

SMB Assembly Manual

SYSTEM MONITOR BOARD ASSEMBLY MANUAL

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CAUTION: THE SYSTEM MONITOR BOARD KIT CONTAINS SEVERAL STATIC SENSITIVE DEVICES. DO NOT REMOVE THESE FROM THEIR PROTECTIVE PACKAGING UNTIL THEY ARE NEEDED IN ASSEMBLY. THEN FOLLOW THE HANDLING INSTRUCTIONS IN THIS MANUAL. FAILURE TO HEED THIS PRECAUTION MAY RESULT IN PERMANENT DAMAGE TO THESE DEVICES AND WOULD AUTOMATICALLY VOID THE WARRANTY.

A. ABOUT BUILDING KITS

Assembling a piece of equipment and finding that it works properly on its first checkout can be a great source of pride and enjoyment. Two factors can make this experience possible for you. The first is quality engineering, which involves properly designing the equipment, securing reliable components, and preparing clear assembly and operating instructions. The second is careful construction. We at TDL have taken care of the first factor. You must be responsible for the second. To help you in this, we offer the following construction tips, which are considered standard operating procedure in many commercial shops. Following these will help ensure that your kit works properly the first time.

1. ALWAYS read all of the instructions before starting to build.
2. Always work in a clean, well-lighted area.
3. Use only high quality rosin core solder of a gauge similar to that of the leads being soldered.
4. Make sure that you have all the parts needed in a given stage of construction before beginning that stage.
5. Use the lowest-power soldering iron that will get the job done. A 25 watt iron is quite adequate for this kit.
6. Use a fine-point soldering iron, and keep the tip clean and well-tinned.
7. Avoid overheating the PC board and components.
8. Before soldering a component, check to make sure that it belongs at that place. Having to remove and resolder a part is difficult, and it is likely that either the board or the component will be damaged in the process.
9. Apply the solder to the iron tip, the pad and the

- component lead at the same time. The solder will melt and flow in a second or two. If it does not, stop and find out why before continuing.
10. Use only enough solder to ensure electro-mechanical integrity. 1/8th inch or so of the solder supplied with this kit is generally adequate for IC socket leads.
 11. Look carefully at each joint, both during and after soldering it. It should have a clean, bright appearance. If the surface is rough or dull, it might be a "cold" joint. It would then have to be reheated, and a little more solder would have to be added.
 12. Avoid working on the kit when you are very tired.
 13. Always check the voltages on appropriate IC pins after assembly and before installing the IC's in their sockets.
 14. Never install IC's in sockets when there is voltage on the board.
 15. ALWAYS install MOS/CMOS devices LAST, when you are sure everything else is perfect.
 16. NEVER insert the board in its socket when the computer is turned on.

B. HANDLING MOS/CMOS DEVICES

Static damage to these sensitive devices is unlikely to occur when they are handled correctly. The rules for correct handling are simple:

1. Keep everything in contact with everything else. While the IC is still in its case, hold it in your hand, touch both to the table, the PC board, etc. This allows any static present to discharge.
2. Work on a conductive surface. Bare, grounded metal (a cookie tin, a piece of aluminum foil) is best. Glass is very bad; plastic is worse.
3. Wear cotton clothes, not synthetics.
4. A medium-humidity environment is better than a very dry room.

Remember, the most basic rule is to keep everything in contact with everything else. If you adhere to this one and to the others, and add some common sense, it is unlikely that you will ever damage a static-sensitive device.

C. PARTS LIST

The following is a list of parts included with the System Monitor Board kit. Before proceeding with assembly, check the contents of the kit with the parts list. Check to see if an errata sheet is included with the kit. It will indicate any changes that have occurred. Occasionally there will be a part that is not exactly the same but is an acceptable substitute and was included due to availability. An example of this is a 47mfd tantalum electrolytic instead of the normal 33mfd unit. However, if a 3.3mfd was included, it would obviously be the wrong part.

