Parvus DuraCOR 313

Rugged Miniature Modular Mission Computer with Intel "Elkhart Lake" Atom CPU and TSN Ethernet

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Conceptual product image

Key Features

- Miniature fanless embedded Intel Atom processor system:
  - + Small size: ~5.2" x 5.4"x 2.0" (LxWxH)
  - + Lighweight: < 2.0 lb (< 0.90 kgs)
  - + Low power: <25W
- Rugged IP67 chassis with high-density MIL-performance circular connectors
- Modular I/O architecture: up to three slots for PCIe Mini-Cards (for add-on I/O)
- Rugged solid-state data storage (mSATA / removable 2.5" SATA SSD)
- 1000BASE-T Ethernet with TSN support
- Wide voltage input MIL-1275/704/DO-160 power supply for aircraft and ground vehicles; optional 50ms power hold-up
- Extreme MIL-STD-810G/DO-160 thermal, shock, vibration, altitude, humidity; also MIL-STD-461F/DO-160G EMI/EMC

Applications

- In-vehicle and airborne rugged embedded computing and sensor integration
- Civil and military SWaP-sensitive C4ISR and situational awareness upgrades
- Fixed-wing and rotary helicopter platforms, industrial applications
- Manned and autonomous vehicles (UAV, UUV, UGV, USV)

Overview

The Parvus® DuraCOR® 313 is an ultra-small form factor (USFF) rugged embedded computer based on a low-power, quad-core Intel® Atom™ x6400E Series (Elkhart Lake) processor equipped with unparalleled modularity for add-on I/O cards and data storage in a fanless IP67-rated miniature design. Featuring MIL-performance circular connectors and industrial temperature components, this rugged Commercial Off the Shelf (COTS) processor is an ideal x86 mission computing solution for size, weight, power and cost (SWaP-C) sensitive vehicle, airborne, industrial, manned and unmanned vehicle and sensor applications. Optimized for high performance energy-efficient processing and as a migration path for the legacy DuraCOR 311, the new 313 boasts significant CPU, GPU, memory, security, and networking performance improvements, including up to 16GB DDR RAM, 64GB EMMC on-board storage, 11th gen Intel HD Graphics, integrated CAN 2.0 / CAN FD interfaces, TPM security module, and low-latency Time Sensitive Networking (TSN) support.

The ultra-reliable and modular design of the DuraCOR 313 features high mechanical robustness and I/O flexibility to meet the needs of industrial, military and aerospace platforms. The unit features an extended temperature Intel-based Computer-on-Module (COM) tightly integrated with a non-volatile Flash Solid State Disk (SSD) and system carrier board, which provides up to three slots for optional add-on Mini-PCIe I/O modules (to add CANbus, 1553, ARINC429, other databus interfaces). The unit integrates on-board eMMC Flash and supports an internal mSATA SSD, as well as optional removable 2.5" SATA SSD storage for high capacity storage, data logging, and information assurance requirements. Like other DuraCOR models, the 313 can leverage a large ecosystem of rugged COTS Mini-PCIe modules together with Curtiss-Wright's responsive, cost-competitive application engineering services to reduce program risk, cost and schedule impact for customer-tailored Modified COTS (MCOTS) variants.

With military-grade ruggedization for harsh embedded environments, the DuraCOR 313 is well suited for operation on-board civil and military aircraft and tactical/combat/industrial vehicle platforms. Comprehensive qualification testing is planned to validate its robustness under MIL-STD-810, MIL-STD-461, MIL-STD-1275, MIL-STD-704 and RTCA/DO-160 conditions for environmental, power and EMI (thermal, shock, vibration, dust, water, humidity, altitude, power spikes/surges, conducted/radiated emissions and susceptibility). In addition, optional 50 ms power hold-up capabilities are supported for MIL-STD-704 aircraft power switch-over requirements.

