

NanoArc ACE RevA

Bill of Materials - Canadian Dollars

Based on NA-MASTER-001 RevA Freeze / Master Revision 1.2

Scope	Low-voltage ACE controller, operator panel, machine I/O/analog simulator, fault logic fixture and service harnessing
Price date	2026-06-29
Currency	CAD, quantity-one planning prices
Core BOM subtotal	\$274.15
10% procurement contingency	\$27.41
Planning total before tax	\$301.56
Ontario HST estimate (13%)	\$39.20
Planning total after HST	\$340.76
Optional/DNP parts	\$34.50 (not included above)

Scope boundary

This BOM deliberately stops at the frozen RevA control-module boundary. It does not include the energy-storage bank, high-current switch, charge converter, raw power conductors, high-current handpiece wiring, or final enclosure. The KiCad project therefore implements only the low-voltage ACE controller and logic-level verification interfaces. Exact analog divider ratios, trip thresholds and monostable timing values remain marked TBD/DNP because the baseline defers them until characterized hardware exists.

Core RevA BOM

Item	Refs	Category	Qty	Part / description	Unit CAD	Ext. CAD	Basis / note
1	A1	Controller	1	ABX00028 Arduino Nano Every module, no headers	\$19.35	\$19.35	Quoted: DigiKey Canada Frozen RevA controller
2	U1-U3	Digital I/O	3	MCP23017-E/SP 16-bit I2C GPIO expander, 28-PDIP	\$2.64	\$7.92	Quoted: DigiKey Canada 0x20 panel input, 0x21 panel output, 0x22 machine I/O
3	U4	Analog acquisition	1	MCP3208-CI/P 12-bit, 8-channel SPI ADC, 16-PDIP	\$4.33	\$4.33	Quoted: DigiKey Canada RevA prototype ADC
4	U5	Persistence	1	Adafruit 1895 / MB85RC256V class 32 KB I2C FRAM breakout	\$14.55	\$14.55	Quoted: DigiKey Canada Breakout chosen for RevA assembly
5	U6	Analog acquisition	1	REF5025AID 2.5 V precision reference, 8-SOIC	\$6.40	\$6.40	Quoted: DigiKey Canada ADC reference and monitor
6	U7	Analog front end	1	MCP6004-I/P Quad rail-to-rail op-amp, 14-PDIP	\$0.92	\$0.92	Quoted: DigiKey Canada Buffer/filter channels
7	U8-U9	Safety logic	2	LMV393 family Dual low-voltage comparator	\$1.25	\$2.50	Allowance: Planning allowance OV/OC and logic-level threshold fixtures; values remain TBD
8	U10	Safety logic	1	CD74HC221PWR Dual non-retriggerable monostable	\$1.39	\$1.39	Quoted: DigiKey Canada Independent maximum-window logic fixture
9	U11	Fault capture	1	SN74HC573AN Octal transparent latch, 20-PDIP	\$1.69	\$1.69	Quoted: DigiKey Canada Fault-source bitmap
10	U12	Panel output	1	ULN2803A 8-channel Darlington low-side driver	\$3.76	\$3.76	Quoted: DigiKey Canada Eight talkbacks; buzzer on spare/discrete channel
11	DS1	Operator panel	1	2.42 in SSD1309 I2C module 128 x 64 monochrome OLED, 4-wire I2C	\$25.60	\$25.60	Quoted: Canadian retail listing Verify controller/address 0x3C before purchase
12	ENC1	Operator panel	1	PEC11R-4215F-S0024 Incremental encoder with push switch	\$4.60	\$4.60	Quoted: DigiKey Canada Frozen encoder family
13	SW1-SW20	Operator panel	20	TL1105TF160Q 6 x 6 mm tactile switch	\$0.46	\$9.20	Quoted: DigiKey Canada 19 functional positions plus one spare
14	D1-D8	Operator panel	8	5 mm diffused LED Talkback indicators	\$0.40	\$3.20	Allowance: Planning allowance SAFE, CHARGE, READY, ARMED, OUTPUT, FAULT, ENERGY, OPR ERR
15	BZ1	Operator panel	1	AI-1223-TWT-5V-6-R or equivalent 5 V through-hole piezo sounder	\$4.34	\$4.34	Quoted: DigiKey Canada Externally or internally driven variant acceptable after firmware review
16	SW21	Operator panel	1	Maintained toggle switch ARM maintained physical control	\$4.50	\$4.50	Allowance: Planning allowance Mechanically distinct from keypad
17	SW22	Operator panel	1	Guarded/latching red switch HARD SAFE / INHIBIT control	\$8.50	\$8.50	Allowance: Planning allowance Dominant physical safe control
18	RV1-RV8	RevA simulator	8	10 k linear trimmer Sensor-simulator channel controls	\$1.15	\$9.20	Allowance: Planning allowance AIN0-AIN7 simulator
19	TH1-TH4	Sensors	4	10 k NTC, B=3950 Temperature-sensor prototypes	\$1.20	\$4.80	Allowance: Planning allowance Bank, stage, ACE, handpiece simulation/fixture use
20	U13-U16	Protection	4	TPD4E05U06 family Four-line low-capacitance ESD array	\$1.15	\$4.60	Allowance: Planning allowance Connector-entry protection
21	D9-D10	Protection	2	SMBJ5.0A 5 V rail TVS diode	\$0.65	\$1.30	Allowance: Planning allowance Final clamp selection after rail review

