9090 :: ANALOGUE DRUM SYNTHESISER
Components List (Boards PC001 ISS 2, PC002 ISS2)

DATE: 5th January 2004

Copyright © Trevor Page 2002,2003,2004

t |at| introspectiv |dot| org

http://introspectiv.org/

Document Update History

31st July 2002	Corrected J reference for VR32.
7th September 2002	Added C125 to Hand Clap parts list.
	Added C129, C133.
	Added C165, C172, C173 to Cymbals parts list.
	Added information regarding C173 in the Notes section.
	Added C146 to Hi-Hats parts list
	Added C20 and C25 to Amplifier parts list.
	R28 (Bass Drum) value corrected! (47K --> 3K3)
22nd December 2002	Updated components in PSU section.
	C18 in bassdrum changed to 1uF (extended decay)
5th January 2004	Added C107 to Rimshot. Was previously missing.
	Added C161
	Note about Issue 1 boards removed - Issue 1 boards were never sold
	Note added about replacement for 2SD1469.

Notes

1   Polyester capacitors are recommended for most non-polarised capacitors. Since PCB space is constrained, minature polyester / polyester film capacitors are recommended.

2   Where electrolytic capacitors are used, be sure to use parts with sufficient voltage rating, particulary those which are connected across power supply rails (use 16V minimum). Voltage ratings of the various electrolytics used in the prototype were typically:
0.47uF @ 50V
10uF @ 63V
                ...and so on.

3   All resistors are 5% tolerance or better, except for those stated as 1%.

4   For potentiometers: "A" indicates LOGARITHMIC. "B" indicates LINEAR.

5   For most 100pf, 220pf etc. capacitors, Wima FKC3 series polycarbonate types were used.

6   Polyester capacitors were used in place of some electrolytics in the prototype, particularly in the tom drum circuits.

7   There are two instances of C173. This designator has been used twice in error.

8   Use ZTX1051A as replacement for the two 2SD1469 transistors used in Snare Drum.

A number of transistors were tried in place of the 2SD1469; ZTX1051A worked the best.
These transistors are available from Rapid Electronics in the UK.

Bass Drum

Quantity	Part Type	Designator	Comment
1	0.1uF	C10	
2	0.33uF	C14	Electrolytic
2	0.47uF	C2 C3	
2	100pF	C9 C51	
2	10uF	C17 C174	
1	2n2F	C21	
3	33nF	C11 C15 C22	
1	1uF	C18	Electrolytic
1	3n3F	C8	
1	4n7F	C12	
1	68nF	C13	
1	6n8F	C1	
9	1N4148	D1 D10 D11 D12 D2 D3 D5 D8 D9	
6	BC549	Q12 Q15 Q4 Q7 Q8 Q9	
6	BC559	Q10 Q11 Q13 Q14 Q2 Q5	
1	1K	R11	
14	100K	R13 R19 R20 R25 R29 R33 R47 R48 R49 R50 R66 R9 R45 R46	
4	10K	R17 R37 R55 R59	
1	12K	R3	
1	150K	R27	
1	1K8	R58	
2	1M	R61 R62	
8	22K	R1 R16 R2 R26 R4 R43 R51 R56	
4	2K2	R12 R52 R53 R64	
1	3K3	R28	
2	330K	R44 R5	
1	330R	R21	
1	39K	R22	
4	470K	R38 R39 R40 R57	
7	47K	R10 R24 R35 R42 R6 R63	
2	47R	R23 R36	
5	4K7	R18 R34 R60 R7 R8	
1	6K8	R65	
1	TL074	U2	
1	TL072	U3	
1	470RB via J3	VR2	Attack
1	100KA via J3	VR3	Tune Decay
1	1MA via J4	VR4	Decay
1	100KB via J4	VR5	Level
1	10K via J39	VR6	Tune Depth

