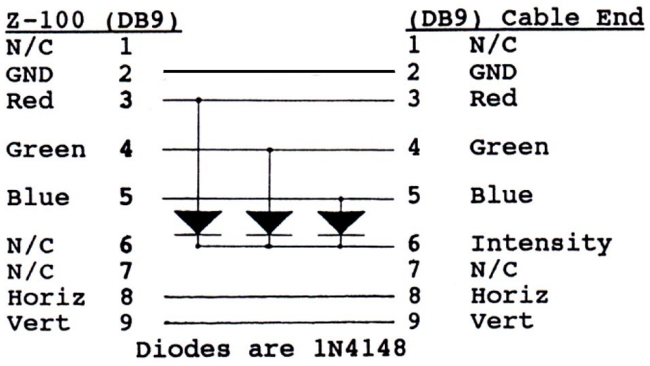
Positive sync is provided by moving the J302 and J304 jumpers to the "+", positive, lower position. However, some monitor cables would require modification to provide this signal to the proper connector pins.

Note: Composite sync can be used for these monitors. However, negative composite sync must be applied to both pins 1 & 9 (or 14 for the ZVM-135), or positive composite sync must be applied to both pins 2 and 4. This will require a modified cable.
~~~~~~

Z-100 Video Cable Intensity Adaptor

Several CGA monitors meant for use with PC-compatible computers use an intensity signal that cannot be provided from the standard Z-100 Video Logic Board. If you connect the Z-100 RGB output to a PC-compatible monitor, and do not make special provisions for the intensity line, the monitor will display only the seven (not including black) low intensity colors and you would need to turn the monitor's brightness control to almost maximum intensity to achieve normal Z-100 colors.

However, these monitors can still be used with the Z-100. The following adaptor pinout from Paul Herman can be constructed to synthesize an intensity signal for those standard CGA monitors that can use it.



Pictorial I-4
Video Cable Intensity Adaptor

The ZVM-135 is one monitor that can accommodate such a video intensity signal, using pin 15. Other monitors may use other pins. Knowing which pin is used, the adaptor can be constructed for either end of the cable or within one of the cable connectors itself.

The adaptor shown uses the pin assignments for the 9-pin DB9 connector because most PC-compatible monitors come with the data cable attached. The adaptor plugs into the Z-100 RGB video jack, then the cable from the monitor plugs into the adaptor.

The adaptor allows each color to produce a corresponding high intensity signal to the monitor. The three IN4148 diodes keep the red, green, and blue signals from feeding back into each other's output, through the intensity line.

Video Logic Board Jumpers:

The following jumpers are located on the Video Board (Refer to Pictorial I-5).

J301 - Selects vertical sync polarity for use by the internal monitor. The "-" position will produce a negative going sync.

J302 - Selects the horizontal sync polarity at pin 8 of the DB-9 connector. The "H" position will produce a negative going sync.