SOCKETS:

CHECK	QUAN.	NUMBER OF PINS
()	1	8
()	12	14
()	12	16
()	4	18
()	5	24
()	1	40

RESISTORS:

CHECK	QUAN.	WATTS	VALUE	COLOR CODE
()	1	--	DIP Pack	White DIP
()	1	1/4	100 ohm	brown, black, brown
()	2	1/2	150 ohm	brown, green, brown
()	2	1/4	620 ohm	blue, red, brown
()	2	1/2	820 ohm	grey, red, brown
()	4	1/4	1K	brown, black, red
()	2	1/2	1.2K	brown, red, red
()	2	1/4	2.2K	red, red, red
()	1	---	2.49K	Precision resistor
()	5	1/4	4.7K	yellow, violet, red
()	6	"	10K	brown, black, orange
()	2	"	20K	red, black, orange
()	2	"	33K	orange, orange, orange
()	2	"	47K	yellow, violet, orange
()	1	"	100K	brown, black, yellow
()	1	"	1 Meg	brown, black, green
()	1	"	10 Meg	brown, black, blue

DIODES:

CHECK	QUAN.	DESCRIPTION
()	4	1N270
()	4	1N4001
()	2	1N5349B
()	1	LED

CAPACITORS:

CHECK	QUAN.	VALUE	TYPE
()	1	47 pf	disc
()	1	220 pf	disc
()	1	560 pf	disc
()	2	0.0022 mfd or 2200 pf	disc
()	11	0.1 mfd	black ceramic
()	1	0.1 mfd	Precision, Silver with red dot
()	1	4.7 mfd	tantalum electrolytic
()	5	33 mfd	tantalum electrolytic

MISC.:

CHECK	QUAN.	DESCRIPTION
()	1	4-bit DIP switch
()	1	8-bit DIP switch
()	14	Augat pins
()	1	Crystal
()	1	T&B/Ansley 26 pin connector
()	1	7805 3-lead regulator
()	1	heat sink, single hole
()	1 ea	6/32 x 5/16 screw, washer, and nut
()	3 in.	jumper wire
()	5 feet	solder, rosin core
()	1	SMB printed circuit board
()	1	SMB Assembly Manual
()	1	SMB User's Guide
()	1	SMB Limited Warranty Card

ICs:

CHECK	QUAN.	NUMBER	TYPE
()	1	C 28050 M or MK 34038 N	Masked 2Kx8 ROM
()	4	TIL 113	20 mil loop driver
()	1	14411	baud rate generator
()	1	1488	RS 232 driver
()	1	1489	RS 232 receiver
()	1	3130	op amp
()	1	4047	one-shot
()	1	4070	quad exclusive OR
()	2	4528	dual one-shot
()	4	4804	1K x 4 static memory
()	1	6820	PIA
()	3	6850	ACIA
()	2	74LS02	quad NOR gate
()	1	74LS04	hex INVERTER
()	2	74LS20	dual 4-input NAND
()	1	74LS27	triple 3-input NOR
()	1	74LS138	3 to 8 decoder
()	6	74LS367	hex buffer
()	2	8T97	hex buffer

D. ASSEMBLY PROCEDURE

IC SOCKETS:

When installing the IC sockets, be sure to orient the pin 1 of the socket in the proper direction. The proper direction is indicated on the board's silk-screen. One end of the rectangle will have a half-moon indentation. If the rectangle is oriented with the half-moon at the top, then pin 1 will be the first pin at the top left. On the socket itself there is also a pin 1 indication. However, the indication may or may not be similar to the one on the silk-screen. It depends on the type of socket being used. The most common designation is a 45 degree angle at the corner where pin 1 is located.

Install the following sockets:

