Parvus DuraNET 20-11

Rugged Ultra-miniature 8-port Gigabit Ethernet Switch, Fully Managed, MIL Circular Connectors

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Key Features

- Rugged 8-port Gigabit Ethernet switch
- High performance, rugged MIL-circular connectors
- Layer 2+ carrier Ethernet software management
- Ultra-miniature SWaP optimized design:
  - + Size: 10 in^3 (fits in hand)
  - + Weight: 0.50 lb (~0.23 kg)
  - + Power: 5W
- PTP (IEEE-1588v2) precision time stamping
- Fully validated to MIL-STD-810G/461F/704F/1275D and DO-160

Applications

- Embedded Gigabit Ethernet edge networking applications
- SWaP-constrained platforms
- Network-centric operations and situational awareness
- In-vehicle/aircraft LAN switching, static IP routing
- Fixed and rotary wing (un)manned air vehicles
- C4ISR technology refresh and LRU upgrades

Overview

The Parvus® DuraNET® 20-11 is an ultra-small form factor (SFF) rugged Commercial Off the Shelf (COTS) 8-port Gigabit Ethernet (GbE) switch optimized for extremely demanding size, weight and power (SWaP) constrained vehicle and aircraft platforms exposed to harsh environmental and noisy electrical conditions (e.g. high altitude, extreme shock and vibration, extended temperatures, humidity, dust and water exposure, noisy EMI, and/or dirty power). The unit boasts an ultra-miniature "pocket-sized" design with a physical size of roughly 10 in^3 in volume, 0.50 lb in weight, and 5W typical power consumption. Bringing out Ethernet, power, console, and zeroize signals over micro-miniature MIL circular connectors, the unit is well suited for low size and weight applications with demanding electromagnetic compatibility (EMC) requirements. Validated for military and civil aircraft use as well as ground vehicle installations, the 20-11 features integrated EMI and power filtering for the input voltages, spikes, surges, transients, and EMI/EMC compatibility requirements of MIL-STD-704F, MIL-STD-1275D, MIL-STD-461F, and RTCA/DO-160.

Not only does the DuraNET 20-11 deliver an ultra-low SWaP-optimized rugged design with IP67 dust and water ingress protection, but it also features the latest in carrier-grade, fully managed Ethernet switch technology to deliver new situational awareness and C4ISR capabilities for unmanned air and ground vehicles (UAVs, UGVs) and other SWaP-constrained platforms deploying network connectivity at the tactical network edge. This fully managed, Layer 2+ switch provides a powerful set of carrier-grade networking features, including support for IPv4 and IPv6 multicast traffic, Virtual Local Area Networks (VLANs), port control (speed/mode/statistics, flow control), Quality of Service (QoS) traffic prioritization, Link Aggregation (802.3ad), Simple Network Management Protocol v1/v2/v3 management, secure authentication (802.1X, ACLs, Web/CLI), redundancy (RSTP/MSTP), precision timing (IEEE-1588v2), port monitoring, IGMP Snooping, Built-in Test (BIT), and data zeroization. The unit also supports Layer 3 IPv4/IPv6 static routing for attached WAN/radios.

This rugged system was engineered for high reliability and validated through extensive qualification testing for extreme EMI/EMC (MIL-STD-461F, DO-160F) and environmental (MIL-STD-810G, DO-160) conditions. Extended temperature operation from -40 to +85°C, resistance to high shock and vibration, humidity, altitude, and dust/water ingress make the DuraNET 20-11 an extremely reliable Local Area Network (LAN) switching solution for technology refresh and new platforms to connect Ethernet-enabled embedded devices, including computers, cameras, sensors, and command-and-control equipment deployed in digital networked architectures at the network edge.