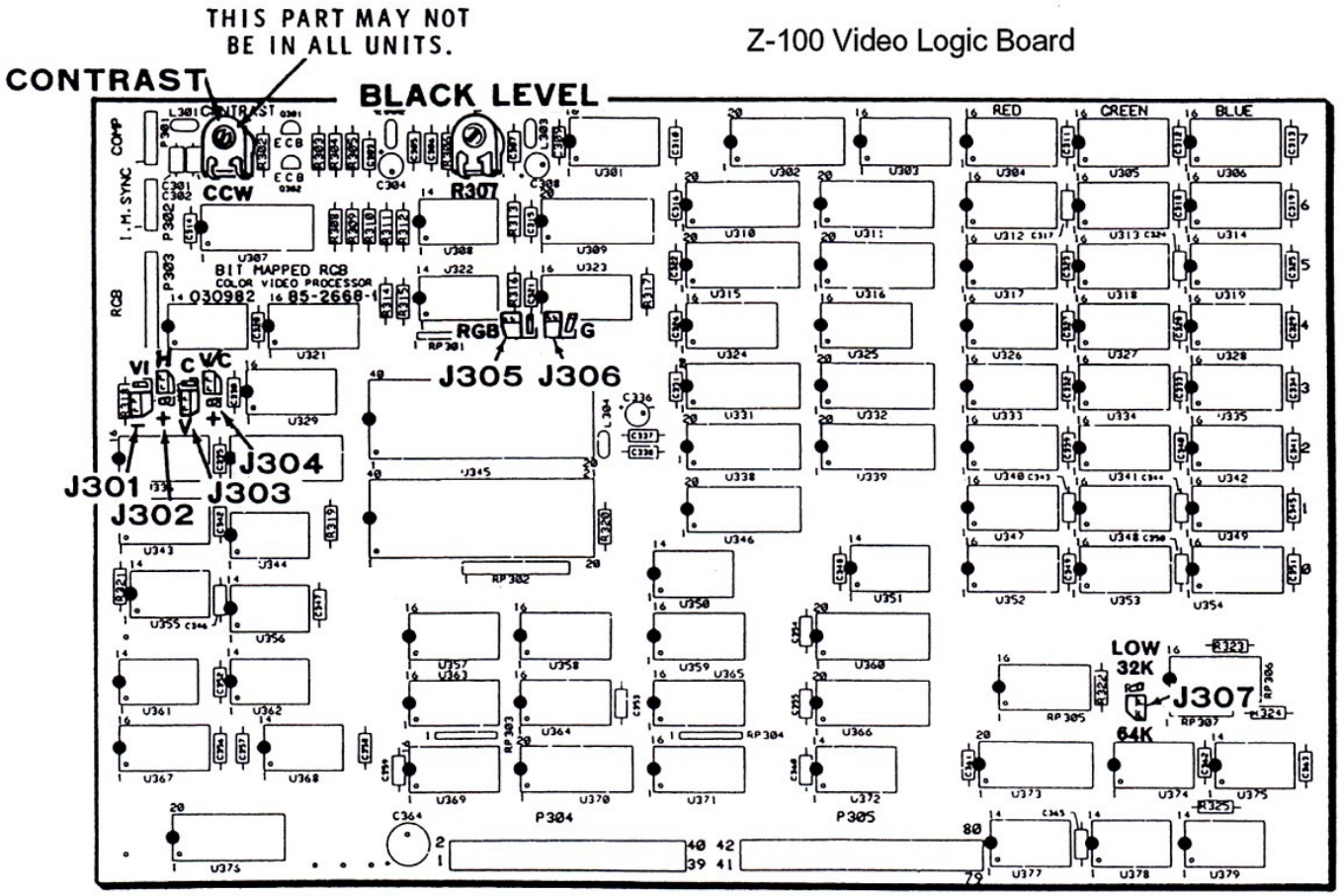
J303 - Selects the signal fed to pin 9 of the DB-9 Connector. If the jumper is in the "C" position, then pin 9 will have a composite sync. If the jumper is in the "V" position, pin 9 will carry the vertical sync signal.

J304 - Selects the polarity of either the composite or vertical sync signal on pin 9 of the DB-9 connector.

J305 - Selects RGB (color option if full video RAM is present) or the Green video RAM bank for a monochrome display. Used in conjunction with J306. If the jumper is in the "RGB" position, then the color option is selected. If the jumper is in the "G" position, a monochrome display will be used.

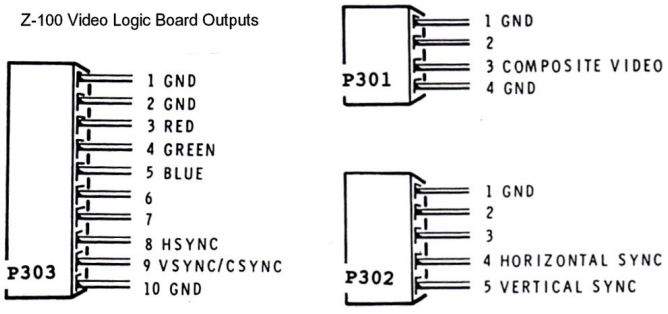
J306 - Selects RGB or monochrome. Set the same as J305.

J307 - Selects the memory addressing options and type for the video memory. If no jumper is present, then the chips are 32K and located in high memory. If the jumper is in the 32 position, the chips are 32K and located in the low end of the video memory. If the jumper is in the 64 position, the chips are 64K and cover both memory locations.



Pictorial I-5
Video Logic Board Jumpers

VIDEO LOGIC BOARD OUTPUTS



Pictorial I-6
Video Logic Board Outputs

Motherboard DIP Switch (S101) Settings

Refer to Pictorial I-7 for the location of switch S101 found on the CPU Motherboard next to the S-100 card cage.

Note: There are two commonly used DIP switches in the Z-100 and they tend to be confusing. Contrary to popular opinion that 1 = ON = shorted, these are 0 = ON = shorted. Therefore, the settings below are shown in this convention.

Section	**Description**
0	Default boot device*
1	Default boot device*
2	Default boot device*
3	1 (OFF) = Autoboot, 0 (ON) = Manual Boot
4	not used
5	not used
6	not used (except for MTR-ROMS v3.x and later) 1 (OFF) = Dvorak keyboard 0 (ON) = Qwerty keyboard
7	Selects video vertical scan frequency 0 (ON) = 60 Hz 1 (OFF) = 50 Hz

* Sections 0, 1, and 2, are set to reflect the type of drive that the system is to be booted from:

Section 0	1	2	Boot Device Type:
0 (ON)	0 (ON)	0 (ON)	5-1/4" Floppy Disk Drive (Internal)
1 (OFF)	0 (ON)	0 (ON)	8" Floppy Disk Drive (External)
0 (ON)	1 (OFF)	0 (ON)	5" Winchester Disk (Internal)
1 (OFF)	1 (OFF)	0 (ON)	LLSCSI EEPROM Device (MTR-ROM v3 or later)
1 (OFF)	1 (OFF)	1 (OFF)	LLIDE NVsRAM Device (MTR-ROM v4 or later)

