

Universal State-Space Engine – Mechanical Connections

Source	Target	Joint	Delta	Description
cnc_aluminum_chassis_lid	cnc_aluminum_chassis_bottom	chassis_closure_screws and silicone_sealing_ring	(0, -37.5, 0)	Chassis Upper Lid → Chassis Lower Enclosure → chassis_closure_screws and silicone_sealing_ring; Chassis Lower Enclosure sits 37.5mm down from Chassis Upper Lid
rugged_carrying_handle	cnc_aluminum_chassis_bottom	M4 stainless bolts	(0, -37.5, 0)	Rugged External Grab Handle → Chassis Lower Enclosure → M4 stainless bolts; Chassis Lower Enclosure sits 37.5mm down from Rugged External Grab Handle
copper_vapor_chamber	cnc_aluminum_chassis_bottom	M3 structural screws to integrated bosses	(0, -28.5, 0)	Vapor Chamber Heat Spreader → Chassis Lower Enclosure → M3 structural screws to integrated bosses; Chassis Lower Enclosure sits 28.5mm down from Vapor Chamber Heat Spreader
jetson_thermal_transfer_block	copper_vapor_chamber	spring-loaded M3 thermal mounting screws	(40, -7.5, 0)	Jetson Thermal Block → Vapor Chamber Heat Spreader → spring-loaded M3 thermal mounting screws; Vapor Chamber Heat Spreader sits 40mm right, 7.5mm down from Jetson Thermal Block
kria_thermal_transfer_block	copper_vapor_chamber	spring-loaded M3 thermal mounting screws	(-60, -6.5, 0)	Kria FPGA Thermal Block → Vapor Chamber Heat Spreader → spring-loaded M3 thermal mounting screws; Vapor Chamber Heat Spreader sits 60mm left, 6.5mm down from Kria FPGA Thermal Block
backplane_carrier_mount_frame	cnc_aluminum_chassis_bottom	internal_pcb_mounting_screws into heat_set_inserts_m3	(0, -37.5, 0)	Carrier Board Mounting Frame → Chassis Lower Enclosure → internal_pcb_mounting_screws into heat_set_inserts_m3; Chassis Lower Enclosure sits

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				37.5mm down from Carrier Board Mounting Frame
portenta_h7_rugged_bracket	cnc_aluminum_chassis_bottom	internal_pcb_mounting_screws into heat_set_inserts_m3	(-117.5, -36, -90)	Portenta Controller Mount â” Chassis Lower Enclosure â€” internal_pcb_mounting_screws into heat_set_inserts_m3; Chassis Lower Enclosure sits 117.5mm left, 36mm down, 90mm back from Portenta Controller Mount
nvme_thermal_clamp	cnc_aluminum_chassis_bottom	internal_pcb_mounting_screws into heat_set_inserts_m3	(115, -35, -105)	M.2 NVMe Thermal Clamp â” Chassis Lower Enclosure â€” internal_pcb_mounting_screws into heat_set_inserts_m3; Chassis Lower Enclosure sits 115mm right, 35mm down, 105mm back from M.2 NVMe Thermal Clamp
battery_bay_divider	cnc_aluminum_chassis_bottom	slot-fit with M3 structural screws	(0, -52.5, 80)	Battery Bay Partition â” Chassis Lower Enclosure â€” slot-fit with M3 structural screws; Chassis Lower Enclosure sits 52.5mm down, 80mm forward from Battery Bay Partition
pcie_switch_standoffs	cnc_aluminum_chassis_bottom	threaded brass press-fit	(-160, -37.5, 0)	PCIe Switch Brass Standoffs â” Chassis Lower Enclosure â€” threaded brass press-fit; Chassis Lower Enclosure sits 160mm left, 37.5mm down from PCIe Switch Brass Standoffs
jetson_thermal_transfer_block	jetson_agx_orin	mount	(0, 14, 0)	Jetson Thermal Block â” Main Compute AI Accelerator â€” mount; Main Compute AI Accelerator sits 14mm up from Jetson Thermal Block