- () 16 pin socket for resistor pack R1-R8. Pin 1 upper left.
- () 16 pin socket for U1. Pin 1 upper left.
- () 16 pin socket for U2. Pin 1 upper left.
- () 16 pin socket for U3. Pin 1 upper left.
- () 16 pin socket for U4. Pin 1 upper left.
- () 16 pin socket for U5. Pin 1 upper left.
- () 16 pin socket for U6. Pin 1 upper left.
- () 16 pin socket for U7. Pin 1 upper left.
- () 16 pin socket for U8. Pin 1 upper left.
- () 16 pin socket for U9. Pin 1 upper left.
- () 14 PIN SOCKET for U10. Pin 1 upper left.
- () 14 pin socket for U11. Pin 1 upper left.
- () 14 pin socket for U12. Pin 1 upper left.
- () 14 pin socket for U13. Pin 1 upper left.
- () 14 pin socket for U14. Pin 1 upper left.
- () 18 PIN SOCKET for U15. Pin 1 upper left.
- () 18 pin socket for U16. Pin 1 upper left.
- () 18 pin socket for U17. Pin 1 upper left.
- () 24 PIN SOCKET for U19. Pin 1 upper left.
- () 24 pin socket for U20. Pin 1 upper left.
- () 24 pin socket for U21. Pin 1 upper left.
- () 24 pin socket for U22. Pin 1 upper left.
- () 16 PIN SOCKET for U23. Pin 1 LOWER LEFT.
- () 24 PIN SOCKET for U24. Pin 1 UPPER LEFT.
- () 14 PIN SOCKET for U25. Pin 1 LOWER LEFT.
- () 40 PIN SOCKET for U26. Pin 1 UPPER RIGHT.
- () 14 PIN SOCKET for U27 and U28. Pin 1 UPPER LEFT.
NOTE: U27 & U28 are each 6 pin ICs which share the same 14 pin socket. The ICs will be placed at the extreme ends of the socket leaving the middle two pins vacant.
- () 14 pin socket for U29. Pin 1 upper left.
- () 14 pin socket for U30 and U31. Pin 1 LOWER RIGHT.
NOTE: U30 & U31 are also 6 pin ICs which share the same 14 pin socket. The ICs will be placed at the extreme ends of the socket leaving the middle two pins vacant. Note also that the pin 1 orientation is OPPOSITE that of U27 & U28.

- () 14 pin socket for U32. Pin 1 UPPER LEFT.
- () 8 pin socket for U33. Pin 1 LOWER RIGHT.
- () 14 pin socket for U34. Pin 1 UPPER LEFT.
- () 16 pin socket for U35. Pin 1 upper left.
- () 14 PIN SOCKET for U36. Pin 1 LOWER LEFT.

INSTALL THE FOLLOWING RESISTORS (the 1/4 watt resistors are the smaller ones and the bigger ones are 1/2 watt):

Start at the upper left of the board.

CHECK	RNr.	VALUE	COLORS	WATTS
()	R43	1K	brown,black,red	1/4
()	R42	10K	brown,black,orange	"
()	R44	4.7K	yellow,violet,red	"
()	R45	4.7K	yellow,violet,red	"
()	R40	10K	brown,black,orange	"
()	R41	10K	brown,black,orange	"
()	R39	100K	brown,black,yellow	"
()	R37	1K	brown,black,red	"
()	R38	1K	brown,black,red	"
()	R35	47K	yellow,violet,orange	"
()	R36	47K	yellow,violet,orange	"
()	R33	10K	brown,black,orange	"
()	R32	10K	brown,black,orange	"
()	R29	33K	orange,orange,orange	"
()	R28	33K	orange,orange,orange	"
()	R31	100ohm	brown,black,brown	"
()	R27	620ohm	blue,red,brown	"
()	R26	620ohm	blue,red,brown	"
()	R30	4.7K	yellow,violet,red	"
()	R18	4.7K	yellow,violet,red	"
()	R25	2.2K	red,red,red	"
()	R24	2.2K	red,red,red	"
()	R19	20K	red,black,orange	"
Move to the bottom right of the board				
()	R9	20K	red,black,orange	"
Move to the bottom of the board just left of center				
()	R10	4.7K	yellow,violet,red	"
()	R11	1Meg	brown,black,green	"
()	R12	10K	brown,black,orange	"
()	R13	1K *	brown,black,red	"
*Note: The value of R13 was incorrectly silk-screened as 10K on some SMBs. 1K is the correct value.				
()	R14	150ohm	brown,green,brown	1/2
()	R15	150ohm	brown,green,brown	"
()	R17	2.49K	Precision resistor not color coded labelled "2491F"	
()	R16	10Meg	brown,black,blue	1/4
Move to the upper right of the board.				
NOTE: The following 4 resistors will be installed in an upright position. (R20, 21, 22, &23).				
()	R20	820ohm	grey,red,brown	1/2
()	R21	1.2K	brown,red,red	"

()	R22	1.2K	brown,red,red	"
()	R23	820ohm	grey,red,brown	"

NOTE THE FOLLOWING:

R1to R8 are contained in the white resistor pack which looks like an IC and is not soldered in like the other resistors. It plugs in like the ICs. Install it when the ICs are installed in the sockets.

R34 is optional. Do not install a resistor there.

INSTALL THE FOLLOWING DIODES:

NOTE: In identifying diodes, there will always be a band on one end of the body which must be oriented in the correct direction. The band is usually black or grey. The silk-screen will contain a symbol inside the rectangle representing the diode. One end has an arrow- this is called the anode. The other end has a bar - this is called the cathode. The band on the diode MUST be oriented on the same side as the bar (cathode) symbol on the silk-screen.

