Fialka (M-125-3) — electromechanical replica

Bill of materials · ten adjustable wheels with removable 4-layer wiring cores on spring-pin contact plates, blocking-pin rings sensed optically, solenoid-and-ratchet stepping, a 30 × 30 key-card board, Raspberry Pi Pico 2 controller, thermal tape printer

Revision: A **Date:** 2026-11-03 **Lines:** 46 **Source:** iconic-machines.fubsypoly.com/fialka/vol-9/

Every part for the Fialka replica designed in Volume 9, in the order of its bill of materials. Quantities are for one drum of ten wheels wired as the Czechoslovak 6K series (the series with the most published test vectors) and two spare cores. Reference designators are those of the Volume 9 architecture and pin map. Part numbers are examples that meet the specification; prices and stock were not checked line by line (November 2026). The printed circuit boards are the project's own designs, generated from the wiring tables in fialka_sim.py; order them from any board house with an ENIG (gold) finish.

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
Drum: wheels, cores and contact plates the cryptographic heart: order the boards and spring pins first										
☐	☐	☐	**12**	K1-K10, 2 spare	**Wiring core PCB** 56 mm round, 1.6 mm FR-4, 4 layers, ENIG; 30 pads 2.8 mm on a 46 mm circle on both faces; the wheel's wiring routed on the inner layers; 30 edge notches for the core setting; silk: core letter, side 1 / side 2, index mark	`project design CORE-6K-A … CORE-6K-K`	any 4-layer board house; HASL is not acceptable on contact pads	JLCPCB jlcpcb.com PCBWay www.pcbway.com	**Spec**	one design per wheel, generated from the 6K table
☐	☐	☐	**9**	CP1-CP9	**Inner contact plate PCB** 64 mm round with 6 mm bore and a slot for the tie rod, 1.6 mm, 2 layers, ENIG; 30 spring-pin footprints on a 46 mm circle on each face, face-to-face by via	`project design CPI30`		JLCPCB jlcpcb.com PCBWay www.pcbway.com	**Spec**	
☐	☐	☐	**2**	CPE, CPR	**End contact plates (entry, reflector)** as CPI30 but pins on one face only, 30 lines to a 2 × 20 IDC header	`project design CPE30`		JLCPCB jlcpcb.com	**Choice**	
☐	☐	☐	**630**	CP*	**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)	DigiKey www.digikey.com Mouser www.mouser.com	**Spec**	600 + 30 spare
☐	☐	☐	**1.5 kg**	W1-W10	**PETG filament** wheel bodies with 30-tooth ratchet and letter band, pin rings, ring latches, pawls, card drawer	`any brand, 1.75 mm`	PLA+ for prototypes	Amazon www.amazon.com	**Choice**	
☐	☐	☐	**150**	pins	**Advance blocking pins** steel dowel pin 2 × 8 mm, pressed into the pin rings	`ISO 8734 / DIN 6325 dowel pin, 2 m6 × 8`	2 mm silver-steel rod cut to length	McMaster-Carr www.mcmaster.com	**Same**	138 for the 6K set + spares