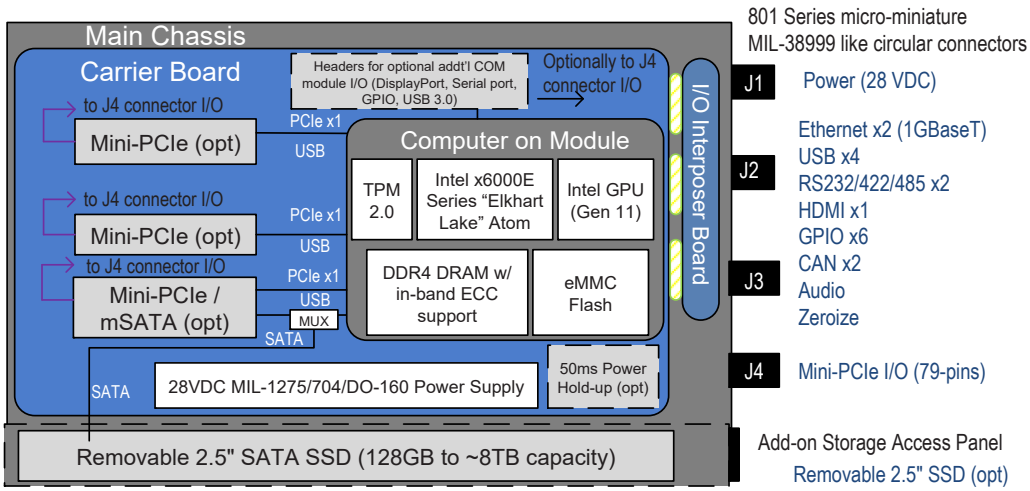

Figure 1: DuraCOR 313 block diagram

Features

Energy efficient CPU/GPU

- Intel Atom x6400E Series (Elkhart Lake) processor with 4-cores, low-power 10 nm System on Chip (SoC), 64-bit instruction set, 12W TDP
- Integrated 11th gen Intel UHD Graphics Processor Unit (GPU) with 2D/3D graphics acceleration and multimedia encode/decode
- Open-architecture computer-on-module (COM)-based design

Connectivity, I/O and storage

- 2 x GbE with TSN support (for real-time networking)
- 4 x USB 2.0, 2 x RS-232/422/485, 6 x DI
- HDMI video, stereo audio
- 2x CAN 2.0 / CAN FD
- Optional COM module I/O: 1x DisplayPort, 1x Serial, 2x USB 3.0, more DIO
- 3 x PCIe-Mini Card slots (for special-order pre-integrated add-on I/O, ii.e. CAN, 1553, ARINC429, more serial / USB / Ethernet ports)
- Up to 64 GB eMMC Flash; Internal mSATA SSD; Removable 2.5' SATA SSD via add-on storage segment

Modular/expandable

- Up to 3 x Mini-PCIe I/O card slots and 79 spare pins on circular connector for add-on I/O modules
- I/O integration services available for turnkey solutions

Rugged mechanical design

- MIL-STD-810G and DO-160G compliance for shock, vibration, thermal, altitude, humidity, dust, water
- -40 to +71°C fanless extended temp operation with no moving parts (passive natural convection)
- Corrosion-resistant, aluminum chassis sealed for water immersion and dust exposure (equivalent to IP67 rating)
- Circular micro-miniature MIL-DTL-38999-like connectors for reliable I/O connections
- Filtered, transient and EMI-protected MIL-STD-1275/704/DO-160 compliant power supply for aircraft and vehicle "dirty power" input; optional 50ms power hold-up
- MIL-STD-461F and DO-160 EMI/EMC compliance (conducted and radiated emissions and susceptibility)
- Conformal coating for humidity/tin-whisker mitigation

Target Applications

- Military, aerospace, industrial on-board computer processing in ground vehicle, fixed wing or rotary aircraft, maritime vessels, outdoor, underground mining, energy exploration, and other embedded computing platforms with SWaP constraints in extreme environments
- Extending energy-efficient, high-performance, multi-core Intel x86 computing architecture into embedded control and artifical intelligence/deep learning applications with harsh temperature, shock, vibration, altitude, dust, water environmental and EMI conditions
- SWaP-constrained mobile, tactical, airborne, vehicle, and sensor processing, including new builds and tech refresh
- Commercial and military aerospace platforms requiring US EAR-exportable solution (ITAR-free) with compliance to MIL-STDs, DO-160, CE Mark