| 1 | 47KB via J38 | VR7 | | Pitch |
| 1 | 10KB via J2 | VR8 | | Distortion |

Snare Drum

Quantity	Part Type	Designator	Comment
1	100pF	C49	
2	0.47uF	C40, C42	Electrolytic.
1	100nF	C43	
3	10nF	C30 C31 C33	
1	10pF	C36	
2	10uF	C34 C35	Electrolytic.
1	15nF	C32	
1	220pF	C38	
1	22nF	C26	
2	2n2F	C27 C28	
1	3n3F	C24	
1	470pF	C41	
1	47nF	C39	
1	4n7F	C45	
2	6n8F	C29 C44	
14	1N4148	D13 D14 D15 D16 D18 D19 D20 D21 D22 D23 D24 D25 D26 D27	
1	18V zener	D17	
2	2SD1469	Q16 Q20	Low Vce(sat) transistor for snappy VCA
8	BC549	Q17 Q19 Q21 Q22 Q23 Q25 Q26 Q27	
3	BC559	Q18 Q24 Q28	
18	100K	R100 R105 R107 R111 R123 R125 R126 R127 R130 R68 R69 R79 R80 R82 R83 R84 R88 R93	
1	100R	R101	
12	10K	R104 R108 R109 R113 R118 R129 R131 R67 R86 R91 R94 R99	
2	1K	R110 R132	
1	1K5	R116	
3	1M	R102 R124 R128	
6	220K	R120 R71 R76 R90 R96 R97	
8	22K	R103 R117 R121 R122 R135 R72 R73 R98	
2	2K2	R112 R87	
1	3K3	R106	
1	470K	R70	
5	47K	R77 R81 R85 R92 R95	
4	47R	R114 R115 R75 R89	
2	4K7	R119 R74	
1	6K8	R78	
6	TL072	U10 U4 U5 U6 U7 U9	
1	4069UB	U8	
1	470KB via J7	VR10	Tone
1	10KB via J7	VR11	Snappy
1	47KB via J7	VR12	Level
1	10KB via J6	VR9	Tune

Low-Tom

Quantity	Part Type	Designator	Comment
1	0.22uF	C55	*Electrolytic.*
2	0.68uF	C52 C59	*Electrolytic.*
1	100nF	C47	
1	10nF	C54	
4	10uF	C61 C63 C66 C67	*Electrolytic.*
1	12nF	C58	
1	1nF	C173	
1	22nF	C57	
1	33nF	C50	
1	47nF	C48	
1	56nF	C46	
16	1N4148	D29 D30 D31 D32 D33 D34 D38 D39 D40 D41 D42 D44 D45 D46 D47	
1	18V ZENER	D36	
8	BC549	Q29 Q30 Q31 Q32 Q33 Q34 Q35 Q37	
2	BC559	Q36 Q38	
17	100K	R148 R153 R154 R155 R156 R159 R166 R174 R176 R178 R179 R182 R183 R189 R191 R192 R193	
2	100R	R181 R188	
13	10K	R136 R145 R146 R149 R157 R165 R168 R171 R177 R184 R187 R190 R180	
3	1K	R147 R152 R160	
4	1M	R150 R164 R167 R169	
3	220K	R142 R143 R173	
3	22K	R185 R186 R200	
3	2K2	R139 R141 R163	
1	2M2	R137	
3	470K	R134 R140 R144	
3	47K	R151 R158 R175	
3	47R	R133 R162 R172	
1	4K7	R170	
1	56K	R161	
1	68K	R138	
5	TL072	U11 U12 U13 U15 U16	
1	4069UB	U14	
1	10KB via J10	VR13	*Tune*
1	470KB via J14	VR14	*Decay*
1	47KB via J14	VR15	*Level*

Mid-Tom

Quantity	Part Type	Designator	Comment
1	0.15uF	C77	*Electrolytic, but try 150nF polyester*
2	0.47uF	C74 C81	*Electrolytic.*
1	100nF	C69	

