SENATOR

Saitek™

Project : RM27
Doc No. : RM27-PG-010
Rev. : 0
Date : 17 September, 1998

GENERAL PRODUCT SPECIFICATIONS FOR SENATOR

A.	Operating voltage	:	8 ~ 11 volts
B.	Current consumption	:	Operating voltage = 9.0 V
	Normal operation	:	110 mA typical 180 mA max (with the RW9)
	Stop mode	:	2 µA typical 10 µA max (by backup battery)
C.	Power consumption	:	1.62 W max
D.	System clock frequency	:	20MHz ± 1% (Operating Voltage = 9.0V)

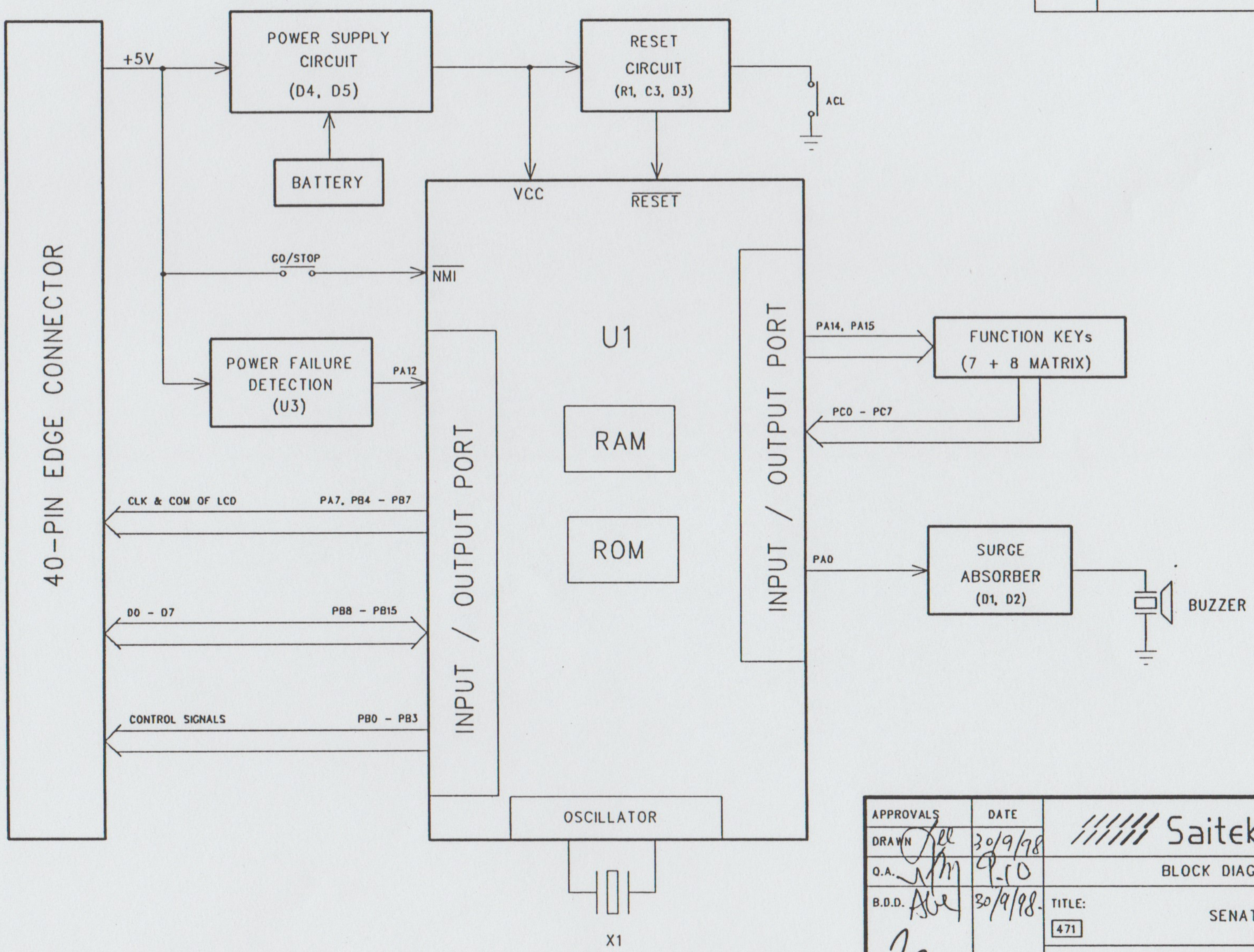
PREPARED BY : ______________
Abraham Au

APPROVED BY : ______________
BDM

DIST : BDM, QAM, SED, AA

PRELIMINERY

REVISION			
DATE	DESCRIPTION	ECN NO.	REV. NO.



APPROVALS	DATE	Saitek Ltd.	
DRAWN	30/9/98	BLOCK DIAGRAM	
Q.A.	9.10		
B.D.D.	30/9/98.	TITLE: 471 SENATOR	
		DWG. NO. RM27 - PE - 002	REV. 0

Dist: BDM, QAM, SED, PE

Project : RM27/RM27B
Doc No. : RM27-PS-011
Rev. : 0
Date : 17 September, 1998

ADJUSTMENT PROCEDURE FOR SENATOR/MAGELLAN

OBJECTIVE : To adjust system clock frequency.

EQUIPMENT :
1. Oscilloscope capable of frequency measurement up to 50MHz,
2. Mephisto Exclusive (RW9) or an equivalent tester with adaptor.
3. Mephisto 6. Generation LCD module (RD2).

PROCEDURE:
1. Disassemble the logic module.
2. Connect the logic module and a RD2 to an RW9 or an equivalent tester.
3. Connect an appropriate adaptor to the RW9 (or tester) and switch it on.
4. Place probe of scope at pin 74 of U1.
   If the frequency measured is out of specification (19.8 - 20.2 MHz), replace X1 until counter/scope reading is within specification.
5. Reassemble the logic module.