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Related Products

- DuraCOR 311: miniature Intel “Baytrail” Atom mission processor
- DuraCOR 312: miniature NVIDIA Jetson TX2i mission processor
- DuraNET 20-11: miniature 8-port GbE Ethernet switch
- DuraMAR 6300: miniature 6-port GbE Cisco router

Multi-Core x86 Processor

- Low-power Intel Atom (Elkhart Lake x6400E Series) processor with 4-cores, one thread per core, Tremont cores, 64-bit instruction set, 1.5 MB L2-cache, 4 MB L3, support for Intel Virtualization Technology (Intel VT-x), Intel® Speed Shift Technology, Intel 64, Intel® AES New Instructions
- Integrated 11th gen Intel UHD GPU: media encode / decode engine with 32 Intel execution units (EUs); supports OpenCL 1.2, OpenGL 4.5, OpenGL-ES 3.2, Vulkan v1.1, DirectX; operates at 500 MHz base frequency and 750 MHz burst frequency; Gen11LP media codec support for video decode/ encode (H.265 / HEVC, H.264, MPEG2, VP8, VP9, JPEG / MJPEG)
- RAM memory: Up to 16GB DDR4 with in-band ECC support

Standard I/O Interfaces

Ethernet

- 2 x GbE LAN interfaces
- Support for IEEE Time Sensitive Networking (TSN) under Linux for low-latency and on-time transfer of critical data (IEEE 802.1: AS, Qav, Qbv, Qbu; IEEE 802.3: az, br)

Serial

- 2 x serial ports - RS-232/422 or 485 half-duplex
- Optional: additional serial port(s) (from COM module/add-on mPCIe modules)

USB

- 4 x USB 2.0 ports
- Optional: 2x USB 3.0 ports (from COM module)

CANbus

- 2 x CAN 2.0/CAN FD ports, data bit rate up to 8 Mbps

Video

- High definition video output: 1 x HMDI
- 2 x CAN 2.0/CAN FD ports, data bit rate up to 8 Mbps
- Special order: Display Port (DP) video output
- Special order: NTSC/PAL composite / HD-SDI frame grabbers/ encoders video inputs (via add-on Mini-PCIe cards)

Audio

- Stereo audio (left/right) and microphone (left/right)

GPIO

- 6 x general-purpose digital I/O
- Optional: additional GPIO from COM module/add-on mini-PCIe cards

Figure 2: Front view

Figure 3: Top view

Figure 4: Rear view

Figure 5: Optional removable 2.5” SATA SSD media support

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I/O Expansion

- Optional I/O from COM module: Additional 1x DisplayPort, 1x Serial, 2x USB 3.0, 10x DIO
- Up to 3 x slots for Mini-PCIe card I/O modules (for optional MIL-STD-1553, ARINC 429, video frame grabber, additional serial, Ethernet, CAN, USB ports, civilian GPS, or Wi-Fi, etc.); 3rd slot can alternatively support mSATA SSD
- 79 pins available on J4 circular connector for additional COM module or Mini-PCIe I/O signals
- Application engineering services available for Modified COTS (MCOTS) variants with pre-integrated I/O modules by the factory

Storage

- 1 x slot for mSATA Flash SSD on internal carrier board (64 GB up to 1 TB capacity)
- Up to 64GB eMMC Flash onboard SOM module (other capacities special order)
- Optional removable 2.5” SATA SSD in add-on mechanical segment
  - + SSD Capacities: ~128 GB to ~8 TB capacity
  - + Flash type: iTemp MLC / 3D-TLC NAND Flash (default)
  - + Removable storage add-on segment features sealed, removable door with thumbscrews for opening by hand without tools
- SSD with secure erase, write-protection, and/or data encryption capabilities can be special ordered (consult with factory)