1	10nF	C80	
4	10uF	C83 C85 C86 C88	*Electrolytic*
1	18nF	C79	
1	1nF	C87	
1	27nF	C72	
1	47nF	C70	
1	56nF	C68	
1	6n8F	C75	
16	1N4148	D103 D48 D49 D50 D51 D56 D59 D60 D61 D62 D63 D64 D66 D68 D69 D70	
1	18V ZENER	D58	
8	BC549	Q39 Q40 Q41 Q42 Q43 Q45 Q46 Q48	
2	BC559	Q47 Q50	
17	100K	R212 R218 R219 R221 R222 R223 R235 R248 R250 R252 R253 R254 R258 R259 R269 R270 R271	
2	100R	R257 R264	
13	10K	R198 R209 R210 R213 R225 R236 R238 R245 R251 R256 R260 R263 R265	
3	1K	R211 R217 R232	
4	1M	R214 R234 R239 R243	
3	220K	R206 R207 R247	
3	22K	R261 R262 R272	
3	2K2	R201 R205 R231	
1	2M2	R203	
3	470K	R199 R202 R208	
3	47K	R216 R226 R249	
3	47R	R197 R230 R242	
1	4K7	R241	
1	56K	R229	
1	68K	R204	
6	TL072	U18 U19 U20 U22 U23	
2	4069UB	U21	
1	10KB via J15	VR16	*Tune*
1	470KB via J16	VR17	*Decay*
1	47KB via J16	VR18	*Level*

Hi-Tom

Quantity	Part Type	Designator	Comment
2	47nF	C89 C99	
1	0.15uF	C95	*Electrolytic.*
2	0.47uF	C100 C92	*Electrolytic.*
4	10uF	C93 C101 C103 C104	*Electrolytic.*
1	100nF	C90	
1	15nF	C96	
1	22nF	C91	
1	1nF	C106	
1	5n6F	C94	

1	8n2F	C97	
18	1N4148	D71 D72 D73 D74 D77 D79 D80 D81 D82 D83 D84 D85 D86 D87 D88 D89	
1	18V ZENER	D78	
8	BC549	Q51 Q52 Q53 Q54 Q55 Q56 Q57 Q59	
2	BC559	Q58 Q60	
17	100K	R286 R288 R290 R293 R294 R295 R302 R311 R312 R314 R317 R318 R323 R324 R332 R333 R336	
2	100R	R322 R329	
13	10K	R274 R283 R284 R287 R296 R303 R305 R313 R316 R325 R328 R330 R334	
3	1K	R285 R292 R298	
4	1M	R276 R301 R306 R310	
3	220K	R280 R281 R331	
3	22K	R319 R326 R327	
3	2K2	R279 R300 R308	
1	2M2	R275	
3	470K	R277 R282 R304	
3	47K	R291 R297 R315	
3	47R	R273 R309 R335	
1	4K7	R321	
1	56K	R299	
1	68K	R278	
5	TL072	U24 U25 U28 U29 U30	
1	4069UB	U26	
1	10KB via J22	VR19	*Tune*
1	470KB via J24	VR20	*Decay*
1	47KB via J24	VR21	*Level*

Rimshot

Used	Part Type	Designator	Comment
1	1nF	C107	
4	10nF	C111 C112 C114 C115	
1	18nF	C110	
1	220pF	C123	
2	27nF	C117 C118	
1	47nF	C113	
2	4n7F	C108 C109	
4	1N4148	D90 D91 D92 D93	
2	BC549	Q61 Q63	
1	BC559	Q62	
2	10K	R341 R353	
3	12K	R345 R346 R347	
2	1M	R340 R368	
1	220K	R344	

4	22K	R337 R343 R352 R355	
3	2K2	R338 R349 R351	
1	2K7	R364	
1	330K	R369	
1	3K3	R348	
2	470K	R350 R365	
1	47K	R342	
3	4K7	R339 R354 R371	
1	680R	R367	
3	TL072	U33 U34 U35	
1	100KB via J28	VR22	