~~~~~~

Motherboard Jumpers

Refer to Pictorial I-7 for the location of the configuration jumpers found on the CPU Mother-board. These jumpers perform the following functions:

J101 - Selects whether +5Vdc or address line BA14 is applied to pin 27 of the PROM. The position shown has +5Vdc connected to pin 27 for an 8K x 8 or 16K x 8 PROM. Move the jumper to the other position to use a 32K x 8 EPROM.

J102 - Same as J101 except for address line BA13 and pin 26 of the PROM. The position shown is for using an 8K x 8 EPROM. Move the jumper to the other position to use a 16K x 8 or a 32K x 8 EPROM.

J103 - Controls which transition of the light pen strobe (LTPNSTB) will cause a light pen interrupt. The position shown causes an inter-rupt on the negative-going edge. It is properly jumpered for operation with a light pen that causes a negative pulse during a "hit".

J104 - No jumper is needed at this position. A foil trace connects the indicated two pins as shown. If the foil is cut and a jumper is installed in the ther position, an NMI (TRAP for the 8085) will be generated when the S-100 power fail signal (PWRFAIL*) is active.

GND - Located beside J104, no jumper is necessary here. It is jumpered internally in the circuit board and to ground, and is used as a storage location for the wait state jumper, J106-1.

J105 - No jumper is needed at this position. If a jumper is installed, the TEST input to the 8088 will be grounded. Otherwise, this input is high.

J106 - For factory test use only. Its location on the motherboard varies.

J106-1 - This jumper, if installed, selects the number of wait states needed for proper motherboard operation, and varies with clock speed:

5 MHz: no jumper = 1 wait state
8 - 10 MHz: "W2" jumpered = 2 wait states
Faster ops: "W3" jumpered = 3 wait states

Incorrect setting may cause read/write problems with the drives, or CPU/boot errors, among other possible problems.

