USER MANUAL

DuraDBH-672 Digital Beachhead

Rugged Small Form Factor GbE Switch and Vehicle Processor System

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CURTISS-WRIGHT

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This symbol has been attached to the equipment or, if that was not possible, on the packaging, instruction literature, and/or the guarantee sheet. Using this symbol states that the device has been marketed after August 13th 2005, and implies that you must separate all of its components when possible, and dispose of them in accordance with local waste disposal legislation.

- Because of the substances present in the equipment, an improper use or disposal of the refuse can cause damage to human health and to the environment.
- With reference to WEEE, it is compulsory not to dispose of the equipment with normal urban refuse. Arrangements should be instigated for separate collection and disposal.
- Contact your local waste collection body for more detailed recycling information.
- In case of illicit disposal, sanctions may be levied on transgressors.

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This device, including all its components, subassemblies, and the consumable materials that are an integral part of the product, has been manufactured in compliance with the European directive 2002/95/EC known as the RoHS directive (Restrictions on the use of certain Hazardous Substances). This directive targets the reduction of certain hazardous substances previously used in electrical and electronic equipment (EEE).

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INTRODUCTION

ABOUT THIS DOCUMENT

This manual provides functional and technical descriptions of the DuraDBH-672 hardware, instructions on connecting the system to test equipment, connector descriptions and pinouts, and specifications.

DESCRIPTION OF SAFETY SYMBOLS

The following symbols are used in this manual to indicate important information and potentially dangerous situations.

Warning! Danger, electrical shock hazard!
Personal injury or death could occur. Also damage to the system, connected peripheral devices, or software could occur if the warnings are not followed carefully.

Caution! Hazard to individuals, environment, devices, or data!
If you do not adhere to the safety advice next to this symbol, there is obvious hazard to individuals, to environment, to materials, or to data.

Note: This symbol highlights important information or instructions that should be observed.

FUNCTIONAL DESCRIPTION

The DuraDBH-672 Digital Beachhead™ is a rugged Commercial Off the Shelf (COTS) multi-function system integrating a Gigabit Ethernet (GbE) switch and quad-core vetronics processor capable of supporting VICTORY services and mounted Assured-Position Navigation Timing (A-PNT) capabilities in a MIL-STD-qualified small form-factor chassis. The DuraDBH-672 builds on and extends many of Curtiss-Wright's original DBH-670 Digital Beachhead capabilities but in a lower Size, Weight, Power and Cost (SWaP-C) design capable of consolidating network switch, vehicle processor, embedded GPS, atomic clock, inertial navigation, solid-state storage, and add-in I/O interface all in a single Line Replaceable Unit (LRU). Featuring 16 ports of fully managed Layer 2 GbE switching/static Layer 3 routing together with a low-power, multi-core ARM-based i.MX6-Quad processor, the DuraDBH-672 system supports not only general-purpose embedded computing/in-vehicle edge networking requirements, but can also serve as a VICTORY Infrastructure Switch and Shared Processing Unit for the In-Vehicle Network (IVN) Architecture adopted by the U.S. Army/US Marine Corps' Vehicle Integration for C4ISR/EW Interoperability (VICTORY) initiative. With optionally integrated Assured Position, Navigation and Timing (A-PNT) components, including a military SASSM/M-Code GB-GRAM (Ground Based GPS Receiver Application Module), a Chip Scale Atomic Clock (CSAC), and Inertial Measurement Unit (IMU), this highly-capable system can enable cost-effective, accurate Mounted Assured-PNT (MAPS) functionality and affordable PNT hub capabilities using non-GPS augmentation for mounted platforms.

Combining proven, high Technology Readiness Level (TRL) COTS subassemblies and open architecture technologies into a single multi-function solution, this next-generation Digital Beachhead delivers a powerful set of standard and optionally integrated capabilities. The unit's carrier-grade network management software provides a powerful feature set for multicast traffic, VLAN, port control, Quality of Service (QoS), Link Aggregation, SNMP management, secure authentication, redundancy, precision timing (IEEE-1588 PTPv2), and data zeroization. It's multi-core processor provides a robust set of vetronics I/O interfaces (USB, GbE, RS-422, RS-232, CANbus, DIO, HDMI) along with a modular I/O and storage architecture based Mini-PCIe cards and mSATA SSD Flash storage modules to support application-specific I/O requirements (i.e. MIL-STD-1553 / ARINC429 / COM / DIO modules). Application engineering services are available for modified COTS (MCOTS) configurations at minimal/no NRE cost, including pre-integration of Mini-PCIe I/O cards. Tested to meet harsh MIL-STD-810G and MIL-STD-461F requirements, the unit boasts fanless operation over a wide operating temperature range (-40 to +71°C) and tolerance to extreme shock/vibration conditions, high altitude, and humidity, making it suitable for technology refresh and new platform deployments, including mobile, tactical, aerospace, and ground vehicle applications. It features front-panel MIL-DTL-38999 circular connectors in a sealed IP67 (dust/ water proof) aluminum chassis together with industrial temperature grade components, EMI filtering, and isolated MIL-STD-1275/704 power supply that protects against vehicle/aircraft voltage surges, spikes and transients.