Move to the lower right of the board.

CHECK	NR.	TYPE	ORIENTATION
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()	CR1	1N270	band RIGHT
()	CR2	1N270	band RIGHT

Move to the far left of the board, midway up.

()	CR11	1N5349B	band TOP
()	CR12	1N5349B	band BOTTOM

Move to the upper right of the board, install the following diodes

in an upright position.

()	CR8	1N4001	band BOTTOM
()	CR7	1N4001	band BOTTOM
()	CR6	1N4001	band BOTTOM
()	CR5	1N4001	band BOTTOM

The following diodes are installed normally.

()	CR3	1N270	band LEFT
()	CR4	1N270	band LEFT

NOTE: There is no CR9 or CR10 on the board. They were removed

during a board revision.

()	LED	band=flat	band BOTTOM
		spot	

INSTALL THE FOLLOWING CAPACITORS:

NOTE: The following capacitors are 0.1 mfd. They are black in color and are labelled "100nS".

Move to bottom right of board.

CHECK	NR.	VALUE
()	C19	0.1mfd
()	C20	"
()	C21	"
()	C22	"
()	C3	"

Move to top left of board.

()	C12	"
()	C15	"
()	C13	"
()	C14	"
()	C10	"
()	C9	"

NOTE: The following capacitors are called disc ceramic.
They are usually yellow in color and circular in shape.

Move to the upper left of the board.

()	C17	0.0022 mfd (=2200 pf) labelled "2200" on silk-screen.
()	C16	0.0022 mfd (=2200 pf) labelled "2200" on silk-screen.
()	C23	47 pf labelled 47 K on capacitor.

Move to the lower left of the board.

()	C5	560 pf	located to the left of R13.
()	C2	220 pf	located to the right of U9.

Move to the upper left of the board.

()	C18	Precision 0.1 mfd	- NOTE: Observe POLARITY! The red end should be on the BOTTOM!
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The following capacitors are electrolytic tantalums.

POLARITY MUST BE OBSERVED!

Match the "+" on the capacitor with the "+" on the silk-screen.

Move to the lower left of the board.

()	C6	33 mfd	+ at bottom
()	C7	33 mfd	+ at bottom
()	C8	33 mfd	+ at bottom
()	C11	33 mfd	+ at bottom

Move to the left of U9.

()	C4	4.7 mfd	+ at bottom
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Move to the lower right of the board.

()	C1	33 mfd	+ at the upper left
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INSTALL THE SWITCHES:

()	4-bit dip switch.	Install so that the "1" is at the top and the "4" is at the bottom.
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- () 8- bit dip switch. CAUTION: This switch is installed U P S I D E D O W N ! ! ! ! ! ! ! ! In other words the "1" is on the RIGHT and the "8" is on the left.

INSTALL THE AUGAT PINS:

- () Find an old 14 pin IC and insert an Augat pin on each lead on one side only. Locate the seven holes immediately above U24 (14411). Insert the side of the IC which carries the Augat pins and solder them in place. The old IC may now be removed and the Augat pins will remain in perfect alignment.
- () Locate the two holes to the right of the above seven. They should be labelled "VIDEO". Insert and solder an Augat pin in the right hole.
- () Locate the two holes above the previous two. They should be labelled "TTY". Insert and solder an Augat pin in the right hole.
- () Cut two jumper wires approximately 1.5 inches long each. Strip both ends on each. On one end of one of the wires solder an Augat pin. Repeat for the other wire.
- () Take the bare end of one of the wires and insert and solder it in the one remaining free hole to the left of the "VIDEO" label. Repeat with the other wire in the hole to the left to the "TTY" label.

Move to the area below U9.

- () Insert an Augat pin in the hole labelled "POC".
- () Insert an Augat pin in the hole labelled "PRESET".
- () Make a jumper wire with Augat pin similar to the two made above. Insert the bare end in the hole to the left of "PRESET". The Augat side of the jumper will then be used to plug into either the "POC" or "RESET".

INSTALL THE FOLLOWING MISC. COMPONENTS:

CRYSTAL

- () The two holes for the crystal are located directly below U36. Insert the wires with 3/16 inch between the board and the crystal's case and solder. Then bend the crystal down flat against the board.