Software

- OS: pre-installed Linux or Windows operating system to boot-up out of the box
- Computer Vision / Artificial Intelligence (A) Inference: Elkhart Lake CPU platform is supported by Intel OpenVino toolkit (which includes Intel® Deep Learning Deployment Toolkit, optimized OpenCV and media encode/decode, 20+ pre-trained models, code samples)

Security

- TPM: Trusted Platform Module compliant with TPM 2.0 specification for creating secure computing environment, ensuring only trusted and signed BIOS and software can execute on system
- Hardware-Accelerated Encryption: Intel Advanced Encryption Standard New Instructions (Intel® AES-NI), Intel SHA Extensions
- Declassification: data zeroization discrete signal to support erasing non-volatile Flash memory (initiated by offboard signal trigger) with compatible SSDs

Physical Specifications

- Weight:
  - + Base system, exclusive of Mini-PCIe or mSATA modules: ~ 2.0 lb (0.90 kg)
  - + System with integrated removable storage segment, excluding SSDs/Mini-PCIe modules: ~ 2.75 lb (1.25 kg)
- Dimensions (L x W x H, excluding connectors and mounting feet):
  - + Base system (est): 5.2” x 5.4” x 2.0” (13.2 x 13.8 x 5.2cm)
  - + With 2.5” storage add-on (est): ~2.8 x 5.2 x 5.4” (6.7 x 13.2 x 13.8 cm)
- Chassis: aluminium alloy, corrosion resistant
- Cooling: passive, natural convection (fanless)
- Ingress protection: dust and water proof (similar to IP67)
- Finish: black anodize finish per MIL-A-8625, Type II, Class 2
- Connectors: micro-miniature MIL-DTL-38999-like connectors with environmental sealing (50%+ smaller/lighter than traditional 38999s), Glenair 801 Series Mighty Mouse
- Installation: base flange mount (4x holes)
- Special Order: Alternative connector or enclosure finishes, mechanical changes

Power Compliance

- 28 VDC nominal power; input range: 9 to 36 VDC
- Power consumption (est.): 25W max for base system (excluding mini-PCIe add-on modules)

MIL-STD-704F, MIL-STD-1275D, DO-160G compliance:

- MIL-STD-704F 28 VDC compliant for aircraft electrical operation: over/under voltages, spikes, surges for normal, transfer, abnormal, emergency, starting, and power failure
  - + Optional support for 50 ms power hold-up capacitance (per MIL-STD-704) for aircraft power switch-over requirements
- MIL-STD-1275D+E 28 VDC compliant for ground vehicle operation: steady state DC voltage variations, no fault/ single fault conditions, ripple voltage susceptibility on input power leads, imported voltage spikes, overvoltage and under voltage surges, ESD immunity
- RTCA/DO-160G compliant for aircraft operation (Sections 16-18, 25): power input, voltage spikes, audio frequency conducted susceptibility-power inputs, electrostatic discharge

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EMI/EMC Compliance

Compliance with MIL-STD-461F+G, RTCA/DO-160G, and CE Mark requirements:

- Conducted emissions:
  - MIL-STD-461F, CE102, power leads, 10 KHz to 10 MHz, basic curve, Fig CE102-1
  - DO-160G Sec. 21; conducted RF emissions, 150 kHz to 152 MHz, Category L; Figures 21-1, 21-2
- Conducted susceptibility:
  - MIL-STD-461F, CS101, power leads, 30 Hz to 150 KHz, Curve 2, Figure CS101-1 (28V and below)
  - MIL-STD-461F, CS114; bulk cable injection, 10 k to 200 MHz; Curve 3, Figure 1
  - MIL-STD-461F, CS115; bulk cable injection, impulse excitation; impulse, Figure 1
  - MIL-STD-461F, CS116; damped sinusoidal transients, cables/power leads, 10 k to 100 MHz; transient, Fig 1-2
  - RTCA/DO-160G Sec. 20; conducted susceptibility, 10 kHz to 400 MHz, category M; Figure 20-6
- Radiated emissions:
  - MIL-STD-461F, RE102, electric field, 10 KHz to 18 GHz, fixed wing internal < 25 meters, Figure RE102-3
  - DO-160G Sec. 21; radiated RF emissions, 100 MHz to 6 GHz, Category L; Figure 21-7
- Radiated susceptibility:
  - MIL-STD-461F RS-103, electric field, 2 MHz to 18 GHz, 200V/m, Table VII, RS-103 limits
  - DO-160G Sec. 20; radiated susceptibility, 100 MHz to 8 GHz, Category R; Figure 20-10
  - Special order: additional program-specific delta qual tests