Prepared by : ______________________
Abraham Au

Approved by : ______________________
BDM

Dist : BDM, QAM, SED, AA

Filename :RM27B_PS.DOC

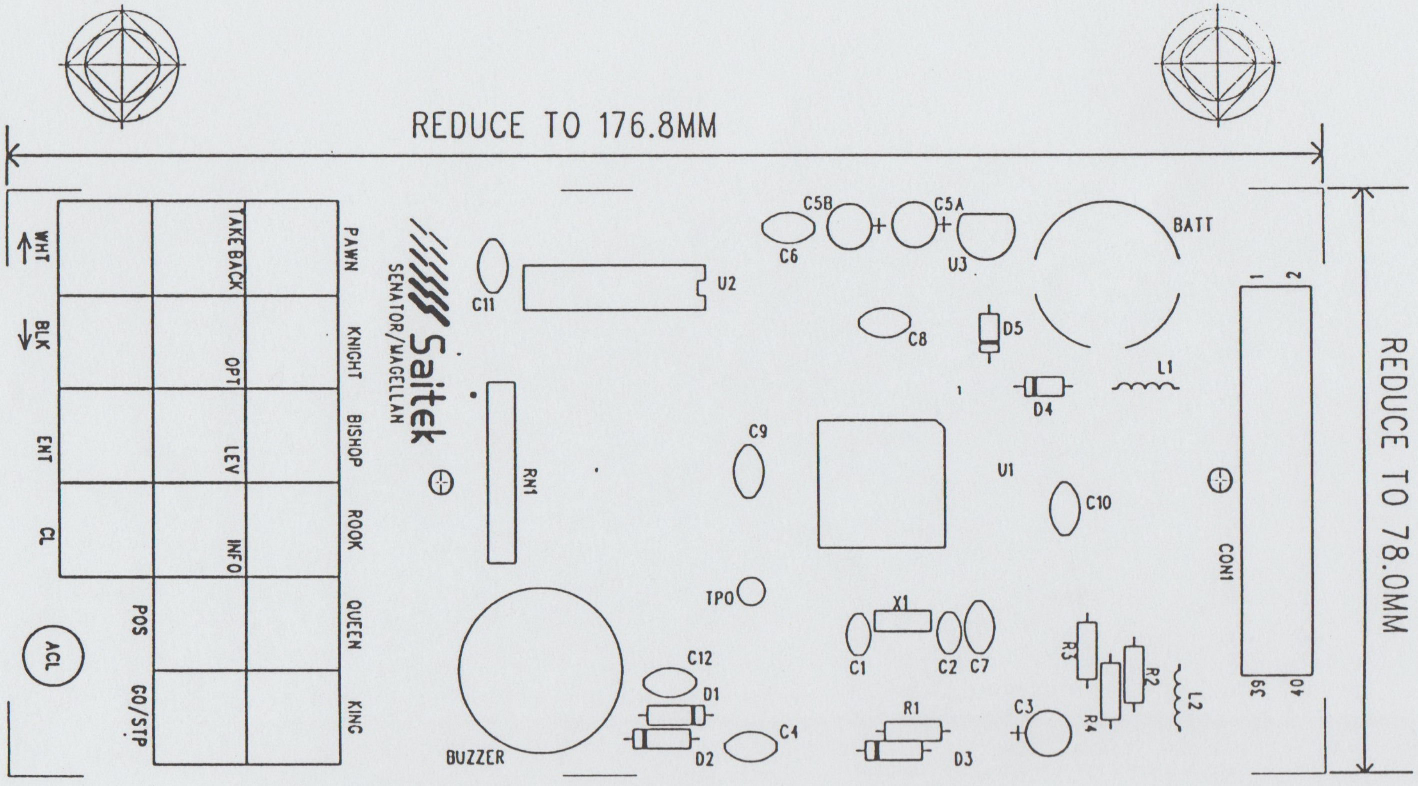
PROJECT : MEPHISTO SENATOR
DOC. NO. : RM27-PS-012
REV. : 0
DATE : 5th October, 1998

Mephisto SENATOR Trouble Shooting Chart

SYMPTOMS		POSSIBLE CAUSES	REMEDIAL ACTIONS
Unit cannot be turned ON	1.	Incorrect MCU Vcc voltage.	• Check and adjust adaptor output to within 8.0 - 11.0V. • Check and ensure RW9 is working properly. • Check and replace defective backup battery if its voltage is lower than 2.0V. • Check and repair any open or short circuits in GND or Vcc traces. • Check and replace any defective components in power supply circuit (L1, L2, D4, D5. C5).
	2.	Reset signal for U1 pin 79 logic "LOW".	• Check and ensure ACL switch is not short to GND. Correct if necessary. • Check and ensure U1 pin 79 is logic "HIGH". Replace R1, D3. C3 or U1 if necessary.
	3.	Crystal not oscillating.	• Check for 20MHz+/-1% at U1 pin 73 (or pin 74). Replace C1, C2. X1, or U1 if necessary.
	4.	GO/STOP circuit defective.	• Check and replace any defective components in GO/STOP circuit (R2, C12, GO/STOP button).
No sound	1.	Defective beeper.	• Replace beeper
	2.	Defective D1, D2.	• Check and replace D1 or D2.
	3.	Bad pulse output.	• Check and ensure that there is pulse output from U1 pin 53 when sound is on. Replace U1 if necessary.
LCD segments missing or LCD does not turn on	1.	Broken or short circuit on PCB.	• Check and repair broken or short circuit on PCB.
	2.	Bad signals to LCD module.	• Check and ensure there are signals at pin 15-23, 26, 27, 28, 33 of the edge connector.
	3.	Defective U1.	• Check and replace U1

LED missing or turns on/off erroneously	1.	Broken or short circuit on PCB.	• Check and repair broken or short circuit on PCB.
	2.	Bad signals to RW9.	• Check and ensure there are signals at pin 15-22, 29-32 of the edge connector.
	3.	Defective U1.	• Check and replace U1
No response/erroneous response to command keys or chessboard	1.	Broken or short traces on PCB.	• Check and repair any broken or short traces on PCB.
	2.	Bad signals to RW9.	• Check and ensure there are signals at pin 15-22, 29-32 of the edge connector.
	3.	Defective U1.	• Check and replace U1
No memory function	1.	Broken or short traces on PCB.	• Check and repair any broken or short traces on PCB.
	2.	Weak or dead backup battery.	• Replace with new battery.
	3.	Defective U1.	• Replace U1.
Excessive current drain	1.	Short traces on PCB.	• Check and repair any short traces on PCB.
	2.	Defective U1.	• Check and replace U1.
	3.	Contamination and/or foreign particles on PCB.	• Check and clean PCB. • Replace PCB.
Generates illegal moves	1.	Defective U1.	• Check and replace U1.