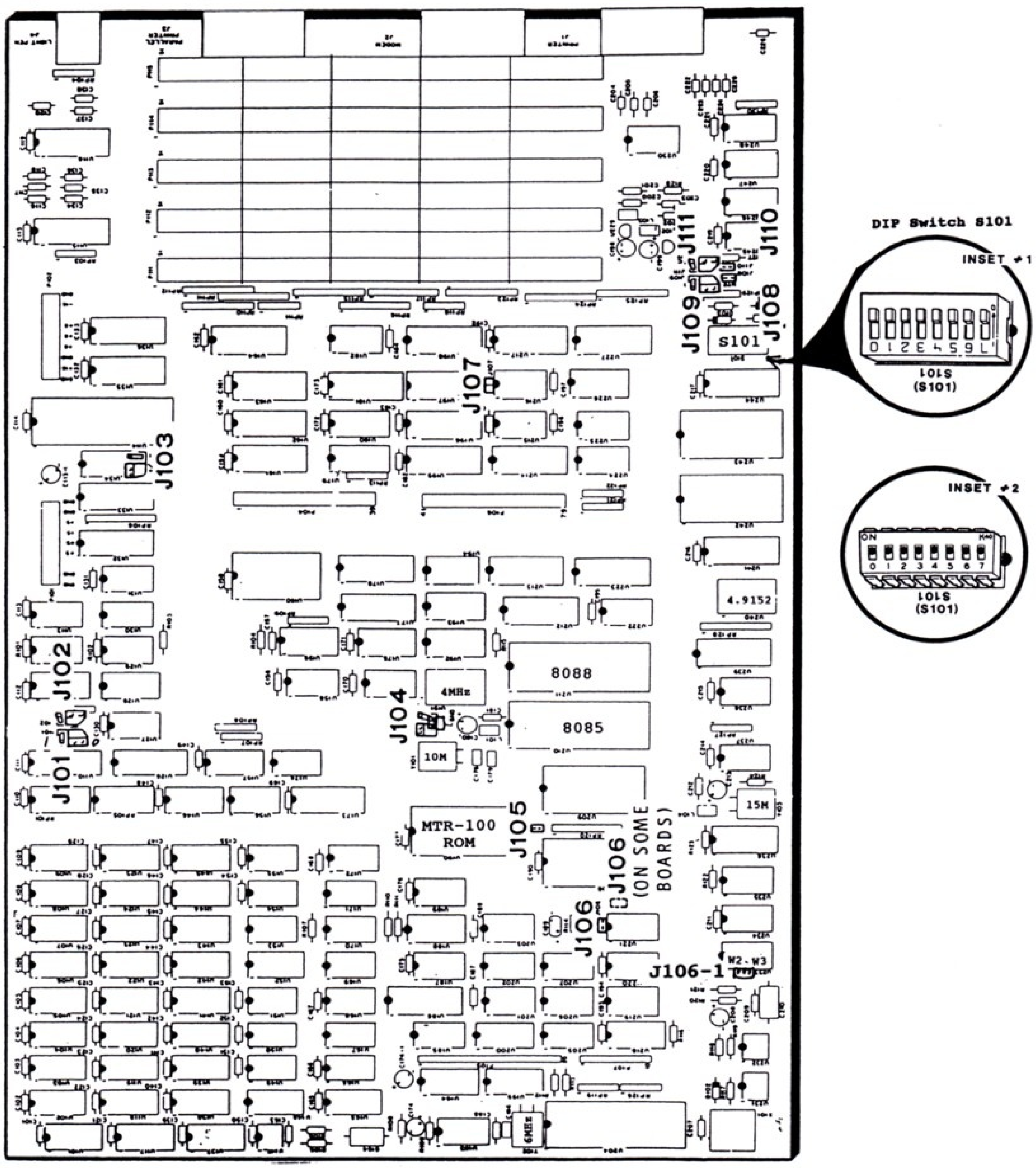
J107 - No jumper is needed at this position. A foil trace connects the two pins together. If the foil is cut, the main board will not provide the S-100 MWRT signal. Currently, the main board does provide this signal to the S-100 bus.
~~~~~~

J108 - No jumper is presently used at this position. If a jumper plug is installed, serial port B will generate an interrupt when the transmitter is empty (TXEMT active) in addition to its normal interrupts.

J109 - This jumper connects serial port A DCD input to either ground or RTS from the connector. It is normally set in the mode shown that connects DCD to RTS.

J110 - Same as J108, but for serial port A.

J111 - This jumper connects the serial port A CTS line to either ground or RTS from the serial connector. It is normally set in the position shown, which connects the CTS line to ground.



Pictorial I-7
Z-100 Motherboard Jumpers and DIP Switch S101

Z-207 Floppy Disk Controller

Introduction

The Floppy Disk Controller Card is located in the S-100 card cage at the rear of the computer, where it operates as a slave unit on the bus. It has the following features:

- Up to four 5.25" drives and four 8" drives may be used.
- Single- or double-density, single- or double-sided formats.
- Clock rates up to 5 MHz and step rates from 3 to 30ms.
- Independently adjustable 5" and 8" drive precompensation.

Operational CAUTION: While the write signal for the drives is held inactive when the supply voltage drops, due to variations in disk drives, write-protection of disks is not guaranteed when disks are left in the drives during power up or power down.

Setting Z-207 DIP Switches (Z-DOS v4.01)

Referring to Pictorial I-8, the Z-207's DIP Switch, DS1, is used to set both the port address and whether a drive requires double-stepping (to do 40 tracks on an 80 track drive). The old BIOS (pre-DOS version 4) only supported either 40 (48 tpi) track drives or 80 (96 tpi) track drives, but NOT both.

The new BIOS (Z-DOS v4.01) supported both, but by doing so, this BIOS Boot Loader required that the DIP switch reflect the number of 40 and 80 track drives connected, and the order in which they are selected. This permited us to boot from any of the drives!

The new command, **DRIVECFG**, was required to be run to tell the BIOS what each drive is; LD (Low Density), DD (Dual Density), or HD (High Density) and would adjust IO.SYS accordingly.