Environmental Compliance

Compliance with MIL-STD-810G, RTCA/DO-160G:

- Operating temperature:
  - -40 to +71°C (-40 to +160°F) ambient (per MIL-STD-810G Methods 501.5 and 502.5)
  - -40 to +70°C (per DO-160G, Section 4 Category A2 and D2 and Section 4.5.5, Category V/Table 4-1)
- Storage temperature:
  - -55 to +85°C (-67 to +185ºF) per DO-160G, Section 4, Category A2
  - -40 to +85ºC (-40 to +185ºF) per MIL-STD-810G Method 502.5 and Method 501.5
- Humidity (operating/transport):
  - Up to 95% RH @ 40°C, non-condensing (per MIL-STD-810G, Method 507.5, Procedure II)
  - DO-160G, Section 6, Category B, Section 6.3.2
- Operating shock:
  - 40 g, 11 ms, 3 pos/neg per axis, 18 terminal peak shock pulses per MIL-STD-810G Method 516.6, Procedure I
  - 6 g, 11 ms, terminal peak shock pulses per DO-160G, Section 7, Class A)
- Crash hazard shock:
  - 75 g, 11 ms, 12 terminal peak shock pulses, 2 pos/neg per axis (per MIL-STD-810G Method 516.6, Procedure V)
- Random vibration:
  - Combined jet-helo-tracked vehicle profile, 3 axes, 1 hour/ axis (per MIL-STD-810G, Method 514, Procedures I-II)
  - Category S, Curve B3, DO-160G Section 8
- Ingress (dust/sand):
  - No ingress (qual by analysis; designed for compliance to IP6X, MIL-STD-810G Method 510.5, Proc. I and II, DO-160G, Sect 12, Cat S)
- Water immersion:
  - No leakage per 1 meter submersion, 30 minutes (per MIL-STD-810G, Meth. 512.5, Proc. I; similar to IPX7)
- Operating altitude:
  - 50,000 ft (15,240 meters) per DO-160G, Section 4, Category D2, Section 4.6.1 and MIL-STD-810G, Method 500.5, Procedures I-II
- Storage altitude:
  - 60,000 ft (18,288 meters) per MIL-STD-810G, Method 500.5, Procedures I-II
  - Special order: additional program-specific delta qual tests

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Other Specifications

Reliability

- Designed and manufactured using AS9100 aerospace grade, ISO 9001:2000 certified quality program
- No moving parts, no active cooling required
- Conformal coated PCBs for humidity/tin-whisker mitigation, staked components, under-filled BGA
- MTBF: Calculated per MIL-HDBK-217F, available with qual test report, upon request
- Human Factors: MIL-STD-1472 compliance with no sharp edges, appropriate connector spacing, etc.
- Workmanship: assembled per IPC-A-610 Class III
- Self-Diagnostics: Built-in-test (BIT) microcontroller (to monitor, count and measure hardware/software events)
- Special Order: Environmental Stress Screening (ESS) services

Export jurisdiction

- ITAR-free: EAR Commerce Department controlled (dual-use)

Regulatory compliance

- European CE Mark pending (including RoHS, REACH cert)

Warranty

- 1 year return to depot warranty
- Extended multi-year warranties available

Long Life Product Availability

- Intel Elkhart Lake SoC for embedded user cases offers up to 15 years of lifecycle for IoT platforms
- Optional extended lifecycle support via Curtiss-Wright Total Lifecycle Management (TLCM) services