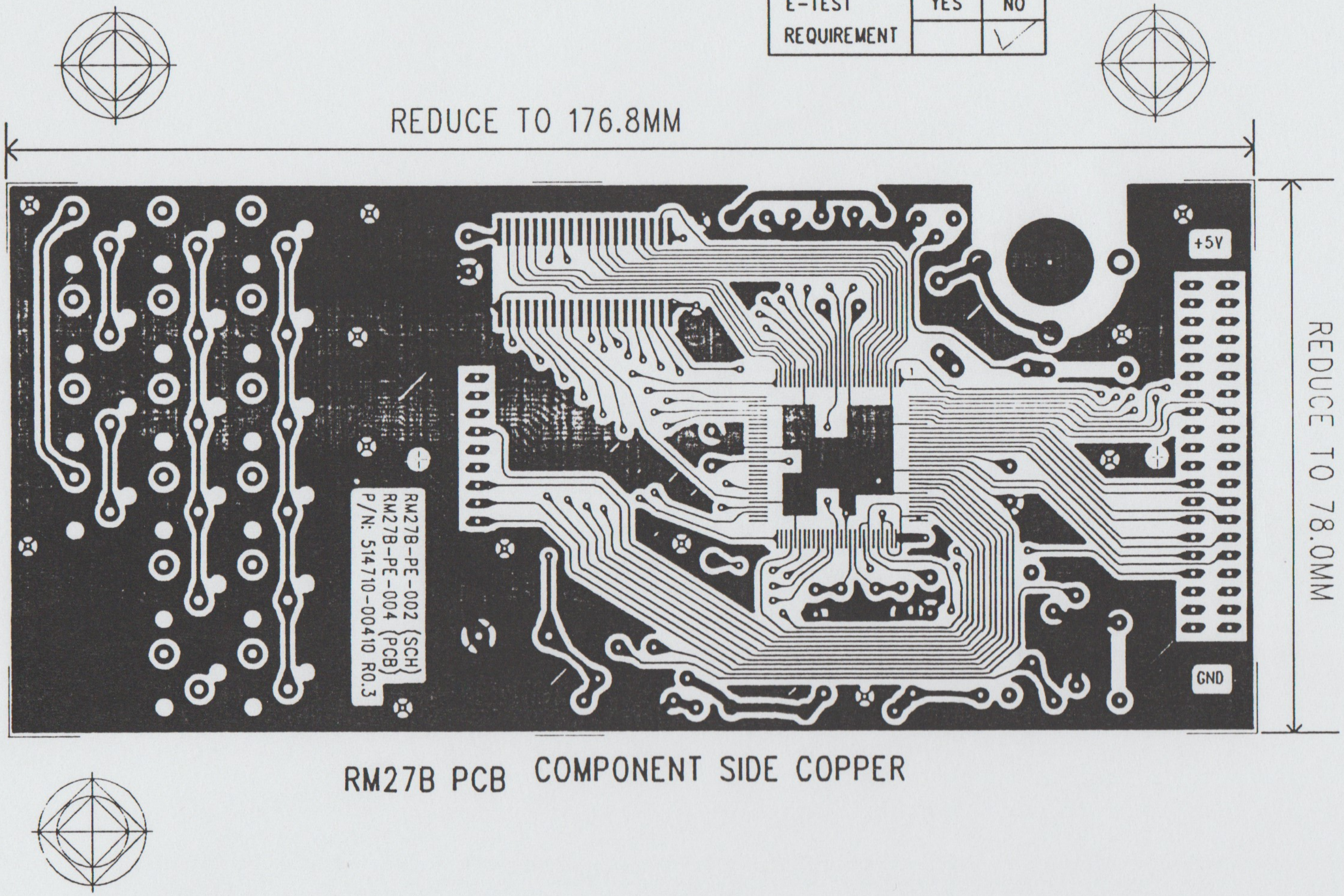
Dist : BDM, QAM, SED, PE



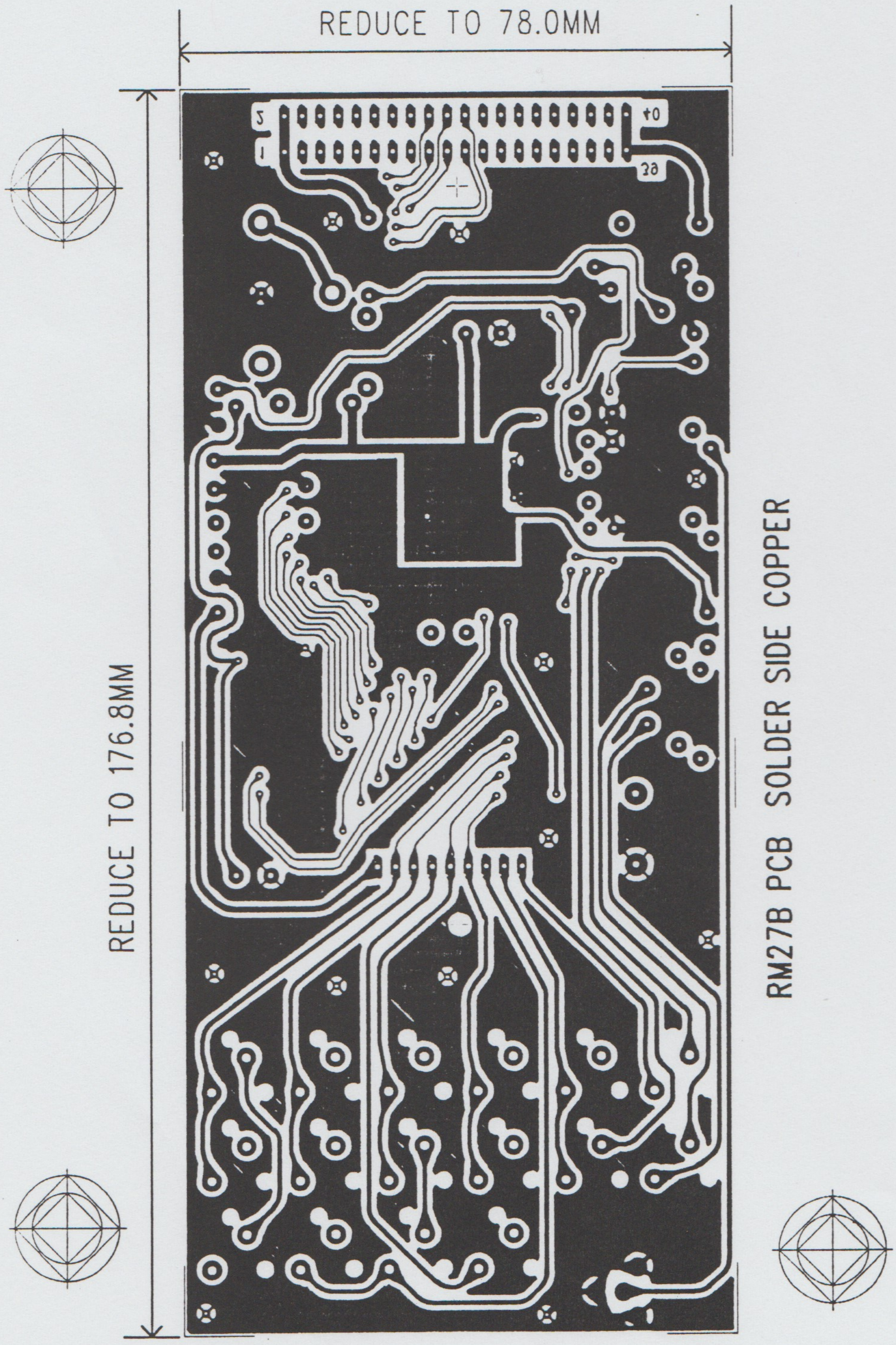
RM27B PCB SILKSCREEN

RM27SS.PHO - Fri Aug 28 10:47:23 1998

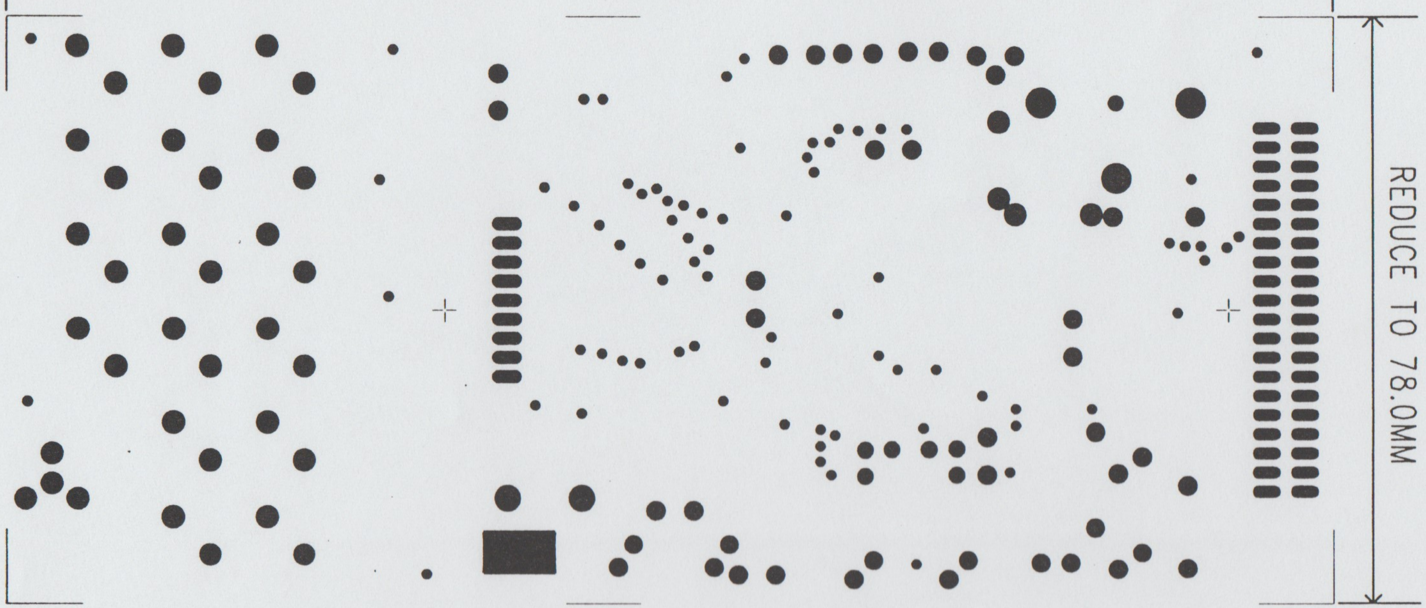
E-TEST REQUIREMENT	YES	NO
		✓



RM27B PCB COMPONENT SIDE COPPER