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kria_thermal_transfer_block	kria_k26_som	mount	(0, 10.5, 0)	Kria FPGA Thermal Block â†’ State-Transition FPGA Accelerator â€™ mount; State-Transition FPGA Accelerator sits 10.5mm up from Kria FPGA Thermal Block
portenta_h7_rugged_bracket	portenta_h7	mount	(0, 9, 0)	Portenta Controller Mount â†’ System Management Controller â€™ mount; System Management Controller sits 9mm up from Portenta Controller Mount
nvme_thermal_clamp	nvme_ssd_4tb	mount	(0, 6.2, 0)	M.2 NVMe Thermal Clamp â†’ Vector Database Storage â€™ mount; Vector Database Storage sits 6.2mm up from M.2 NVMe Thermal Clamp; Vector Database Storage rotated 90Â° about Y
pcie_switch_standoffs	pcie_switch	mount	(0, 9, 0)	PCIe Switch Brass Standoffs â†’ High-Speed PCIe Switch â€™ mount; High-Speed PCIe Switch sits 9mm up from PCIe Switch Brass Standoffs
cnc_aluminum_chassis_bottom	buck_boost_pnd	attached	(100, 33.6, 0)	Chassis Lower Enclosure â†’ System Power Regulator â€™ attached; System Power Regulator sits 100mm right, 33.6mm up from Chassis Lower Enclosure
cnc_aluminum_chassis_bottom	pcie_switch	attached	(100, 31.5, 50)	Chassis Lower Enclosure â†’ High-Speed PCIe Switch â€™ attached; High-Speed PCIe Switch sits 100mm right, 31.5mm up, 50mm forward from Chassis Lower Enclosure
power_dist_block	cnc_aluminum_chassis_bottom	M3 structural screws to integrated bosses	(0, -30, 0)	Power Distribution Block â†’ Chassis Lower Enclosure â€™ M3 structural screws to integrated bosses; Chassis Lower Enclosure sits 30mm down from Power Distribution Block

Source	Target	Joint	Delta	Description
rugged_usb_c_panel_conn	cnc_aluminum_chassis_lid	D-Cut Threaded Hex Nut Mount with Silicone O-Ring	(0, 7.5, 0)	IP67 Rugged USB-C Panel Connector → Chassis Upper Lid → D-Cut Threaded Hex Nut Mount with Silicone O-Ring; Chassis Upper Lid sits 7.5mm up from IP67 Rugged USB-C Panel Connector
industrial_usb_c_cap	rugged_usb_c_panel_conn	integrated tether loop	(0, 0, 0)	Sealing Dust Cap for USB-C → IP67 Rugged USB-C Panel Connector → integrated tether loop; IP67 Rugged USB-C Panel Connector centered on Sealing Dust Cap for USB-C
rugged_hdmi_panel_conn	cnc_aluminum_chassis_lid	D-Cut Threaded Jam Nut Mount with Silicone O-Ring	(0, 25, 0)	IP67 Rugged HDMI Panel Connector → Chassis Upper Lid → D-Cut Threaded Jam Nut Mount with Silicone O-Ring; Chassis Upper Lid sits 25mm up from IP67 Rugged HDMI Panel Connector
hdmi_sealing_cap	rugged_hdmi_panel_conn	integrated tether loop	(0, 0, 0)	Sealing Dust Cap for HDMI → IP67 Rugged HDMI Panel Connector → integrated tether loop; IP67 Rugged HDMI Panel Connector centered on Sealing Dust Cap for HDMI
dp_to_hdmi_active_adapter	backplane_carrier_mount_frame	M3 mounting screws into heat_set_inserts_m3	(0, 0, 0)	Active DP to HDMI Converter → Carrier Board Mounting Frame → M3 mounting screws into heat_set_inserts_m3; Carrier Board Mounting Frame centered on Active DP to HDMI Converter
cnc_aluminum_chassis_bottom	rugged_touch_display	attached	(0, 37.5, 120)	Chassis Lower Enclosure → Waterproof Touchscreen Monitor → attached; Waterproof Touchscreen Monitor sits 37.5mm up, 120mm forward from Chassis Lower Enclosure