Ordering Information

TABLE 1 Early Access Unit (EAU) Systems and Lab Cables - limited quantities available

PART NUMBER	DESCRIPTION
C313-L3-E	DuraCOR 313, Intel x6400E Series, 16GB RAM, 64 GB mSATA SSD, Linux OS, Early Access Unit (EAU)
CBL-C31X-01	Optional starter breakout cable set mates with J0, J1, and J2 circular connectors transitioning to traditional commercial connectors (i.e. RJ-45/DB-9/USB/HDMI) for lab/testing purposes

TABLE 2 DuraCOR 313 System - example configs and part number legend

Part Number	Operating System			Internal mSATA SSD						Remove 2.5" SATA SSD Segment		-	Power Hold-up	
	0 if none	L for Linux	W for Windows	0 for none	3 for 64GB	4 for 128GB	5 for 256GB	6 for 512GB	7 for 1TB	Blank if None	R for Yes		Blank if None	P for Yes
C313-L3		L			3									
C313-L5		L					5							
C313-W7			W						7					
C313-00R				0							R			
C313-00R-P	0			0								-		P
C313-L6-P	0	L						6				-		P

Note: Due to modularity, many configurations possible. Please consult with sales.

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TABLE 3	Lab Breakout Cables / Starter Connector Kit
PART NUMBER	DESCRIPTION
CBL-C31X-01	Starter breakout cable set for J1/J2/J3 connectors of DuraCOR 310 / 311 / 313 for lab/ testing purposes (from mating circular 801-series connectors to commercial PC-style RJ-45/USB/DB9/HDMI connectors for I/O & banana plugs for power)
CON-C31X-01	Starter mating connector set for J1/J2/J3 micro-miniature 801 series connectors of DuraCOR 310 / 311 / 313, electroless nickel finish, keyed

TABLE 4	Removable 2.5” SATA SSDs / Spare SSD Mounting Sled
PART NUMBER	DESCRIPTION
SSD31X-512M-L	512 GB 2.5" SATA SSD, Industrial MLC NAND Flash -40/+85C, Linux OS, installed on SSD mounting tray compatible with DuraCOR 31X
SSD31X-1TBM-L	1 TB 2.5" SATA SSD, Industrial MLC NAND Flash -40/+85C, Linux OS, installed on SSD mounting tray compatible with DuraCOR 31X
SSD31X-2TBM-L	2TB 2.5" SATA SSD, Industrial MLC NAND Flash -40/+85C, Linux OS, installed on SSD mounting tray compatible with DuraCOR 31X
MCH-2557-01	SSD mounting tray for DuraCOR 31X, compatible with industry standard 2.5" SATA SSDs (SSD sold separately)

Note: Additional SSD options possible (different memory type, storage capacities, security capabilities, etc.). Please consult with sales.