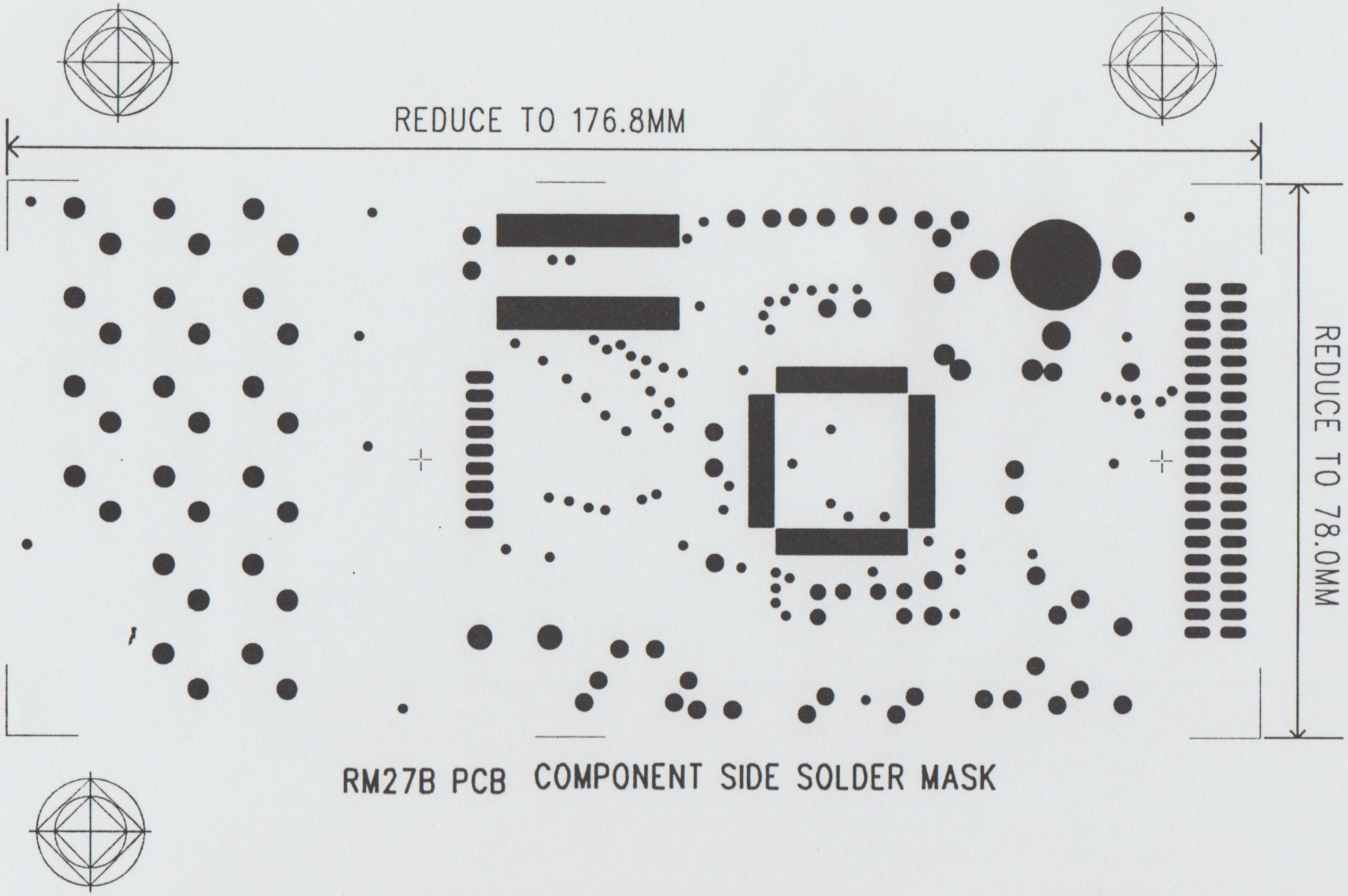

REDUCE TO 78.0MM
REDUCE TO 176.8MM
RM27B PCB SOLDER SIDE COPPER

REDUCE TO 176.8MM

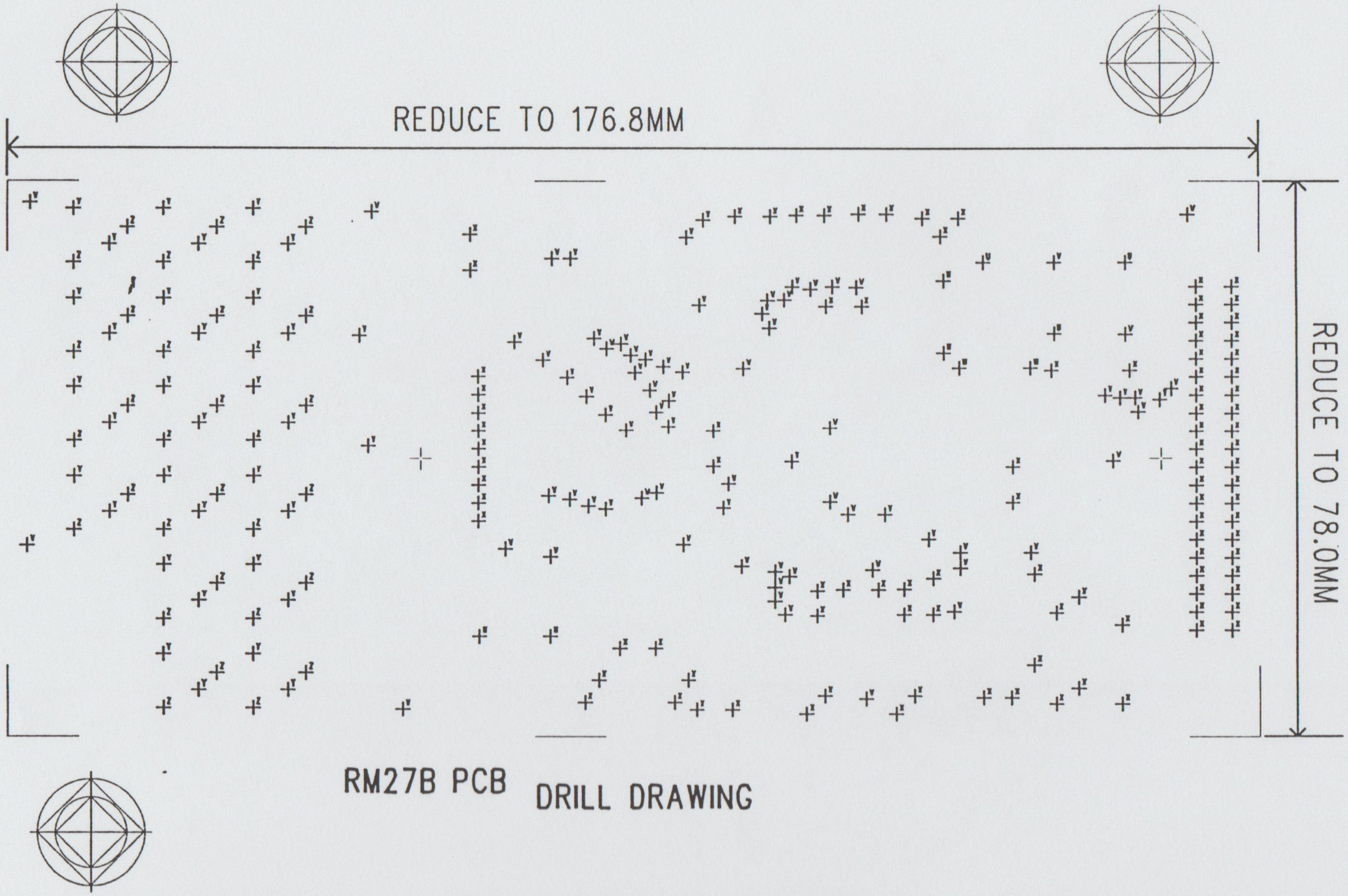


RM27B PCB SOLDER SIDE SOLDER MASK

RM27M2.PHO - Fri Aug 28 10:46:07 1998



