SIGABA (ECM Mark II) — electromechanical replica

Bill of materials · fifteen removable wheels on spring-pin contact plates, solenoid-and-ratchet stepping, Raspberry Pi Pico 2 controller, thermal tape printer

Revision: A **Date:** 2026-11-03 **Lines:** 41 **Source:** iconic-machines.fubsypoly.com/sigaba/vol-10/

Every part for the SIGABA replica designed in Volume 10, in the order of its bill of materials. Reference designators are those of the Volume 11 schematic. Quantities are for ten code wheels, four straight-through test wheels and five index wheels. Part numbers are examples that meet the specification; prices and stock were not checked for every line (November 2026). The printed circuit boards are the project's own designs (Volume 11); order them from any board house with an ENIG (gold) finish. Wheel wirings come from sigaba_sim.py.

Tick **Ord** when ordered, **Have** when it is in hand and checked against the part number, **Fit** when it is installed. Write the vendor, order number and price on the last page. Alternates for obsolete (EOL) parts are in **bold**.

Same A standard part, still made; any equivalent that meets the specification will do. **EOL** Obsolete: buy surplus or new old stock, or the alternate given.

Spec The specification that matters is easy to get wrong; check it before ordering. **Conflict** The sources disagree; the resolution is given. **Choice** A design choice for this replica; other parts can be used.

ORD	HAVE	FIT	QTY	REF. DES.	PART / SPECIFICATION	PART NUMBER	ALTERNATES / SUBSTITUTES	WHERE TO BUY	TAG	NOTES
Wheels and cipher unit (basket) the cryptographic heart: order the boards and pins first										
☐	☐	☐	**30**	W1-W14 (x2)	**Code-wheel face-plate PCB** 60 mm round, 1.6 mm FR-4, 2 layers, ENIG; 26 pads 3.0 mm on 50 mm circle, plated through	`project design FP26`	any board house; HASL is not acceptable on contact pads	JLCPCB jlcpcb.com PCBWay www.pcbway.com	**Spec**	10 wheels + 4 test wheels (T) + 2 spare
☐	☐	☐	**10**	X1-X5 (x2)	**Index-wheel face-plate PCB** 36 mm round, ENIG; 10 pads on 26 mm circle	`project design FP10`		JLCPCB jlcpcb.com PCBWay www.pcbway.com	**Spec**	
☐	☐	☐	**8 + 4**	CP1-CP12	**Contact plates, code mazes** inner: spring pins both faces; end: pins one face + IDC connector	`project designs CPI26, CPE26`		JLCPCB jlcpcb.com	**Choice**	4 inner + 2 end per maze
☐	☐	☐	**4 + 2**	CP13-CP18	**Contact plates, Index Maze** inner and end, 10 positions	`project designs CPI10, CPE10`		JLCPCB jlcpcb.com	**Choice**	
☐	☐	☐	**1**	GB1, PB1	**Group board and pair board** 26 → 9 groups (A→9, B→1, C→2, DE→3, FGH→4, IJK→5, LMNO→6, PQRST→7, U-Z→8); 10 → 5 pairs (0+9, 7+8, 5+6, 3+4, 1+2)	`project design GPB`	hand-wired perfboard	JLCPCB jlcpcb.com	**Spec**	CSP-889 wiring; check every net with a meter
☐	☐	☐	**680**	on CP1-CP18	**Spring pins (pogo pins)** SMT, gold plated, about 5.8 mm working height; rounded head	`Mill-Max 0907-0-15-20-75-14-11-0`	generic SMD pogo pins (untested; about $0.10 each)	DigiKey www.digikey.com/en/products/result?keywords=… Mouser www.mouser.com/c/?q=0907-0-15-20-75-14-11-0	**Spec**	620 needed; check stroke on the Mill-Max drawing before layout
☐	☐	☐	**2 kg**	—	**PETG filament** for 14 code-wheel bodies with ratchet and letter rims, 5 index rims, pawls	`any brand, 1.75 mm`	PLA+ for prototypes	Amazon www.amazon.com/s?k=PETG+filament+1.75	**Choice**	