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☐	☐	☐	**1 set**	W1-W10	**Letter bands** printed self-adhesive vinyl, 30 Cyrillic letters at 12°, black (operational) or red (spare set)	`project artwork`	waterslide decals	local print shop	Choice	
☐	☐	☐	**10**	W1-W10	**Bronze bushings** oil-impregnated sintered bronze, 6 × 10 × 8 mm	`any`		McMaster-Carr www.mcmaster.com	Same	
☐	☐	☐	**1 + 2**	spindle	**Spindle and retaining clips** 6 mm stainless rod, 300 mm, and a 4 mm tie rod for the plates; DIN 6799 E-clip 6 mm	`any`		McMaster-Carr www.mcmaster.com	Same	
☐	☐	☐	**10**	DT1-DT10	**Detent plungers** M5 ball spring plunger, light force, on the ratchet teeth	`Misumi BSPM or equivalent`		Misumi us.misumi-ec.com Amazon www.amazon.com	Same	
☐	☐	☐	**2 + 1**	frame	**Drum side frames and ruler** 3 mm aluminium 5052, laser cut, with lift-out levers; ruler 20 × 3 mm aluminium flat with a window	`project drawing`		SendCutSend sendcutsend.com	Choice	
Stepping units one per wheel; even wheels driven from the rear row, odd from the front										
☐	☐	☐	**10 + 1**	SOL1-SOL10	**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; change pawl geometry)	Amazon www.amazon.com AliExpress www.aliexpress.com DigiKey www.digikey.com	Choice	
☐	☐	☐	**10 + 1**	OPT1-OPT10	**Pin sensor** slotted optical switch, 3.1 mm gap, phototransistor output, straddling the pin ring at the sensing place (+17 even, +20 odd)	`Vishay TCST2103`	Omron EE-SX1041; Everlight ITR9608	DigiKey www.digikey.com Mouser www.mouser.com	Spec	
☐	☐	☐	**10 + 10**	R-OPT	**Sensor resistors** 220 Ω (LED, from 5 V); 10 kΩ (collector pull-up to 3.3 V)	`any 1/4 W`		DigiKey www.digikey.com	Same	
☐	☐	☐	**10**	PW1-PW10	**Pawl pivots** M3 shoulder screw with torsion spring; pawls printed or 1.5 mm brass	`any`		McMaster-Carr www.mcmaster.com	Choice	
Card reader a passive 30 × 30 matrix: the key card is a punched mask over a field of jumper positions										
☐	☐	☐	**1**	KC1	**Card board PCB** 170 × 170 mm, 2 layers; 30 column traces from the keyboard side, 30 row traces wired to the entry plate in the entry-disc order; a 2-pin position at every crossing	`project design KC30`	hand-wired perfboard (not recommended: 900 positions)	JLCPCB jlcpcb.com PCBWay www.pcbway.com	Spec	entry-disc order is routed on this board

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☐	☐	☐	**23**	KC1	**2-pin positions** 2.54 mm male header, 1 × 40 strips, cut into 900 pairs	any 1 × 40 break-away male header, 2.54 mm, gold		DigiKey www.digikey.com	Same	
☐	☐	☐	**40**	KC1	**Jumpers** 2.54 mm shunts with grip tab, gold	Sullins SPC02SYAN	any 2.54 mm shunt	DigiKey www.digikey.com	Same	30 + 10 spare
☐	☐	☐	**1 pack**	cards	**Card stock** 160 g/m² A4, for key cards printed with the 30 × 30 grid; a 2.5 mm hand punch	any		Amazon www.amazon.com	Choice	
☐	☐	☐	**1**	KC1	**Test triangle** a key card punched on the diagonal (identity), laminated	project artwork		local print shop	Choice	

Controller electronics

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☐	☐	☐	**1**	U0	**Microcontroller** Raspberry Pi Pico 2 (RP2350), MicroPython	SC1631	Pico (RP2040) works	Raspberry Pi www.raspberrypi.com/products/raspberry-pi-pi… DigiKey www.digikey.com	Same	
☐	☐	☐	**6**	U1-U6	**Port expander** 16-bit I2C GPIO, DIP-28; 0x20-0x21 card lines, 0x22-0x23 reflector lines, 0x24 solenoids, 0x25 sensors and switches	MCP23017-E/SP	MCP23S17 (SPI) with code changes	DigiKey www.digikey.com Mouser www.mouser.com	Same	
☐	☐	☐	**9**	RN1-RN9	**Pull-up networks** 4.7 kΩ × 8, bussed, 9-pin SIP	Bourns 4609X-101-472LF	discrete 4.7 kΩ	DigiKey www.digikey.com	Same	
☐	☐	☐	**2**	R-I2C	**I2C pull-ups** 4.7 kΩ 1/4 W	any		DigiKey www.digikey.com	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	Spec	
☐	☐	☐	**10**	D1-D10	**Flyback diodes** 1 A rectifier, fitted at each coil	1N4007	UF4007	DigiKey www.digikey.com	Same	
☐	☐	☐	**10 + 10**	RG	**Gate resistors** 100 Ω series; 10 kΩ gate pull-down	any 1/4 W		DigiKey www.digikey.com	Same	
☐	☐	☐	**1 + 1 + 8**	C	**Capacitors** 2200 µF 35 V on 24 V; 470 µF 10 V on 5 V; 100 nF at each IC	any		DigiKey www.digikey.com	Same	
☐	☐	☐	**2 + 2**	J1-J2	**Ribbon connectors** 2 × 20 IDC box headers, sockets and 40-way ribbon (card board, reflector plate)	any 2 × 20 IDC box header (3M 3000 series or equivalent)		DigiKey www.digikey.com	Same	
☐	☐	☐	**1**	CTL	**Controller board** 100 × 160 mm PCB or stripboard	project design CTL30	stripboard	JLCPCB jlcpcb.com	Choice	