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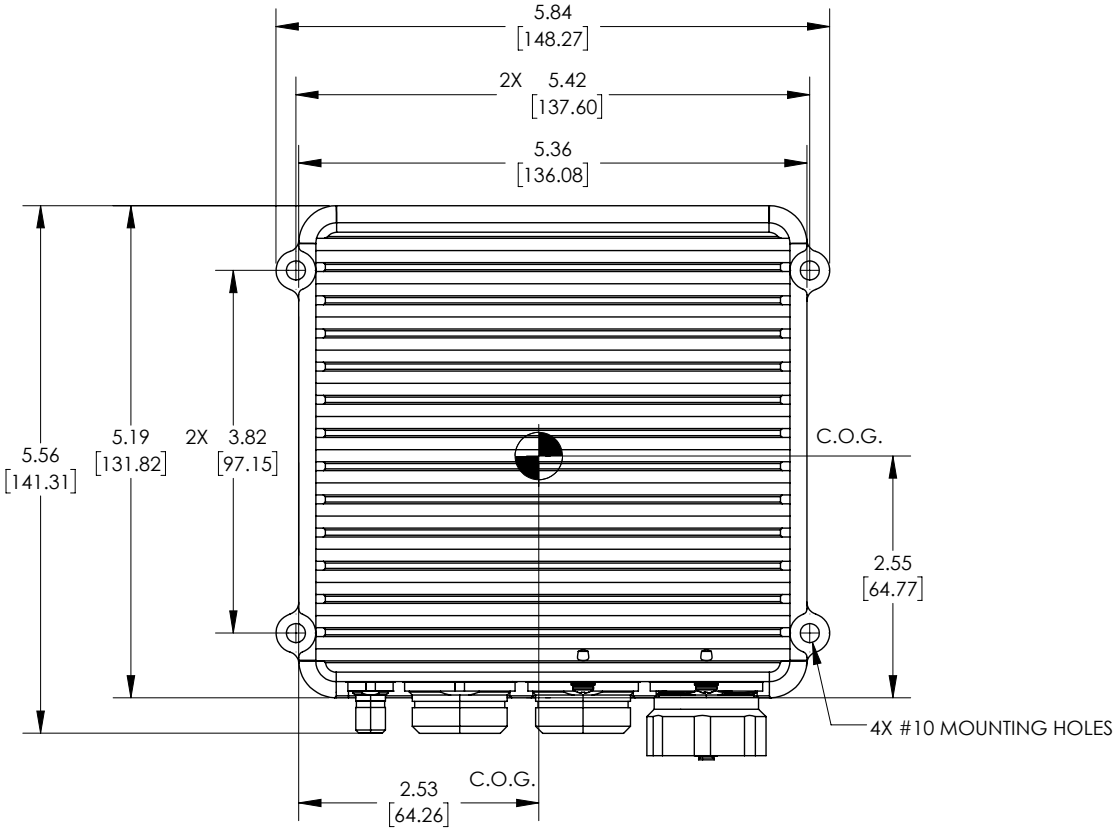
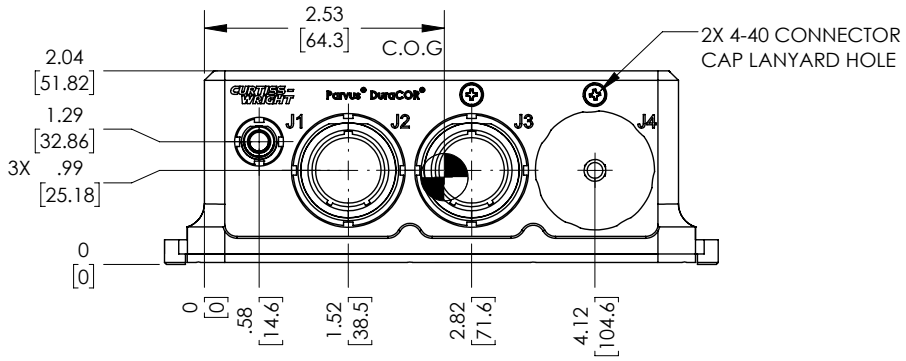
Mechanical Envelope Drawings





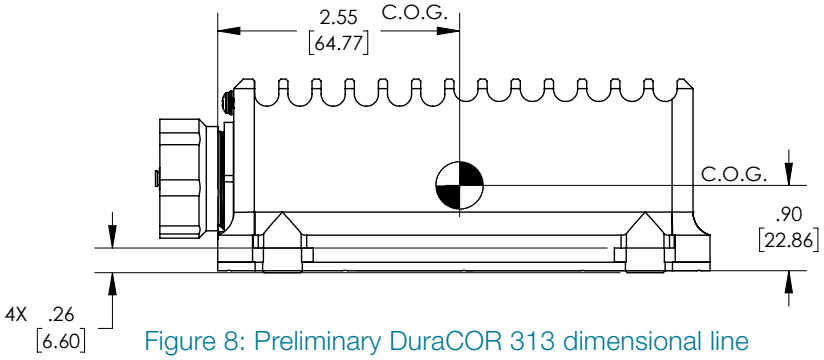


Figure 8: Preliminary DuraCOR 313 dimensional line drawings (measurements shown are in inches and [cm])