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☐	☐	☐	**1 roll**	—	**Wire-wrap wire** 30 AWG Kynar insulated, 26 wires per code wheel, 10 per index wheel	`Jonard KSW30B-0100 or equivalent`		DigiKey www.digikey.com/en/products/result?keywords=…	Same	use two colours to tell faces apart
☐	☐	☐	**20**	—	**Bronze bushings** oil-impregnated sintered bronze, 6 x 10 x 8 mm	`any`		McMaster-Carr www.mcmaster.com	Same	
☐	☐	☐	**3**	—	**Spindles** 6 mm stainless steel rod, 250 mm	`any`		McMaster-Carr www.mcmaster.com	Same	
☐	☐	☐	**15**	—	**Detent plungers** M6 ball spring plunger, light force	`Misumi BSPM or equivalent`		Misumi us.misumi-ec.com Amazon www.amazon.com/s?k=M6+ball+spring+plunger	Same	10 code slots + 5 index slots
☐	☐	☐	**2**	—	**Basket side plates** 3 mm aluminium 5052, laser cut, with tie rods, 4 thumb screws, 2 handles	`project drawing`		SendCutSend sendcutsend.com	Choice	
Stepping units one under each of the ten code-wheel slots										
☐	☐	☐	**10 + 1**	L1-L10	**Stepping solenoid** 24 V DC, push type, 10 mm stroke, about 5 N, 300 mA, return spring	`JF-0530B 24 V`	Delta DSOL-0630-24C (pull, 12.7 mm; change pawl geometry)	Amazon www.amazon.com/s?k=JF-0530B+24V+solenoid AliExpress www.aliexpress.com/w/wholesale-JF-0530B-24V.... DigiKey www.digikey.com/en/products/result?keywords=…	Choice	25 ms pulse per step
☐	☐	☐	**10 + 1**	S1-S10	**O-switch** subminiature microswitch with roller lever, closed by the cam-lobe at O	`Omron D2F-01L3`	Omron D2F-01FL3; any SPST roller-lever subminiature	DigiKey www.digikey.com/en/products/result?keywords=… Mouser www.mouser.com/c/?q=D2F-01L3	Same	
☐	☐	☐	**10**	—	**Pawl pivots** M3 shoulder screw with torsion spring; pawls printed or 1.5 mm brass	`any`		McMaster-Carr www.mcmaster.com	Choice	
Controller electronics reference designators on the Volume 11 schematic										
☐	☐	☐	**1**	U1	**Microcontroller** Raspberry Pi Pico 2 (RP2350), MicroPython	`SC1631`	Pico (RP2040) works	Raspberry Pi www.raspberrypi.com/products/raspberry-pi-pi… DigiKey www.digikey.com/en/products/result?keywords=…	Same	

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☐	☐	☐	**6**	U2-U7	**Port expander** 16-bit I2C GPIO, DIP-28; addresses 0x20-0x25	`MCP23017-E/SP`	MCP23S17 (SPI) with code changes	DigiKey www.digikey.com/en/products/result?keywords=… Mouser www.mouser.com/c/?q=MCP23017-E/SP	**Same**	
☐	☐	☐	**8**	RN1-RN8	**Pull-up networks** 4.7 kOhm x 8, bussed, 9-pin SIP	`Bourns 4609X-101-472LF`	discrete 4.7 kOhm	DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	52 maze lines + 5 magnet lines
☐	☐	☐	**2**	R1, R2	**I2C pull-ups** 4.7 kOhm 1/4 W	`any`		DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**10**	Q1-Q10	**Solenoid MOSFET** logic-level N-channel, TO-220, Vgs(th) under 2.5 V	`IRLB8721PBF`	IRLZ44N (marginal at 3.3 V gate)	DigiKey www.digikey.com/en/products/result?keywords=…	**Spec**	3.3 V gate drive from U7
☐	☐	☐	**10**	D2-D11	**Flyback diodes** 1 A 1000 V rectifier, fitted at each coil	`1N4007`	UF4007 (faster release)	DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**10 + 10**	R3-R12, R13-R22	**Gate resistors** 100 Ohm series; 10 kOhm gate pull-down	`any 1/4 W`		DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**1**	D1	**VSYS diode** Schottky, 1 A	`1N5819`		DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**1 + 1 + 8**	C1, C2, C3-C10	**Capacitors** 2200 uF 35 V on 24 V; 470 uF 10 V on 5 V; 100 nF at each IC	`any`		DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**2 + 1**	J1-J2, J3	**Basket connectors** 34-way and 10-way IDC box headers with ribbon and sockets	`3M 30334 / 30310 or equivalent`		DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**20**	J4-J13	**Slot connectors** KK 254 2-way (coil) and 3-way (O-switch), headers and housings	`Molex 22-27-2021 / 22-27-2031`	JST XH	DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**1**	—	**Controller board** 100 x 160 mm PCB or stripboard	`project design CTL`	stripboard	JLCPCB jlcpcb.com	**Choice**	
☐	☐	☐	**1 + 1**	LED1, R23	**Fault LED** red 3 mm LED, 330 Ohm	`any`		DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	lights on a maze fault