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Keyboard and operator's controls										
☐	☐	☐	**32 + 2**	S1-S31	**Key switches** MX-compatible, plate mount, tactile	`Gateron KS-3 or Cherry MX Brown`		Amazon www.amazon.com	**Choice**	30 letter keys, space, one spare
☐	☐	☐	**4**	S1-S30	**Keycaps** relegendable two-part caps, 18 × 18 mm, legends printed on paper inserts (Cyrillic + Latin)	`Adafruit 5039 (10 pack)`	Adafruit 5662 (black)	Adafruit www.adafruit.com	**Choice**	
☐	☐	☐	**1 + 1**	S31	**Space bar** 6.25 u MX keycap and plate-mount stabiliser	`any 6.25 u spacebar; Cherry plate-mount stabiliser`		Amazon www.amazon.com	**Same**	
☐	☐	☐	**36**	DK	**Matrix diodes** small-signal	`1N4148`		DigiKey www.digikey.com	**Same**	
☐	☐	☐	**2**	SW1, SW2	**MODE and TEXT switches** rotary, 1 pole, adjustable stop set to 3 positions; knobs marked О Р З and Б С Ц	`Lorlin CK1049`	Alpha SR2612F-0112	DigiKey www.digikey.com Mouser www.mouser.com	**Choice**	
☐	☐	☐	**1**	SW3	**NumLock switch** SPDT lever toggle marked 30 / 10	`C&K 7101SYZQE`	any SPDT toggle	DigiKey www.digikey.com	**Same**	
☐	☐	☐	**1 + 1**	CNT	**Letter-group counter and reset** 4-digit TM1637 7-segment module, last digit counts to 5; momentary push button	`TM1637 module`	24 V electromechanical impulse counter	Amazon www.amazon.com	**Choice**	
Printer prints the tape in five-letter groups										
☐	☐	☐	**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	**Same**	
☐	☐	☐	**5**	PR1	**Thermal paper** 57 mm × 15 m rolls (slit to tape width if wanted)	`Adafruit 599`	any 57 mm roll	Adafruit www.adafruit.com	**Same**	
Power and case the supply lives in its own box, as the original's power unit did										
☐	☐	☐	**1**	PSU1	**24 V supply** 24 V 4.5 A enclosed	`Mean Well LRS-100-24`		DigiKey www.digikey.com	**Same**	
☐	☐	☐	**1**	REG1	**5 V regulator** step-down, 24 V in, 5 V 2.5 A out	`Pololu D24V22F5 (item 2858)`	Mean Well LRS-35-5	Pololu www.pololu.com	**Same**	
☐	☐	☐	**1**	J3	**Mains inlet** IEC C14 inlet with switch and fuse holder; 2 A T fuse	`Schurter DD11.0111.1111`	any fused switched inlet	DigiKey www.digikey.com	**Same**	

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☐	☐	☐	**1 + 1**	J4	**24 V cable** 4-pin GX16 aviation plug and socket, 1 m 2-core 0.75 mm² cable	GX16-4	XLR-4	AliExpress www.aliexpress.com	**Choice**	
☐	☐	☐	**1**	F1	**24 V rail fuse** 5 × 20 mm panel holder, 5 A T fuse	any		DigiKey www.digikey.com	**Same**	
☐	☐	☐	**1**	PSU box	**Supply enclosure** aluminium, about 220 × 150 × 100 mm	Hammond 1590 series or similar		DigiKey www.digikey.com	**Choice**	
☐	☐	☐	**1**	case	**Case** 1.5 mm aluminium sheet, folded, hinged lid; 465 × 380 mm footprint; grey hammer-finish paint	project drawing	12 mm plywood carcass with aluminium top	SendCutSend sendcutsend.com	**Choice**	

Orders

VENDOR	ORDER NO.	DATE	TOTAL	RECEIVED	LINES / NOTES

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

Notes