T & B /Ansley Connector.

- () Merely insert this connector from the component side of the board and solder all 26 pins.

Regulator

- () The regulator is labelled "7805". Hold the lettering facing you with the 3 leads pointing downward. Insert the regulator into the 3 holes in the upper left of the board. DO NOT SOLDER YET!!!!
- () Put a 90 degree bend in the 3 leads and do it in a way that allows the hole in the regulator to line up with the hole in the board.
- () Slip the heatsink between the board and the regulator and secure in place with the nut and bolt provided. Insert the bolt from the component side of the board and fasten the nut on the opposite side.
- () Solder the regulator leads.

CHECKOUT BEFORE INSTALLING CHIPS.

- () Visually check the entire board for any solder splashes, shorts, cold solder joints, wrong components, etc.
- () Check to make sure that the polarity of C1, C4, C6, C7, C8, and C11 are correct.
- () With an ohmmeter, check the resistance between pins 1 and 50 on the edge connector fingers on the board. It should register a resistance above 2000 ohms. If not, check for solder bridges between the positive voltage and ground.

PLUG THE BOARD INTO THE MOTHERBOARD. REMOVE ALL OTHER BOARDS FROM THE SYSTEM FOR THE FOLLOWING TEST. TURN THE POWER ON.

- () With a DC voltmeter, connect the negative lead to ground (pin 50 or 100), and measure with the positive lead the voltage on each of the three leads on the regulator. The left lead should indicate the input voltage to the board. This should be +8 volts normally but under the light load of only one board will be higher. Up to 12 volts is likely. The center lead should measure zero. The right lead is the +5 volts lead.
- () Check the +5 volt lead on all of the sockets to verify that they are all receiving their proper voltage.

- () The voltage at the cathode (band) of CR12 should be +12 volts.
- () The voltage at the anode (arrow) of CR11 should be -12 volts. The leads will have to be reversed on voltmeters which do not have provision for measuring negative. Turn the system's power off and remove the board.

Install all of the following except those with a double asterisk, **, into their respective sockets:

POSITION	IC	
R1-R8	ResistorPack	
U1	74LS367	*
U2	8T97	*
U3	8T97	*
U4	74LS367	*
U5	74LS367	*
U6	74LS367	*
U7	74LS367	*
U8	74LS367	*
U9	** 4528	
U10	74LS02	
U11	74LS20	
U12	74LS02	
U13	74LS27	
U14	74LS20	
U15	** 4804	
U16	** 4804	
U17	** 4804	
U18	** 4804	
U19	** MK34038NorC28050M	*
U20	** 6850	
U21	** 6850	
U22	** 6850	
U23	74LS138	
U24	** 14411	
U25	74LS04	
U26	** 6820	
U27	TIL113	
U28	TIL113	
U29	1488	
U30	TIL113	
U31	TIL113	
U32	1489	
U33	** 3130	
U34	** 4070	
U35	** 4528	
U36	** 4047	

- * An IC with an asterisk indicates that the label on the silk-screen may not be exactly the same as the above list shows. Go by the above list when there

is a difference.

** A double asterisk indicates MOS devices sensitive to static charge. Handle with caution according to procedures described elsewhere in this manual.

Notes: U27 is installed in the top part of the socket to the right of U29. Pin 1 is in the upper left. U28 is installed in the bottom part of the socket. If properly installed, there should be 2 unused pins in the CENTER of the socket. Pin 1 is upper left on both ICs. U30 and U31 are installed in the socket to the LEFT of U29. A similar procedure is followed as for U27 and U28 EXCEPT THE PIN 1 ON BOTH ICs IS L-O-W-E-R R-I-G-H-T rather than upper left.

() Measure the voltages again. They should be the same.

If they are not, an IC may have been inserted incorrectly or may be defective. Check the orientation of each chip. Next, find the defective chip by removing power, removing the IC, reapplying power, and measuring voltages. Repeat this process until the voltages return to normal-- until the defective IC is found.

A quick way to find a defective IC is to feel each IC for one that is especially hotter than the rest. This is usually the defective one.

() When everything is satisfactory up to this point, proceed by removing power and the board and installing the remaining ICs. CAUTION. These ICs are the static sensitive CMOS type. Observe caution in their handling.

This completes the assembly of Technical Design Labs' System Monitor Board. Refer to the User's Manual for instructions