Keyboard and operator's controls

ORD	HAVE	FIT	QTY	REF. DES.	PART / SPECIFICATION	PART NUMBER	ALTERNATES / SUBSTITUTES	WHERE TO BUY	TAG	NOTES
☐	☐	☐	**36 + 4**	SW1-SW36	**Key switches** MX-compatible, linear or tactile, plate mount	`Gateron KS-3 or Cherry MX`		Amazon www.amazon.com/s?k=MX+switches	**Choice**	26 letters, space, 1-5, dash, BLANK, RPT

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☐	☐	☐	**1 set**	—	**Keycaps** round typewriter-style keycaps for MX stems, with legends incl. BLANK and RPT	`any 'typewriter keycap' set`	custom-printed caps	Amazon www.amazon.com/s?k=typewriter+keycaps+round+MX	**Choice**	
☐	☐	☐	**36**	D12-D47	**Matrix diodes** small-signal	`1N4148`		DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**1**	S11	**Controller switch** rotary, 1 pole, adjustable stop set to 5 positions; large knob engraved O P R E D	`Lorlin CK1049`	Alpha SR2612F-0112	DigiKey www.digikey.com/en/products/result?keywords=… Mouser www.mouser.com/c/?q=Lorlin%20CK1049	**Choice**	
☐	☐	☐	**1**	S12	**Zeroizer switch** SPDT toggle, panel mount	`C&K 7101SYZQE`	any SPDT toggle	DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**1 + 1**	DS1, S13	**Counter and reset** 4-digit 7-segment TM1637 module; momentary push button	`TM1637 module`	24 V electromechanical impulse counter with reset knob (period style)	Amazon www.amazon.com/s?k=TM1637+4+digit	**Choice**	
Printer										
☐	☐	☐	**1**	PR1	**Tape printer** 58 mm thermal, TTL serial, 5-9 V, 2 A peak	`Adafruit 597 (CSN-A2 mechanism)`	any CSN-A2 TTL printer	Adafruit www.adafruit.com/product/597	**Same**	
☐	☐	☐	**5**	—	**Thermal paper** 57 mm x 15 m rolls	`Adafruit 599`	any 57 mm thermal roll	Adafruit www.adafruit.com/product/599	**Same**	
Power and case										
☐	☐	☐	**1**	PS1	**24 V supply** 24 V 4.5 A enclosed	`Mean Well LRS-100-24`		DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	all ten solenoids at once when zeroizing
☐	☐	☐	**1**	PS2	**5 V supply** 5 V 7 A enclosed	`Mean Well LRS-35-5`		DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	logic and printer
☐	☐	☐	**1**	F1	**Mains inlet** IEC C14 inlet with switch and 5 x 20 mm fuse holder; 2 A T fuse	`Schurter DD11.0111.1111`	any fused switched inlet	DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**1**	F2	**24 V rail fuse** 5 x 20 mm holder, 5 A T fuse	`any`		DigiKey www.digikey.com/en/products/result?keywords=…	**Same**	
☐	☐	☐	**1**	—	**Case** 12 mm plywood, 1.5 mm steel top plate, black wrinkle paint; 381 x 489 x 305 mm	`project drawing`		local supply	**Choice**	the ECM's footprint in operation

Orders

VENDOR	ORDER NO.	DATE	TOTAL	RECEIVED	LINES / NOTES

Build total: _____ **Started:** _____ **First power-up:** _____

Notes