Handclap

Quantity	Part Type	Designator	Comment
3	0.47uF	C121 C131 C135	*Electrolytic.*
2	100nF	C124 C134	
2	1nF	C116 C125 C130	
2	10uF	C128 C132	*Electrolytic.*
1	220pF	C127	
1	22nF	C126	
1	27nF	C122	
2	4n7F	C119 C120	
4	1N4148	D94 D95 D96 D97	
3	BC549	Q64 Q67 Q69	
3	BC559	Q65 Q66 Q68	
1	100K	R375	
5	10K	R370 R387 R396 R400 R401	
1	150K	R386	
2	15K	R372 R379	
3	1K	R377 R389 R390	
2	1M	R376 R384	
4	22K	R383 R397 R398 R399	
1	2K2	R357	
1	2K7	R393	
1	330R	R380	
1	39K	R388	
1	3K3	R391	
2	470K	R374 R394	
3	47K	R356 R366 R395	
1	47R	R402	
4	4K7	R378 R392 R403 R405	
1	5K6	R373	
2	68K	R382 R381	
2	82K	R385 R404	
2	TL072	U36 U40	
1	CA3080	U38	*Transconductance amplifier*

Used	Part Type	Designator	Comment
1	LM2901	U39	*Quad comparator IC. Also use LM339, etc.*
1	50KB via J28	VR23	
1	10KB	VR1	*Bourns horizontal mount PCB trimmer*

Hi hats

Used	Part Type	Designator	Comment
1	0.01uF	C152	*Polyester - ignore footprint for electrolytic.*
1	100pF	C150	
1	10uF	C143, C146	*Electrolytic.*
1	1n2F	C141	
2	1nF	C140 C142	
1	1uF	C163	*Electrolytic.*
1	2n7F	C139	
1	390pF	C138	*Polyester or ceramic disk*
1	470pF	C164	*Polystyrene*
4	1N4148	D101 D102 D98 D99	*Observe necessary PCB modification before fitting D99.*
5	BC549	Q70 Q71 Q72 Q74 Q91	
3	BC559	Q73 Q80 Q90	
2	100K	R425 R466	
1	100R	R434	
9	10K	R415 R417 R422 R436 R463 R467 R473 R475 R476	
1	10K 1%	R525	
1	150R	R411	
1	160K 1%	R528	
1	20K 1%	R526	
1	220K	R423	
4	22K	R435 R454 R468 R481	
1	22R	R410	
2	2K2	R421 R464	
1	33K	R469	
1	40K2 1%	R527	
1	47K	R420	
1	4K7	R406	
1	5K1 1%	R524	
4	5K6	R414 R416 R418 R419	
1	6K8	R470	
1	80K6 1%	R529	
2	TL072	U42 U52	
1	40174	U44	
1	4040	U48	
1	27C256	U49	*EPROM / PROM containing hi-hat data*
1	4520	U54	
1	4011UB	U61	*Use unbuffered (4011**U**..) device only.*
1	4013	U64	
1	47KB	VR24 via J33	*Hihat Level*
1	100KB	VR25 via J33	*Open-hat Decay*

| 1 | 1MA | VR26 via J33 | *Closed-hat Decay* |
| 1 | 10KB | VR31 via J34 | *Hihat Tune* |