RM27B PCB COMPONENT SIDE SOLDER MASK

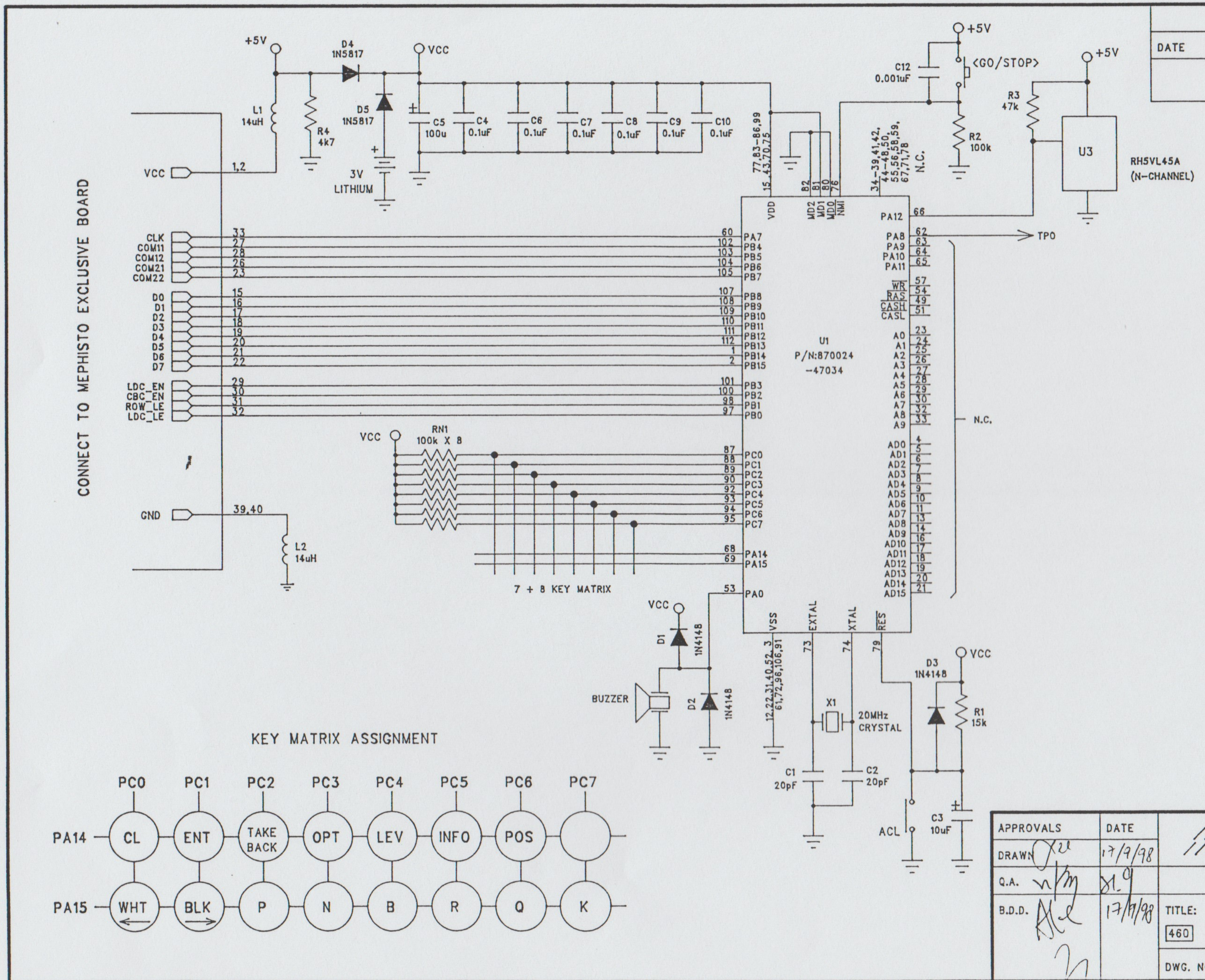


RM27B PCB DRILL DRAWING

SIZE	QTY	SYM
2	3	U
0.6	77	V
1	6	W
0.8	98	X
1.3	32	Y
1.1	32	Z

RM27DD.PHO - Fri Aug 28 10:40:11 1998

ORIGINAL



REVISION			
DATE	DESCRIPTION	ECN NO.	REV. NO.