Item	Refs	Category	Qty	Part / description	Unit CAD	Ext. CAD	Basis / note
22	J1	Interconnect	1	IDC 2 x 10 set Boxed header, cable receptacle and short ribbon cable	\$8.50	\$8.50	Allowance: Planning allowance J-PNL
23	J2	Interconnect	1	Micro-Fit 3.0 12-circuit set PCB header, plug housing and crimp contacts	\$14.00	\$14.00	Allowance: Planning allowance J-PWR conditioned machine interface
24	J3	Interconnect	1	Micro-Fit 3.0 8-circuit set PCB header, plug housing and crimp contacts	\$11.00	\$11.00	Allowance: Planning allowance J-HND low-voltage handpiece signals only
25	J4	Interconnect	1	JST-XH 6-circuit set Header, housing and contacts	\$3.50	\$3.50	Allowance: Planning allowance J-AUX enclosure/service
26	J5, TP1-TP12	Service	1	2.54 mm headers/test points UART, reset, rails, trips, buses and inhibit test access	\$5.00	\$5.00	Allowance: Planning allowance Serviceability requirement
27	H1-H2	Assembly	1	2 x 15 Nano socket/header set Replaceable Nano Every carrier socket	\$3.50	\$3.50	Allowance: Planning allowance Preserves USB service access
28	Sockets	Assembly	1	DIP sockets / SOIC adapters Sockets and breakout adapters for prototype ICs	\$6.00	\$6.00	Allowance: Planning allowance RevA prototype convenience
29	R*, C*, D*	Passives	1	Assorted 1% resistors, ceramics, electrolytics, signal diodes Pull-ups, pull-downs, series resistors, filters, LED resistors and decoupling	\$12.00	\$12.00	Allowance: Planning allowance Threshold/divider values marked TBD where baseline defers them
30	PS1	Power	1	Qualified 5 V buck module Protected control-power conversion module	\$10.00	\$10.00	Allowance: Planning allowance May be omitted when bench-powered from regulated 5 V/USB
31	PCB1-PCB3	Prototype construction	3	Perfboard/prototype carrier Controller, panel I/O and machine I/O boards	\$6.00	\$18.00	Allowance: Planning allowance Dedicated PCB deferred until electrical values are frozen
32	TB*, JP*	Prototype construction	1	Terminal blocks and jumper assortment Loopback, simulator and harness terminations	\$10.00	\$10.00	Allowance: Planning allowance Logic-level verification fixture only
33	Harness	Harness	1	Hook-up wire, ribbon, heat-shrink and labels Low-voltage internal harness materials	\$15.00	\$15.00	Allowance: Planning allowance No high-current conductors included
34	Mechanical	Mechanical	1	Standoffs, fasteners, panel stock and test-fixture hardware RevA bench mock-up hardware	\$15.00	\$15.00	Allowance: Planning allowance Final enclosure mechanics remain deferred

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Optional and DNP population

These parts are represented in the KiCad project as optional or DNP and are not included in the core planning total.

Item	Refs	Category	Qty	Part / description	Unit CAD	Ext. CAD	Basis / note
O1	U17	DNP/Optional	1	TPS3431/TPS3823 family Independent external watchdog	\$3.00	\$3.00	DNP: Planning allowance Optional RevB/C supervision
O2	U18	DNP/Optional	1	ADS7953SBDBT 16-channel, 12-bit SPI ADC	\$15.00	\$15.00	DNP: Planning allowance RevB/C production migration target
O3	U19	DNP/Optional	1	PCA9306 Bidirectional I2C level shifter	\$1.50	\$1.50	DNP: Planning allowance Fit only for a true 3.3 V target
O4	U20	DNP/Optional	1	ISO1540 I2C isolator	\$7.00	\$7.00	DNP: Planning allowance Do not fit unless I2C leaves the local enclosure
O5	U21	DNP/Optional	1	TLV75533 3.3 V auxiliary LDO	\$1.50	\$1.50	DNP: Planning allowance Mixed-voltage option only
O6	U22	DNP/Optional	1	RTC module at 0x68 Real-time clock	\$4.00	\$4.00	DNP: Planning allowance Fit only if wall-clock evidence is required
O7	U23	DNP/Optional	1	SN74HC148 Hardware fault priority encoder	\$1.50	\$1.50	DNP: Planning allowance Optional immediate cause classification
O8	U24	DNP/Optional	1	MCP9700A Local analog temperature sensor	\$1.00	\$1.00	DNP: Planning allowance Optional ACE-board temperature

Optional/DNP planning value: **\$34.50**

Procurement and configuration notes

- Use the three MCP23017 devices at addresses 0x20, 0x21 and 0x22 exactly as frozen.
- The OLED must be verified as a 128 x 64 I2C module at address 0x3C before ordering; some 2.42 in boards are SPI-only.
- The FRAM line uses a breakout for RevA because the baseline explicitly permits breakout modules. A later carrier PCB may replace it with the bare SOIC-8 device.
- The ADC reference, comparator networks, external clamp timing network and analog scaling components require bench characterization before a production PCB release.
- All external harness lines are represented as conditioned low-voltage signals. Raw I2C is kept local to the ACE/panel enclosure.
- The project uses a replaceable Nano Every module and separates the controller carrier, panel I/O and machine I/O/analog assemblies.

Price-source snapshot

Major component prices were captured from DigiKey Canada quantity-one CAD listings on 2026-06-29. The OLED price is a Canadian retail listing for a 2.42 in SSD1309 I2C/SPI module. Generic switches, connectors, passives, prototype boards and mechanical items are planning allowances because exact shell/keying, board geometry and enclosure details remain deferred. Ontario HST is shown at 13%. Shipping is excluded; DigiKey Canada states that CAD orders of at least \$100 normally qualify for free delivery, excluding marketplace items.

Controlled source: NanoArc Master Technical Architecture and Configuration Baseline, NA-MASTER-001, RevA Freeze / Master Revision 1.2, dated 2026-06-26.