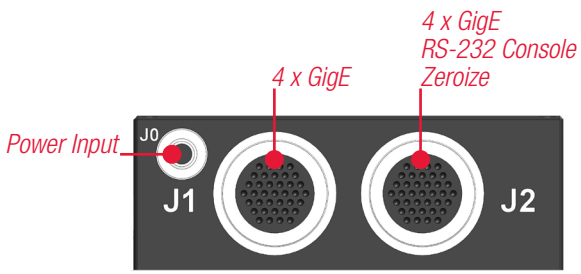

Figure 1: MIL-performance rugged I/O connectors

Features

Small Form Factor Ethernet switch

- 8 ports of 10/100/1000 Mbps Ethernet in ultra-miniature SWaP-optimized chassis
  - + Small size: 10 in³ (143 cm³) volume
    1.2” x 2.5” x 3.3” (3.0 x 6.3 x 8.5cm)
  - + Low weight: 0.50 lb (~0.23 kg)
  - + Power: 5W (typical)
- Carrier Ethernet switch engine with embedded 32-bit management processor
- Robust Layer 2+ switching and network management software support
- Extremely low power design: Energy Efficient Ethernet (IEEE-802.3az) support with low-power PHYs and smart cable reach technology

Management

- Carrier Ethernet services software deliver rich Layer 2 switch features, Layer 3 aware packet processing, service classification and traffic policing; IEEE-1588 Precision Timing Protocol (PTP) and hardware accurate time-stamping
- L2+ switch management: 10/100/1000 Mbps gigabit Ethernet connectivity, IPv4/IPv6 multicast, VLAN, QoS/CoS traffic prioritization, multiple/rapid spanning tree, link aggregation, and IEEE-1588 PTP
- Layer 3 support for IPv4/IPv6 unicast static routing to attached radio and WAN ports
- SNMPv3, HTTP server, Web GUI, RS-232 console CLI, port monitoring, RMON, syslog, Network Access Server (NAS), 802.1X authentication, IGMP snooping, Access Control Lists (ACLs), zeroization, and BIT diagnostics

Rugged MIL-STD design

- Validated through qual-testing:
  - + Harsh MIL-STD-810G and DO-160 conditions (temp, shock, vibration, humidity, altitude, and dust/water ingress)
  - + MIL-STD-461F and DO-160 EMI/EMC (conducted and radiated emissions and susceptibility)
  - + MIL-STD-1275, MIL-STD-704 and DO-160 compliant power filtering, transient, ESD and EMI protection for aircraft and vehicle “dirty power” input
- -40 to +85°C fanless extended temp operation with no moving parts
- Corrosion-resistant, aluminum chassis sealed against water and dust (IP67) ingress
- High-performance MIL-circular connectors
- Export jurisdiction: ITAR-free, U.S. Commerce EAR Controlled

Figure 2: Small size fits in hand

Figure 3: Top view

Figure 4: Rear view

Figure 5: Front view

Applications

- Gigabit Ethernet LAN switching in harsh temperature and vibration environments (e.g. on-board computers, cameras, sensors, monitoring devices, and command-and-control gear)
- SWaP-sensitive mobile, tactical, airborne, and vehicle applications for situational awareness and network centric operations at network edge (i.e. UAV, UAS, UGV, helicopter, aircraft, and ground vehicles)

Architecture

- Packet processor: Vitesse carrier-grade Ethernet switch engine
- Switching: non-blocking OSI data Layer 2, IPv4/IPv6 multicast, low-latency, auto-MDI/MDIX, auto-negotiation, auto-detect; speed auto-sensing, auto-crossover, full/half duplex modes, and QoS
- Management processor: embedded MIPS CPU with DDR-2 memory
- Networking software: Vitesse CE services carrier Ethernet application

Ports

- 8 x 10/100/1000BaseT GbE ports
- RS-232 management console
- Power input and data zeroize

Layer 3 routing

- Layer 3 IPv4/IPv6 unicast static routing to attached WAN and radio ports

Layer 2 switching

- Port control: port-speed, duplex mode, flow control, port frame size (jumbo frames), port state, port status (link monitoring), and port statistics (MIB counters)
- Quality of Service (QoS) traffic prioritization and queuing: 8 priorities, 8 CoS queues per port, strict or deficit-weighted RR scheduling, shaping/policing per queue and per port, and storm control
- VLAN: 8K MAC addresses, 4K VLANs, 802.1Q static VLAN, protocol-based VLAN, MRP, MVRP, MVR, IEEE-802.10ad provider bridge, and link aggregation (IEEE-802.3ad)
- IEEE-802.1 D/w/s (spanning tree, rapid spanning tree, and multiple spanning tree protocol)
- PTP (IEEE-1588v2) time stamping as (a) peer to peer transparent clock, (b) end to end transparent clock, (c) boundary clock, or (d) slave only clock