APPROVALS	DATE	
DRAWN	17/9/98	Saitek Ltd.
Q.A.		SCHEMATIC DIAGRAM
B.D.D.	17/9/98	TITLE: 460 SENATOR
		DWG. NO. RM27 - PE - 003 — REV. 0

Dist= BDM, QAM, SED, PE

SAITEK

BILL OF MATERIALS

PROJECT	:	RM27 (Mephisto Senator)
ART.NO.	:	460
SHIP VER.	:	EV
REVISION	:	2

REVISION HISTORY

REVISION	DATE	BY	DESCRIPTION OF CHANGES
1	6/10/97	K.H. Au	first BOM.
2	30/9/98	K.H. Au	ECN:97209, 97232, 98100, 98165, 98230

RELATED DOCUMENTS	REV
Schematic dwg :RM27-PE-003	0

Prepared By : Abraham Au

Approved by : BDM

Distribution :
+1.00 [X] MMM, FAM, SED, QAM
+0.10 [ ] MMM, FAM, SED, QAM
+0.01 [ ] MMM, IEM

Date issue : 12 OCT 1998

CHG MOD:NW=new component; *=desc/PN/Ref changed +/-=cost up/down; C/NC=consigned/non-consigned; +/-Q=QTY up/down

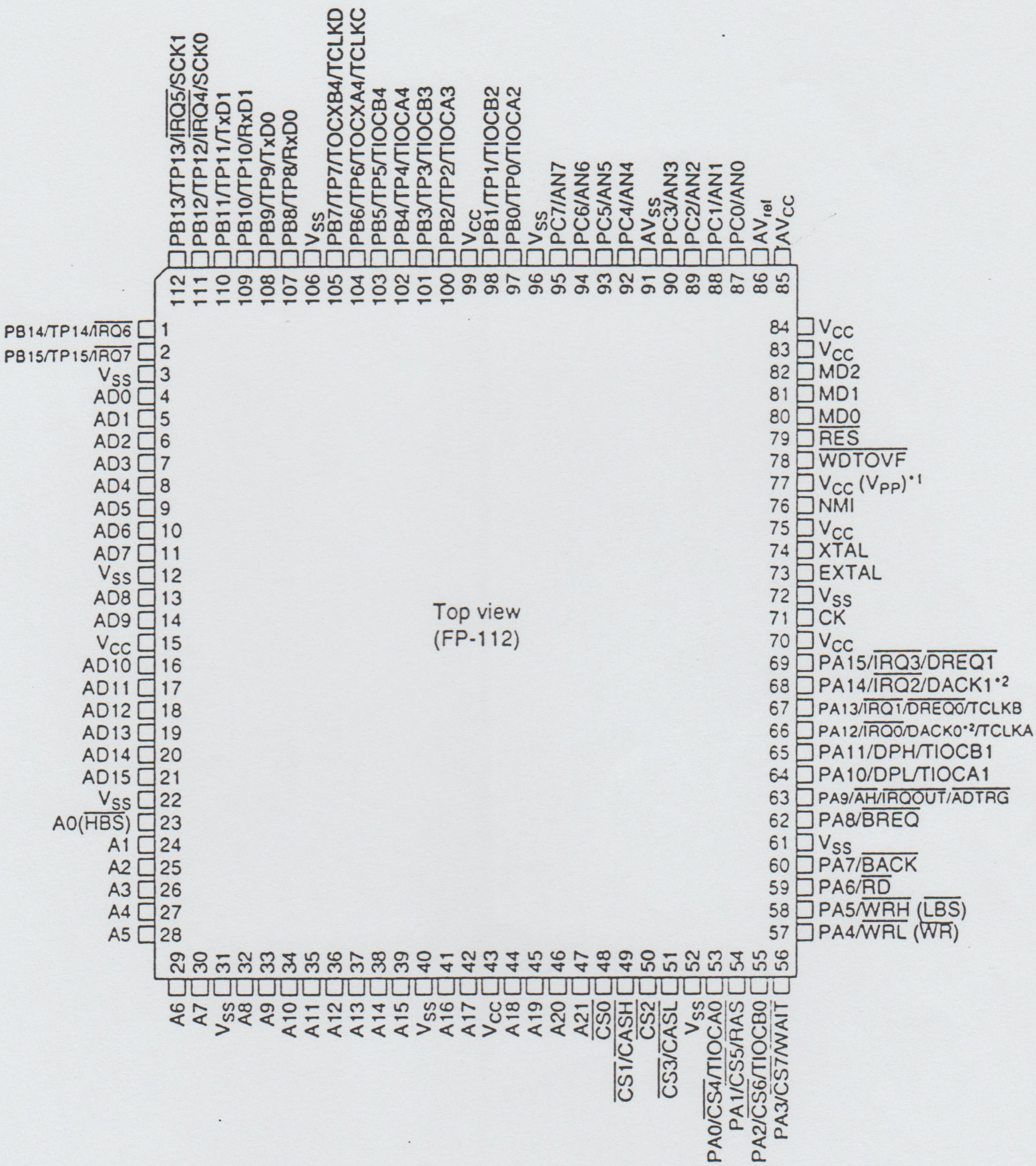
994600 - RM27, MEPHISTO SENATOR Rev : 2

Level	Item	Chg	Stock Code	Rev	Cons	Description	Qty Per	Reference
1			984600-00000	1		UNIT ASSEMBLY,FOR RM27	1.000	
2			914600-00001	1		GUTS ASSEMBLY - LOGIC,FOR RM27	1.000	
3	1		514710-00410		RC	PCB,LOGIC,D.S,1.6MM,FR4,RM27B/RM27	1.000	PCB1
3	2	+	870024-47034		RC	ZTAT,MICROCOMPUTER,HD6477034F20,HITACHI	1.000	U1 ECN98165
3	3		000260-00004		RC	BATTERY,LITHIUM,2032,3V	1.000	BATT
3	4		224470-03500		RC	METAL,BATTERY HOLDER,PH.BRONZE,NI-PLT	1.000	
3	5		654148-10000		RC	DIODE,SWITCHING,1N4148	3.000	D1-D3
3	6		62200M-05014		RC	CAPACITOR,C-CAP NPO,20PF,+/-20%,50V	2.000	C1,2
3	7		62104M-01611		RC	CAPACITOR,C-CAP,0.1UF,+/-20%,16V	7.000	C4,C6-C11
3	8		62106M-01615		RC	CAPACITOR,E-CAP,10UF,+/-20%,16V	1.000	C3
3	9		62107M-01615		RC	CAPACITOR,E-CAP,100UF,+/-20%,16V	1.000	C5A
3	10		62102M-01611		RC	CAPACITOR,C-CAP,0.001UF,+/-20%,16V	1.000	ECN98230
3	11		611535-21102		RC	RESISTOR,FIXED C-FILM,15K,5%,1/8W	1.000	R1
3	12		611045-22109		RC	RESISTOR,ARRAY,C-FILM,100KX8,5%,1/8W,9	1.000	RN1
3	13		000190-00027		RC	CONNECTOR,EDGE,40PIN,BENDED LEADS	1.000	CON1
3	14		000132-00200		RC	BUZZER,20MM WITH CABINET	1.000	
3	15		750048-5VL45		RC	IC,VOLTAGE DETECTOR,RE5VL45A,SOT-89	1.000	U3 ECN98165
3	16	—	642000-03130		RC	CRYSTAL,20MHZ,30PPM	1.000	X1
3	17		655817-34015		RC	DIODE SCHOTTKY,IN5817,20 TO 40V,1A	2.000	D4,5
3	18		630007-20000		RC	INDUCTOR,RFI,14UH,+/-10%,Q=44MIN	2.000	L1,2,ECN98230
3	19	NW	611045-31102		RC	RESISTOR,FIXED C-FILM,100K,5%,1/4W	1.000	ECN98165
3	20	NW	614735-31102		RC	RESISTOR,FIXED C-FILM,47K,+/-5%,1/4W	1.000	ECN98165
3	21	NW	614725-31102		RC	RESISTOR,FIXED C-FILM,4K7,5%,1/4W	1.000	ECN98230
3	22	NW	000010-00080		RC	ACL RESET CONTACT,D=8MM,CR STEEL	1.000	ECN98230
2			964600-00000	1		CASING ASSEMBLY,FOR RM27	1.000	
3			954600-00000	1		CABINET SET ASSEMBLY FOR RM27	1.000	
4	23	+	214610-00152		RC	PLASTIC,T.CAB,BLACK,WITH SILK'N,RM27	1.000	ECN97232
4	24	+	214610-00200		RC	PLASTIC,B.CABINET,ABS,BLACK,RM18	1.000	
3	25		227290-00800		RC	METAL,B.CONTACT,"-",PH,BRONZE,NI-PT,IH20	1.000	FOR FOIL PAPER
3	26		364660-02400		RC	CARDBOARD,RM20,RFI FOIL,AL COATED	1.000	
3	27		000090-00110		RC	FOAM PAD,6X5X2MM	1.000	FOR FOIL PAPER
3	28		354720-01010		RC	INLAY,KEY COVER,LEXAN,0.125MM,CLEAN,RM27	1.000	
3	29		334600-00600		RC	RATING PLATE, FOR RM27 FOIL PAPER	1.000	
3			524720-00880	1		SWITCH,TACT,RM19 PAWN,320 E1-1	1.000	ECN98100
4	30	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-00890	1		SWITCH,TACT,RM19 KNIGHT,320 E1-1	1.000	
4	31	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-00900	1		SWITCH,TACT,RM19 BISHOP,320 E1-1	1.000	
4	32	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-00910	1		SWITCH,TACT RM19,ROOK,320 E1-1	1.000	
4	33	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-00920	1		SWITCH,TACT RM19,QUEEN,320 E1-1	1.000	
4	34	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	