Cymbals

Quantity	Part Type	Designator	Comment
2	100pF	C170 C171	
4	10uF	C149 C155 C156 C160 C165 C172 C173	*Electrolytic*
2	1n2F	C136 C137	
4	1nF	C144 C145 C154 C157	
2	2n7F	C151 C153	
1	390pF	C158 C159	*Polyester or ceramic disk.*
2	470pF	C168 C169	*Polystyrene*
6	BC549	Q75 Q76 Q81 Q83 Q84 Q85	
4	BC559	Q77 Q78 Q79 Q82	
2	100K	R480 R482	
2	100R	R428 R441	
6	10K	R426 R427 R442 R443 R477 R479	
4	10K 1%	R501 R506 R513 R519	
4	160K 1%	R502 R510 R515 R523	
4	20K 1%	R503 R508 R514 R521	
2	220R	R431 R444	
2	22K	R452 R453	
2	22R	R432 R449	
1	270K	R448	
4	2K2	R439 R440 R445 R460	
4	40K2 1%	R504 R509 R516 R520	
1	470K	R430	
2	47K	R424 R429	
2	4K7	R407 R433	
4	5K1 1%	R500 R507 R512 R518	
8	5K6	R408 R409 R412 R413 R437 R438 R446 R447	
2	6K8	R478 R483	
4	80K6 1%	R505 R511 R517 R522	
3	TL072	U45 U47 U50 (U52)	*U52 is already listed in hi-hats section*
2	40174	U51 U53	
1	27C256	U55	*Ride EPROM / PROM*
1	27C256	U56	*Crash EPROM / PROM*
2	4040	U58 U60	
1	4520	U59	
3	4011UB	U63 U66	*Use unbuffered (4011**U..**) device only.*
2	4013	U62 U65	
1	10KB via J35	VR28	*Crash Cymbal Tune*
1	47KB via J35	VR27	*Crash Cymbal Level*
1	10KB via J37	VR30	*Ride Cymbal Tune*
1	47KB via J37	VR29	*Ride Cymbal Level*

MIDI interface

Quantity	Part Type	Designator	Comment
3	1nF	C102 C105 C98	*Sample / Hold capacitors for cymbal and hi-hats*
2	10uF	C162, C166	*Electrolytic.*
2	100nF	C167, C161	*Ceramic disk, etc*
2	33pF	C147, C148	*Note small pitch on PCB for C147, C148.*
1	1N4148	D100	
1	MIDI LED	LED1	*MIDI activity LED. Connected via J20*
1	Power LED	LED2	*Power LED. Connected via J20*
3	BC559	Q86 Q87 Q88	
1	BC549	Q89	
1	4K7	R289	
1	100K	R462	
1	10K 1%	R360	*The 1% resistors here form velocity DAC*
1	160K 1%	R359	
2	1K	R451 R457	
1	20K 1%	R362	
3	220R	R471 R472 R474	
2	22K	R455 R458	
2	330R	R307 R320	
1	3K9	R459	
1	40K2 1%	R363	
3	47K	R450 R456 R465	
1	5K1 1%	R358	
1	680R	R461	
1	80K6 1%	R361	
1	Pushswitch	SW1	*Pushbutton connected via J19. MIDI channel select, sustain mode.*
2	4051	U27 U32	*Try 74x4051 - for lower on resistance*
1	TL074	U31	
3	40174	U37 U43 U41	*Hex latches; older devices are marked 4174*
1	PIC16F84	U46	*Firmware - preprogrammed PIC*
1	6N136	U57	*Optoisolator. Also SFH6136, etc.*
1	4MHz crystal	XTAL1	

Noise circuit

Quantity	Part Type	Designator	Comment
1	10uF	C82	*Electrolytic*
1	100nF	C71	*Ceramic disk*
1	100pF	C84	
1	47nF	C73	
4	4n7F	C62 C64 C65 C78	
1	4u7F	C76	*Electrolytic*

8	1N4148	D53 D54 D55 D57 D65 D67 D75 D76	
		D75 & D76 are located on PC002	
2	BC549	Q44 Q49	
4	100K	R215 R237 R244 R246	
5	10K	R194 R228 R233 R255 R267	
1	1K	R227	
1	220K	R196	
3	22K	R195 R224 R266	
1	33K	R268	
1	47K	R220	
1	47R	R240	
1	TL072	U17	
2	4006	U68 U69	
1	4070	U67	

Amplifier

Quantity	Part Type	Designator	Comment
3	10uF	C23 C6 C7 C20 C25	*Electrolytic.*
2	1uF	C4 C5	*Electrolytic.*
1	47uF/35V	C16	*Electrolytic. Use 35V minimum.*
3	1N4148	D4 D6 D7	
2	2SC2878	Q1 Q3	*2SC2878 have high reverse current gain.*
1	BC559	Q6	
1	10K	R31	
2	1K	R30 R32	
2	22K	R14 R15	
1	470K	R41	
1	4K7	R54	
1	TL072	U1	
1	47KB via J5	VR32	*VR32 is a dual-gang potentiometer*