Management

- In-band Ethernet management using Web GUI, SNMP, or Command Line Interface (CLI) over RS-232 console for Telnet/SSH/Terminal
- HTTP/HTTPS web server, SNMP v1/v2/v3 client, DHCP client, IEEE 802.1X authentication, system syslog, SSHv2, IPv6 management, IGMP/MLD/DHCP snooping, access control lists, port mirroring, BPDU guard, RMON, Cisco discovery filtering, and IEEE-802.10AB LLDP
- BIT functionality to detect system faults

Security

- Network Access Server (NAS) IEEE-802.1X, RADIUS accounting, MAC address limit, TACACS, web and CLI authentication, ACLs, and IP source guard
- Declassification: data zeroization support to erase non-volatile Flash memory and restore board to factor default configuration (initiated by offboard signal trigger)

Power Compliance

- Power input: 28 VDC nominal steady state
- MIL-STD-704F 28 VDC compliant for aircraft electrical operation: over/under voltages, spikes, surges for normal, transfer, abnormal, emergency, starting, and power failure
- MIL-STD-1275D 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, starting disturbances, and ESD immunity
- RTCA/DO-160 compliant for aircraft operation (Sections 16-18, 25): power input, voltage spikes, audio frequency conducted susceptibility-power inputs, and electrostatic discharge
- EN 55024 surge immunity per EN 61000-4-5, criteria B; EN 55024 electrostatic discharge immunity (per EN 61000-4-2)
- Power consumption (estimated): < 8W maximum (~5W typical)
- Support for Energy Efficient Ethernet (IEEE 802.3az), ActiPHY, and Vitesse PerfectReach technologies to reduce active Ethernet power for unused or idle links and/or shorter cable lengths

Physical Specifications

- Dimensions (H x D x W) (estimated, excl connectors):
  - 1.20” x 2.49” x 3.34” (3.05 x 6.32 x 8.48cm)
- Weight: approx. 0.5 lb (~0.23 kg)
- Installation: four (4) mounting holes on bottom for 6 to 32 hardware; can also be used with custom mounting brackets
- Connectors:
  - J0: Omnetics Metal Nano Circular (MNC) for power input (Note: Early Access Units (EAUs) bring out power on J1)
  - J1/J2: Amphenol 2M series micro-miniature MIL-DTL-38999-like connectors with environmental sealing for Ethernet, serial ports (50%+ smaller/lighter than traditional 38999s)
- Cooling: passive natural convection without forced air or fans and no moving parts
- Enclosure and finish: corrosion resistant, aluminium alloy with black anodize finish per MIL-A-8625

Environmental Specifications

Qual tested to meet MIL-STD-810G and RTCA/DO-160G

- Operating temperature: -40 to +85°C (-40 to +185°F) ambient (per MIL-STD-810G Methods 501.5 and 502.5) and -40 to +70°C (per DO-160G, Sect 4 Cat A2 and D2 and Section 4.5.5, Category V/Table 4-1)
- Storage temperature: -55 to +85°C (per DO-160G, Section 4, Category A2) and -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: 3 axes, 1 hour/axis (per MIL-STD-810G, Method 514, per Procedures I and II and DO-160G Section 8, Category S, Curve B3 per combined jet-helo-tracked vehicle profile)
- Ingress (dust/sand): no ingress (designed for compliance to IP67, MIL-STD-810G Method 510.5, Procedure I and II, DO-160G, Section 12, Category S)
- Water immersion: no leakage per 1 meter submersion, 30 minutes (similar to IP67 and MIL-STD-810G, Method 512.5, Procedure I (1 meter, 30 minutes))
- Operating altitude: up to 50,000 ft (15,240 meters) per DO-160G, Section 4, Category D2, Section 4.6.1) and +30,000 ft (9,144 meters) per MIL-STD-810G, Method 500.5, Procedures I-II)
- Non-operating altitude: up to 60,000 ft (18,288 meters) (per MIL-STD-810G, Method 500.5, Procedures I-II)
- Rapid decompression: per MIL-STD-810G, method 500.5, procedure III
- Fungus/salt-fog: per MIL-STD-810G (by analysis)