994600 - RM27, MEPHISTO SENATOR Rev : 2

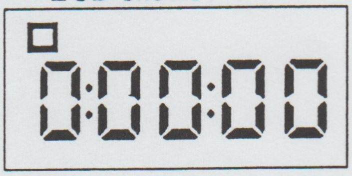
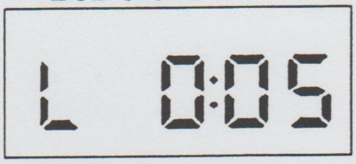
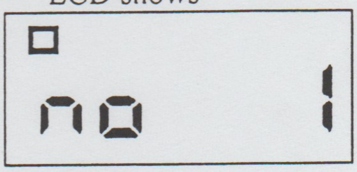
Level	Item	Chg	Stock Code	Rev	Cons	Description	Qty Per	Reference
3			524720-00930	1		SWITCH,TACT RM19,KING,320 E1-1	1.000	
4	35	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-01330	1		SWITCH,TACT RM19,"TAKE BACK".320 E1-1	1.000	ECN98100
4	36	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-00950	1		SWITCH,TACT RM19,"OPT",320 E1-1	1.000	
4	37	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-00960	1		SWITCH,TACT RM19,"LEV",320 E1-1	1.000	
4	38	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-00970	1		SWITCH,TACT RM19,"INFO",320 E1-1	1.000	
4	39	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-00980	1		SWITCH,TACT RM19,"POS",320 E1-1	1.000	
4	40	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-01350	1		SWITCH,TACT RM19,"GO/STOP".320 E1-1	1.000	ECN98100
4	41	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-01000	1		SWITCH,TACT RM19,ARROW LEFT,320 E1-1	1.000	
4	42	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-01010	1		SWITCH,TACT RM19,ARROW RIGHT,320 E1-1	1.000	ECN98128
4	43	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-01020	1		SWITCH,TACT RM19,"ENT",320 E1-1	1.000	ECN98128
4	44	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3			524720-01030	1		SWITCH,TACT RM19,"CL",320 E1-1	1.000	ECN98128
4	45	—	524660-00830		RC	SWITCH,KEY,FOR RM20,BLANK,BLACK	1.000	
3	46		520000-00001C			SWITCH,SILKSCREEN CHARGE PER SET	1.000	
1			944600-10000	1		PACKING ASSEMBLY FOR RM27	1.000	
2	47		454660-01600		RC	INSERT, FOR RM20,CORRUGATED PAPER	1.000	
2	48		000122-80160		RC	POLYBAG,280X160X0.045MM	1.000	FOR UNIT
2	49		000123-00200		RC	POLYBAG,300X200X0.045MM	1.000	FOR MANUAL
2	50		360000-00220		RC	LABEL,SERIAL NO,ADHESIVE PAPER,STD	1.000	
2	51	NW	454660-00800		RC	CARTON, FOR RM20, 20PCS/CTN	.050	ECN97209
1			974600-00000	1		OPTIONS ASSEMBLY,FOR RM27	1.000	
2	52		414600-61100		RC	MANUAL,RM27,E/G/F/D/I/S	1.000	
2	53	+	424600-61100		RC	GIFTBOX,RM27,G/F/E/D/S/I	1.000	
2	54		370000-00000			LABEL,ASSEMBLY	1.000	

RM27

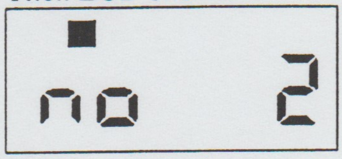
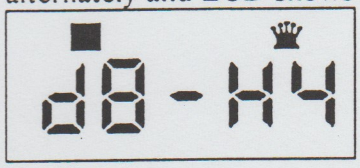
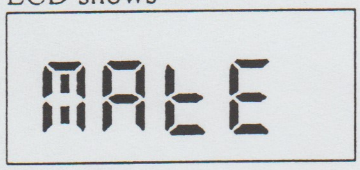
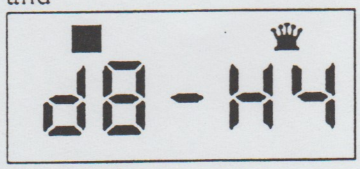