Power Supply

Quantity	Part Type	Designator	Comment
2	2200uF	C37, C19	*Electrolytics, 35V minimum.*
3	100nF	C53, C56, C60	*PCB footprint shows electrolytic- ignore this! Use 100nF ceramics.*
3	1N4001	D28 D35 D43	
1	Bridge rect	BR1	*Bridge rectifier, 5.1mm pitch*
1	REG1	7915	*15V negative linear regulator*
1	REG2	7805	*5V positive linear regulator*
1	REG3	7815	*15V positive linear regulator*
2	FUSE	CP1, CP2	*FUSE, PCB lead mounted. 315mA, slow blow.*
1	15V - 0 - 15V mains transformer		*Or whatever power source you decide upon*

Additional decoupling

Quantity	Part Type	Designator	Comment
2	10uF	C129, C133	*Electrolytic. Located on PC002*

Output Sockets and associated circuitry

Quantity	Part Type	Designator	Comment
10	1K		
2	2K2		
4	8K2		*No components in this section are mounted*
3	10K		*to the PCB. Are mounted directly to sockets.*
11	12K		
4	15K		
12	10nF		*Long-leaded capacitors to allow mounting directly to jack socket terminals*
12	1/4" jack socket, mono		

IC sockets, headers & terminal housings, heatsinks, and miscellaneous

36	8-pin DIP IC socket		*Turned-pin type IC sockets*
16	14-pin DIP IC socket		*are highly recommended.*
13	16-pin DIP IC socket		
3	28-pin DIP IC socket		
1	18-pin DIP IC socket		
5	2-pin straight pin header 0.1" pitch		
5	3-pin straight pin header 0.1" pitch		
19	4-pin straight pin header 0.1" pitch		
5	6-pin straight pin header 0.1" pitch		
5	2-pin crimp terminal housing 0.1" pitch		
5	3-pin crimp terminal housing 0.1" pitch		
19	4-pin crimp terminal housing 0.1" pitch		
5	6-pin crimp terminal housing 0.1" pitch		
1	Pack of crimp terminals for above		
4	4-pin 0.156" Molex-type straight header		*Order 3 each only of Molex parts*
4	4-pin 0.156" Molex-type crimp terminal housing		*if PWR OUT is not required*
1	Pack of crimp terminals for above		
1	Heatshrink tubing		*Narrow tubing is useful for when wiring to potentiometer terminals. Wide tubing to insulate PSU wiring if necessary, e.g. terminals on transformer.*
3	TO220 heatsinks		*For 7805,7815 and 7915 regulators. Ensure dimensions of heatsink will fit within the available space on PCB.*
3	5-pin DIN sockets, panel mount		*For MIDI in, MIDI thru and Sync out*
1	Power socket, panel mount		*This might be a mains power connector, depending on configuration. Suggest using type with integral primary fuse / switch.*

Alternative Component Values

Some capacitor values are not stocked by many electronics suppliers, such as 12nF, 27nF and so on. The table here suggests some alternative E6 values to try in their place, these values being easily obtainable (e.g. 22nF instead of 27nF). Resistor substitutions are then made to compensate.

	Designator	Value	Substitute
Low-Tom	C58	12nF	10nF
	R175	47K	56K
Mid-Tom	C72	27nF	33nF
	C68	56nF	47nF
	R216	47K	39K
Hi-Tom	C94	5n6F	4n7F
	C97	8n2F	10F
	R315	47K	39K
Rimshot	C110	18nF	15nF
	C117	27nF	22nF
	C118	27nF	22nF
	R349	2K2	3K3
Handclap	C122	27nF	22nF

In addition, polyester capacitors were used in place of some electrolytics in the prototype, particuarly in the tom-drum circuits.