Please NOTE:

- Dual Density Drives counted as High Density for these settings.

- By design, the High or Dual Density drives must occupy the lowest drive select numbers! This could leave your primary Boot 360Kb drive set as DS3! But, this drive could still be set by DRIVECFG to Drive A:!

- During a floppy boot, the computer defaulted to the first drive, DS0. For any other boot device, you needed to include the device number, 1, 2, or 3. For example: To boot from your low density, 360Kb drive that is set as DS3, at the hand Prompt, type:

{B}(oot){F1}{3}

where F1 is the normal boot command for a floppy drive, and 3 is the device number. Your default drive letter will be whichever was assigned by DRIVECFG as unit 3.

- **HINT:** To avoid having special Boot disks for each of your different computer configurations, set DRIVECFG on your 360Kb Boot floppies so all your floppy drives are Low Density. This allows Booting your Low Density 360Kb floppy from any of your low density drives.

Note: There are two commonly used DIP switches in the Z-100 and they tend to be confusing. Contrary to popular opinion that 1 = ON = shorted these are 0 = ON = shorted. Therefore, the settings on the next page are shown in this convention.

Setting Z-207 DIP Switches (Z-DOS v4.05+)

Note: The new Z-DOS v4.05 and later made the earlier Z-DOS v4.01 obsolete, and it is no longer supported. Changing the Z-207 DIP switch to reflect 48 TPI vs 96 TPI drive numbers caused a problem with other operating systems! Therefore, the Z-207's DIP Switch, DS1, is back to the original configuration definition.

DRIVECFG has now added the capability to mix 48 TPI and 96 TPI drives independently. And the latest Z-DOS no longer looks at the Z-207 DIP switch nor cares what drives are installed where. However, to remain compatible with the other operating systems, set the DIP switch as needed for those other operating systems.

Remember, for compatibility with the other operating systems, leave one 48 TPI drive as either A: or B:, any 8" drives as C: or D:, and any hard drive partitions as E:, F:, G:, or H:.

During a floppy boot, the computer still defaults to the first drive, DS0. For any other boot device, you needed to include the device number, 1, 2, or 3. For example: To boot from your low density, 360Kb drive that is set as DS3, at the hand Prompt, type:

{B}(oot){F1}{3}

where F1 is the normal boot command for a floppy drive, and 3 is the device number.

Setting the Z-207 DIP Switch

DIP Switch #		Function
7	1 (Off)*	MSB Port Address (0Bxh). The x indicates the LSB setting
6	0 (On) *	Port Address
5	1 (Off)*	Port Address
4	1 (Off)*	Port Address
3		LSB Port Address
	0 (On) *	= Primary Controller LSB port address (0)
	1 (Off)	= Secondary Controller port address (8)
2	0 (On) *	(don't care, not used)
1	**Precomp**	= For 5-1/4" DDEN Media: For 8" DDEN Media:
	0 (On) *	Precomp tracks 23-40 Precomp all tracks
	1 (Off)	Precomp off Precomp tracks 44-76

Note: While the Hardware Manual states that Section 1 controls pre-compensation as stipulated above, it is NOT used by standard Heath/Zenith Operating Systems. Write Precompensation is controlled as follows:

34-pin Connector:	Applied Pre-compensation:
48 tpi DDEN media Tracks	>22 via software (IO.SYS)
96/135 tpi DDEN media	Tracks >43 via Z-207 hardware

50-pin Connector:	Applied Pre-compensation:
96/135 tpi DDEN media	Tracks >43 via Z-207 hardware

Note: Pre-compensation is automatically disabled for all single density media.

Note: If a jumper is installed at J0 on the Z-207 Controller, 96/135 tpi drives on the 34-pin connector will have NO precompensation applied, but it could be placed under software control, using the DIP switch.

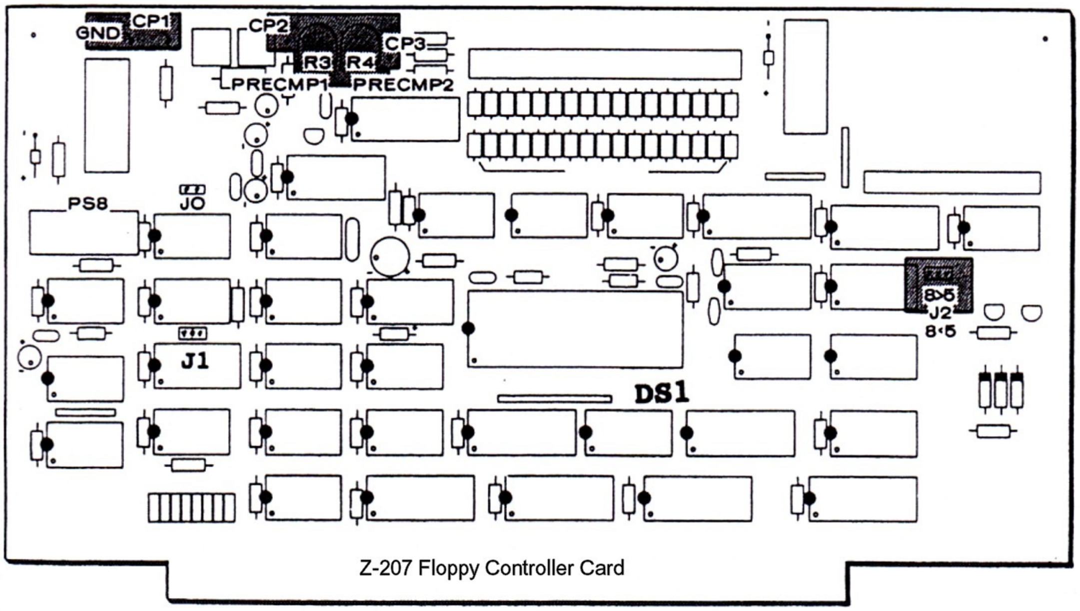
0	0 (On)*	= 48 tpi, 5-1/4" drive setting
	1 (Off)	= 96 tpi, 5-1/4" drive setting (except DOS v4.x)

Note: While Z-DOS v4.06 no longer cares what mix of 48 and 96 tpi 5-1/4" drives are used, earlier distributions of Z-DOS v4.01 required DIP switch sections 0 and 1 be set for the number of high density drives attached as follows:

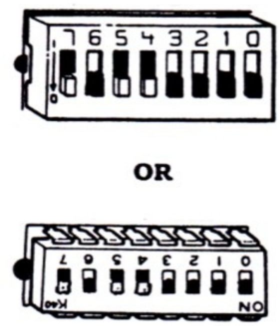
1	0	Drive Types Connected	
0 (On)	0 (On)	4 -48 TPI drives (std 360 Kb drives)	
0 (On)	1 (Off)	1 -96 TPI drive (DS0),	3 -48 TPI drives (DS1 -DS3)
1 (Off)	0 (On)	2 -96 TPI drives (DS0, DS1),	2 -48 TPI drives (DS2, DS3)
1 (Off)	1 (Off)	3 -96 TPI drives (DS0 -DS2),	1 -48 TPI drive (DS3)

Table Notes:

- 0=On, 1=Off
- An Asterisk (*) denotes the standard Heath/Zenith Setting
- DS = Drive Select (DS0 - DS3)



DIP Switch DS1



Shaded areas shown are used by calibration procedures.

Pictorial I-8
Z-207 Floppy Disk Controller Board