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Mechanical Envelope Drawings

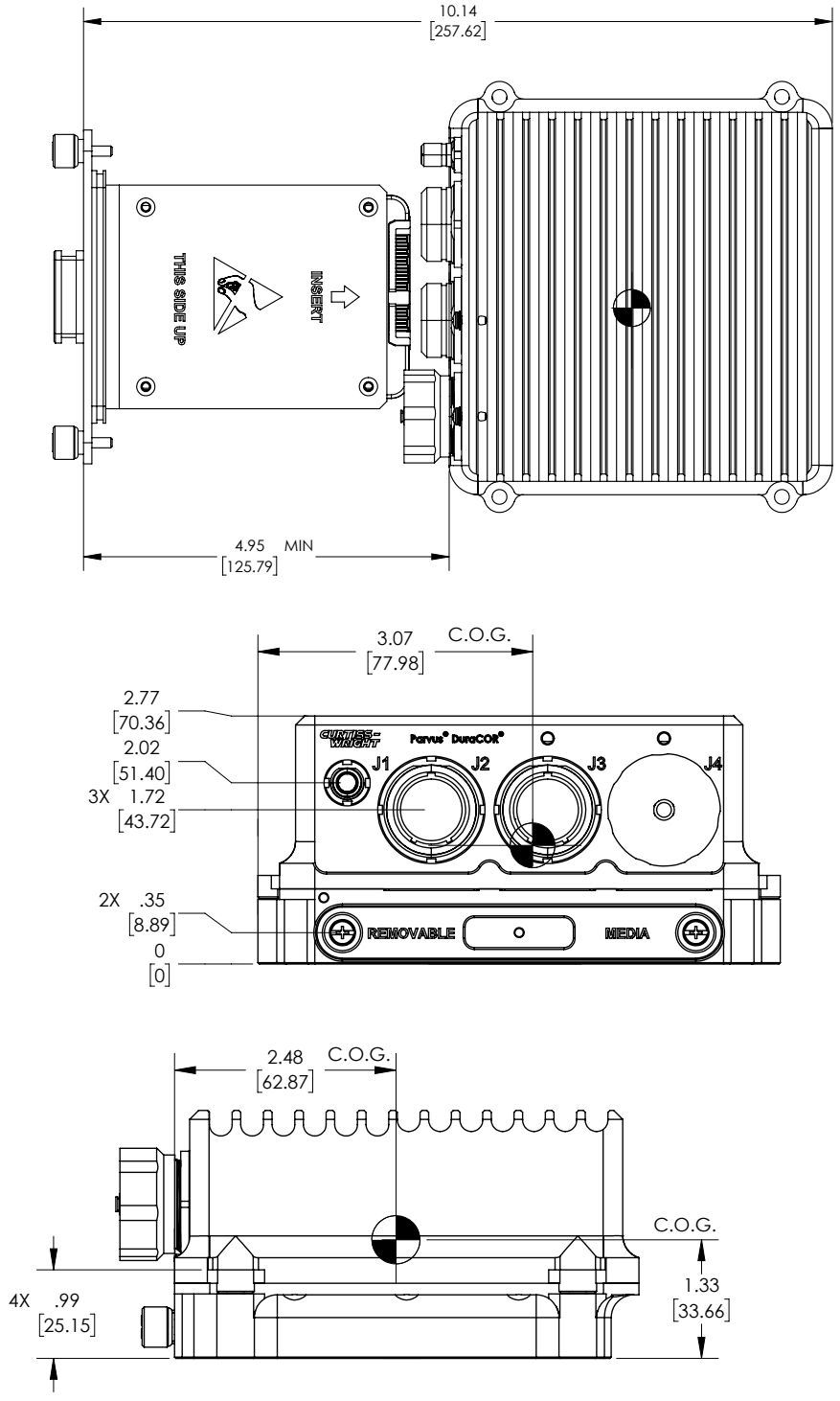

Figure 9: Preliminary DuraCOR 313 with removable storage option dimensional line drawings (measurements shown are in inches and [cm])

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