Figure 6: Side view

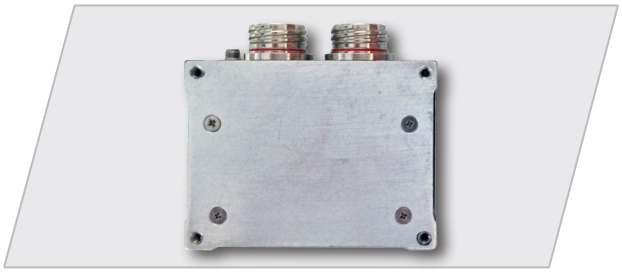

Figure 7: Bottom view

Figure 8: Starter breakout cable set

EMI/EMC Compliance

Qualified to meet MIL-STD-461F and RTCA/DO-160G

- Conducted emissions: MIL-STD-461F CE102, power leads, 10 KHz to 10 MHz, basic curve, Figure CE102-1; DO-160G Sec. 21; conducted RF emissions, 150 kHz to 152 MHz, Category L; Figures 21-1, 21-2; EN 55022 Class A (power line conducted emissions)
- Conducted susceptibility: MIL-STD-461F, CS101, power leads, 30 Hz to 150 KHz, Curve 2, Figure CS101-1 (28V and below); CS114; bulk cable injection, 10k-200 MHz; curve 3, figure 1; CS115, bulk cable injection, impulse excitation; impulse, figure 1; CS116, damped sinusoidal transients, cables/power leads, 10k-100 MHz; transient, Figures 1-2; RTCA/DO-160G Sec. 20, conducted susceptibility, 10 kHz to 400 MHz, category M, figure 20-6; EN 55024 electrical fast transient/burst immunity and conducted immunity (per EN 61000-4-4, criteria B, EN61000-4-6, criteria A)
- Radiated emissions: MIL-STD-461F, RE102; electric field, 10 kHz to 18 GHz, fixed wing internal < 25 meters, figure RE102-3; DO-160 section 21, radiated RF emissions, 100 MHz to 6 GHz, category L, figure 21-7; EN 55022, class A (power line radiated emissions)
- Radiated susceptibility: 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; EN 55024 radiated electromagnetic field and immunity tests, perf. criteria A

VICTORY Compliance

- Vehicle Integration for C4ISR/EW Interoperability (VICTORY) infrastructure switch component type (formal validation pending)
- Centralized network support for VICTORY initiative
- Product shares the same switching architecture as DuraDBH-672 Digital Beachhead to support common network services to connected equipment for command and control, situational awareness, data communications, automotive systems and logistics, sensors and data acquisition, among others.

Other Specifications

Export jurisdiction

- ITAR-free, dual use, U.S. Commerce EAR controlled (ECCN 5A002)

Regulatory compliance

- European CE Mark (including EN55022, EN55024, RoHS2)

Reliability

- Mean Time Between Failure (MTBF) calculated per MIL-HDBK-217F:
  - Ground Benign, +25°C: 889,828 hours (101.6 years)
  - Ground Mobile, +25°C: 102,223 hours (11.67 years)
  - Airborne Inhabit Fighter, +25°C: 68,931 hours (7.87 years)
  - Airborne Rotary Winged, +25°C: 40,720 hours (4.65 years)
- Workmanship: assembled to IPC-A-610 Class III
- No moving parts, no active cooling required
- Conformal coated PCBs for humidity/tin-whisker mitigation, staked components, and underfilled BGA

Warranty

- 1 year return to depot warranty (extended warranty available with service contract)
- Extended, multi-year service agreements available (basic/priority service)

Ordering Information

Breakout cable set

- Optional starter breakout cable set mates with MIL-circular connectors for Ethernet, console, and power signals, transitioning to traditional RJ-45/DB-9/power (for lab and testing purposes)

Ordering codes

- NET-20-11-01: DuraNET 20-11, 8x port GbE Ethernet switch, MIL-circular connectors
- CBL-NET-20-11-01: breakout cable set for NET-20-11-01 (mating circular to RJ-45, DB-9, banana plugs), separate power connector, keyed connectors

Related Products

- See also DuraNET 20-12: 6x port 10/100 Ethernet switch variant with Quadrax MicroD connector
- See also DuraNET 20-10: 20x port Gigabit Ethernet switch variant with DTL-38999 connectors

Line Drawings