~~~~~~

Z-207 Floppy Controller Card Jumpers

Refer to Pictorial I-8 for the location of the configuration jumpers found on the Floppy Disk Controller Card. These jumpers are:

J0 - Not normally installed (out), this jumper is used to configure the board for use in other non-standard configurations. It can set a special configuration for using 5.25", 96 TPI Double Density drives.

J1 - Not normally requiring change, this jumper adjusts the clock speed of the board for non-standard configurations. The clock speed jumper is a factor under the following conditions:

- For a CPU that operates faster than 3 MHz, no changes are required. The card is ready for operation.

- For a CPU that operates at 3 MHz or slower, perform the Z-207 Throughput Mod described later.

- For a CPU operating at 10 MHz or faster, changing this jumper will improve floppy disk throughput by reducing by one wait state the time necessary for the Z-207 card's RDY line to show ready. At 12.667 MHz, the increase is 24%; at 10 MHz it is 6-8%. At 8 MHz the increase is marginal.

J2 - This jumper is used during calibration and selects whether the 5.25" or the 8" drive will receive the lower pre-compensation value.

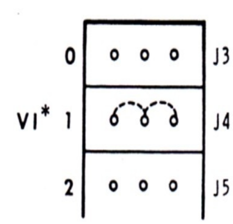
The VI Lines

The Vectored Interrupt (VI) lines are properly configured to operate in the Z-100; no interrupt jumpers are necessary. However, if you use the Controller Card in a non-standard configuration, configure VI lines 0 thru 7, as required, by installing the necessary jumper wires.

The data request line (DRQ) from the 1797 is connected to holes J3 thru J10, while the 1797's interrupt request line (IRQ) is connected to holes 0 thru 7. The center row of holes are connected to the S-100 interrupt lines VI0 thru VI7, which corresponds to the 0 thru 7 numbering of the IRQ holes. Connect the selected option to the proper center hole.

For example, a jumper wire soldered from the center hole to J4 selects a data request interrupt on S-100 interrupt line VI1, while a jumper wire soldered from the center hole to 1 selects an interrupt request on S-100 interrupt line VI1 (see Pictorial I-9).

You may connect both interrupt lines to the same center hole if you desire to generate an interrupt on either DRQ OR IRQ.

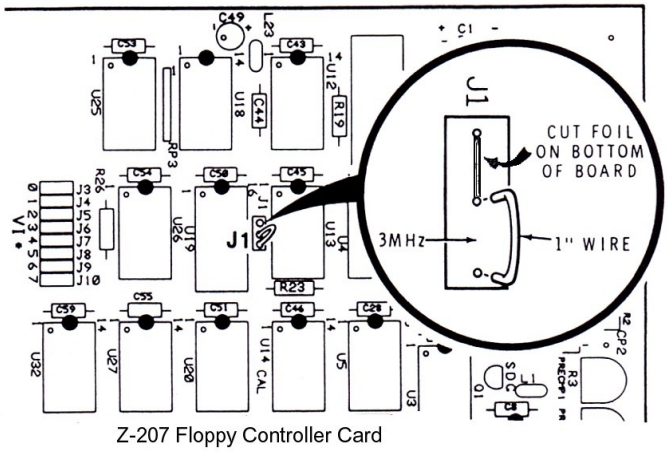


Pictorial I-9
Selecting Vector Interrupts
~~~~~~

Z-207 Board Throughput Mod

This modification includes de-soldering, soldering, and cutting a trace on the circuit board.

Pictorial 1-10 shows cutting the indicated foil on the bottom side of the circuit board at J1, installing a 1" bare wire, and then soldering the wire ends to the foils.



Pictorial 1-10
Clock Speed Selection

A suggested alternative to installing a wire jumper is to install a three terminal, single row, straight header in the holes marked J1 and use a shorting jumper.

CAUTION: There are two different H/Z-207 boards. The earlier version board has a U2 silkscreen outline on the upper left side near the voltage regulators. The newer version has J0, the TG43 jumper, in the same location. This modification is described for the J0 board. If you have the other board, the pins are reversed, but the procedure is the same. Simply install the shorting jumper on the pins that were not shorted by the circuit trace.

If you have any questions or comments, please email me at:
z100lifeline@swvagts.com

Cheers,

Steven W. Vagts