PB14/TP14/IRQ6 1
PB15/TP15/IRQ7 2
VSS 3
AD0 4
AD1 5
AD2 6
AD3 7
AD4 8
AD5 9
AD6 10
AD7 11
VSS 12
AD8 13
AD9 14
VCC 15
AD10 16
AD11 17
AD12 18
AD13 19
AD14 20
AD15 21
VSS 22
A0(HBS) 23
A1 24
A2 25
A3 26
A4 27
A5 28
29 A6
30 A7
31 VSS
32 A8
33 A9
34 A10
35 A11
36 A12
37 A13
38 A14
39 A15
40 VSS
41 A16
42 A17
43 VCC
44 A18
45 A19
46 A20
47 A21
48 CS0
49 CS1/CASH
50 CS2
51 CS3/CASL
52 VSS
53 PA0/CS4/TIOCA0
54 PA1/CS5/RAS
55 PA2/CS6/TIOCB0
56 PA3/CS7/WAIT
57 PA4/WRL (WR)
58 PA5/WRH (LBS)
59 PA6/RD
60 PA7/BACK
61 VSS
62 PA8/BREQ
63 PA9/AH/IRQOUT/ADTRG
64 PA10/DPL/TIOCA1
65 PA11/DPH/TIOCB1
66 PA12/IRQ0/DACK0*2/TCLKA
67 PA13/IRQ1/DREQ0/TCLKB
68 PA14/IRQ2/DACK1*2
69 PA15/IRQ3/DREQ1
70 VCC
71 CK
72 VSS
73 EXTAL
74 XTAL
75 VCC
76 NMI
77 VCC (VPP)*1
78 WDTOVF
79 RES
80 MD0
81 MD1
82 MD2
83 VCC
84 VCC
85 AVCC
86 AVref
87 PC0/AN0
88 PC1/AN1
89 PC2/AN2
90 PC3/AN3
91 AVSS
92 PC4/AN4
93 PC5/AN5
94 PC6/AN6
95 PC7/AN7
96 VSS
97 PB0/TP0/TIOCA2
98 PB1/TP1/TIOCB2
99 VCC
100 PB2/TP2/TIOCA3
101 PB3/TP3/TIOCB3
102 PB4/TP4/TIOCA4
103 PB5/TP5/TIOCB4
104 PB6/TP6/TOCXA4/TCLKC
105 PB7/TP7/TOCXB4/TCLKD
106 VSS
107 PB8/TP8/RxD0
108 PB9/TP9/TxD0
109 PB10/TP10/RxD1
110 PB11/TP11/TxD1
111 PB12/TP12/IRQ4/SCK0
112 PB13/TP13/IRQ5/SCK1
Top view
(FP-112)

8. FUNCTIONAL TEST PROCEDURE FOR RM27/RM27B

Make sure that the ON/OFF switch of RW9 is at OFF position before any module is inserted into the unit, then insert the Senator/Magellan Module (RM27/RM27B logic unit) and LCD Module (RD2-Mephisto 6. GENERATION LCD MODUL) into the slots. Hence insert the energized adapter into DC socket.

Purpose	Procedure	Observation
1. Check memory content (make sure that no chesspiece is located on the chessboard)	- Slide the ON/OFF switch to ON position.	- LCD and LED are still off
	- Press **GO/STOP** once	- LCD shows 
2. Check default settings	- Press **LEVEL**	- LCD shows 
	- Press **CL** then **TAKEBACK**	- LCD shows 
3. Check Reset and model	- Press ACL for 2 seconds then release it.	- LCD and LEDs scanning (see Table 1) - **"H: 512" would be displayed for awhile if Magellen (RM27B) is used** *Note: The unit is defective if* *1. "Err" is displayed on LCD or* *2. "H:512" is displayed on LCD when testing Senator (RM27) or* *3. No "H:512" is displayed on LCD when testing Magellen*

Purpose	**Procedure**	**Observation**
4. QC mode	- Press **OPT**	- LCD shows -Auto
	- Press □ / ←	- LCD shows -tESt
	- Press **ENT**	- See Table 2
	- Place a RW9 chesspieces on square A1 to H8 sequentially (make sure to remove all chesspiece before testing the function keys on next step)	- Corresponding square LED is on and LCD shows CHS:- - where -- is the coordinate of the square
	- Press function keys as shows in Table 3	- See Table 3
5. Newgame	- Setup pieces at Newgame position	
	- Press **CL** and **ENT** simultaneously	- Newgame sound is emitted. - LCD □ 0:00:00
6. Multimove	- Press **TAKEBACK** key	- LCD shows □ no 1
	- Move the piece from F2 to F4, piece from E7 to E5 and piece from G2 to G4 in sequences	- Corresponding coordinate LED turn on with a beep sound for each piece movement and LCD shows the corresponding move

Purpose	Procedure	Observation
		- Then LCD shows 
	- Press **CLEAR**, then **ENTER**	- D8 and H4 LED flash alternately and LCD shows 
	- Remove the piece on **D8**	- H4 LED are on and LCD shows as above
	- Place the piece on **H4**	- LCD shows  and  alternately
	- Press **CL**	- white clock counting up
7. Check memory	- Press **GO/STOP**	- LCD turns off
	- Press **NEWGAME** twice	- Same as above
	- Slide the **ON/OFF** switch to **OFF** position	- No response
	- Slide the **ON/OFF** switch to **ON** position	- No response
	- Press **GO/STOP**	- A Beep is emitted. LCD shows white clock and it counts up

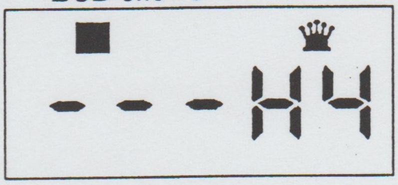
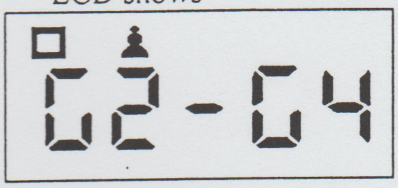
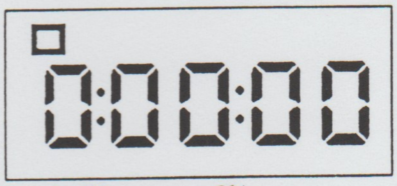
Purpose	Procedure	Observation
	- Pick up the Black Queen on H4	- H4 LEDs are on and - LCD shows 
	- Put down the Black Queen on D8	- LCD shows 
	- Press **CL**	- G4 LED is on - Black clock starts counting up
	- Press **CL** and **ENT** simultaneously	- New game sound is emitted - LCD shows 
	- Press **GO/STOP**	- LCD turns off
8. Test finish	- Slide the **ON/OFF** switch to OFF position - Remove the module	

Table 1

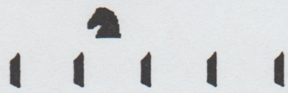
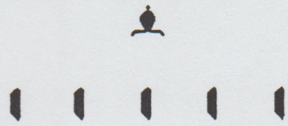
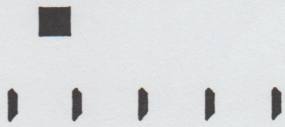
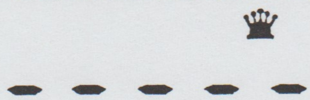
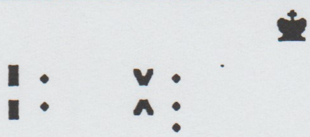
Sequence	LCD shows	Row /LED to be ON
1		Row 1
2		Row 2
3		Row 3
4		Row 4
5		Row 5
6		Row 6
7		Row 7
8		Row 8

Table 2

Sequence	LCD display with RM27	LCD display withRM27B
1	+tESt	+tESt
2	1: 0 counts up to 1: 64	1: 0 counts up to 1: 64
3	PaSS	PaSS
4	2: 0 counts up to 2: 4	2: 0 counts up to 2: 4
5	PaSS	PaSS
6	LCD and LED scan test as in table 1	3: 0 counts up to 3: 512
7		PaSS
8		LCD and LED scan test as in table 1

Table 3

Function Key Press	LCD displays	Function Key Press	LCD displays
♟	k 11	LEV	k 5
♞	k 12	INFO	k 7
♗	k 13	POS	k 6
♜	k 14	□ / ←	k 9
♕	k 15	■ / →	k 10
♔	k 16	ENT	k 2
TAKEBACK	k 1	CL	k 3
OPT	k 4		

- A beep sound is given out for each key press.
- Pressing **GO/STOP** would turn off/on the module

* Pressing <ENT> and <CL> simultaneously will exit QC test mode.