FEATURES

Managed Gigabit Ethernet Switch

- 16 ports of 10/100/1000Mbps Gigabit Ethernet in Size, Weight and Power (SWaP) optimized chassis with the following switch interfaces:
  - 16 x 10/100/1000BaseT GbE ports
  - 1 x RS-232: management console
- Carrier Ethernet switch packet processor with embedded 32-bit management processor
  - Microsemi-Vitesse carrier-grade Ethernet switch engine
  - 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
  - Management processor: embedded MIPS CPU with DDR-2 memory
- Networking software: Microsemi-Vitesse CE Services carrier Ethernet application
- Layer 2 Switching:
  - Port control: port-speed, duplex mode, flow control, port frame size (jumbo frames), port state, port status (link monitoring), port statistics (MIB counters)
  - 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, storm control
  - VLAN: 8K MAC addresses, 4K VLANs, 802.1Q static VLAN, protocol-based VLAN, MRP, MVRP, MVR, IEEE-802.10ad provider bridge, link aggregation (IEEE-802.3ad)
  - IEEE-802.1 D/w/s Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP)
  - L2 IEEE-1588v2 Precision Timing Protocol (PTP) time stamping
- Layer 3 Routing
  - Layer 3 IPv4 / IPv6 unicast static IP routing for attached WAN / radio ports
- Management:
  - In-band Ethernet management using Web GUI or Simple Network Management Protocol (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 (ACLs), port mirroring, BPDU guard, RMON, Cisco Discovery filtering, IEEE-802.10AB LLDP
- Security:
  - Network Access Server (NAS) IEEE-802.1X, RADIUS accounting, MAC address limit, TACACS, Web & CLI authentication, ACLs, IP source guard
  - Declassification: data zeroization support to erase non-volatile Flash memory and restore board to factory default configuration

Low Power ARM-based vetronics computer

- Multi-core NXP (Freescale) i.MX6-Quad ARM-based vehicle management computer with flexible vetronics interfaces, including CANbus, serial, audio, video, digital I/O
  - i.MX6-Quad (ARM Cortex-A9 Core, 800 MHz, 4-core, 32-bit)
- Operating system software: Linux®
- Memory/storage:
  - 2 GB RAM
  - 8 GB on-board NAND Flash for storage memory/boot
- Storage expansion:
  - mSATA Flash SSD (~up to 256GB)
  - Removable Flash storage option (roadmapped)
- Standard I/O:
  - USB: 2 x USB 2.0
  - CAN: 2 x CANbus
  - Serial: 2 x RS-232/422/485, 1 x RS-232 (for external GPS input), 1 x RS-232 (console)
  - Network: 1 x GbE (+ 1 x connected internally to switch)
  - DIO: 6 x general-purpose digital I/O
  - Video: HDMI output
  - PCIe MiniCard I/O: 2 x module slots, 30 spare pins on DTL-38999 for add-on I/O modules
  - 1-PPS interface for external GPS (DAGR) or internal embedded GPS receiver (GB-GRAM/Polaris™Link), SMA antenna interface and KEY-FILL interface
  - Internal host module site for Ground-Based GPS Receiver Application Module (GB-GRAM)
- Optional I/O:
  - Optional stereo audio support
  - Optional pre-integrated Mini-PCIe I/O modules: MIL-STD-1553 / ARINC429 / other application-specific I/O can be special ordered

Assured PNT Hub Services (optional)

- Capable of distributing A-PNT services to connected devices over Ethernet network
- Support for direct connection to external GPS input (i.e. DAGR) and 1 PPS input for PTP time accuracy
- Support for hosting optional government-furnished equipment (GFE) GB-GRAM GPS receiver module (PolarisLink, SASSM or Military Code (M-Code))
- Roadmapped option for integrated Chip Scale Atomic Clock (CSAC) and Inertial Measurement Unit (IMU) for non-GPS augmentation to PNT service

Rugged MIL-STD Design

- Validated to meet harsh MIL-STD-810G conditions (temp, shock, vibration, humidity, altitude, dust/water ingress)
- Validated to meet MIL-STD-461F EMI/EMC (Conducted & Radiated Emissions & Susceptibility) and MIL-STD-1275 & 704 Power Input and Transient Protections
- -40 to +71C fanless extended temp operation with no moving parts
- Corrosion-resistant, aluminum chassis sealed against water, dust (similar to IP67) with CARC finish
- Circular MIL-DTL-38999 connectors for reliable network connections
- Filtered, transient-protected power supply for aircraft and vehicle use

VICTORY architecture compatibility

- Infrastructure switch component type
- Shared processing unit component
- Support for other VICTORY data bus services dependent on VICTORY software installed by customer

ORDERING CODES / CONFIGURATIONS

Base standard configuration and cable set for DuraDBH-672:

- DBH672-4F0: 16 x GbE switch + 4-core i.MX6 processor with full vetronics computer I/O
- CBL-DBH672-4F: Starter breakout cable set for DuraDBH-672 w/full system I/O (DBH672-4F), mating DTL-38999 to commercial connectors

Due to the modularity of the DuraDBH-672 system, many variants are possible. Contact your sales representative for information on system variants integrating (a) mini-PCIe modules, (b) mSATA SSD, (c) CSAC, (d) NED, (e) removable Flash storage, (f) IMU, (g) GB-GRAM and/or (h) libVICTORY software.

More information specific to the DuraDBH-672 product can be found online at:

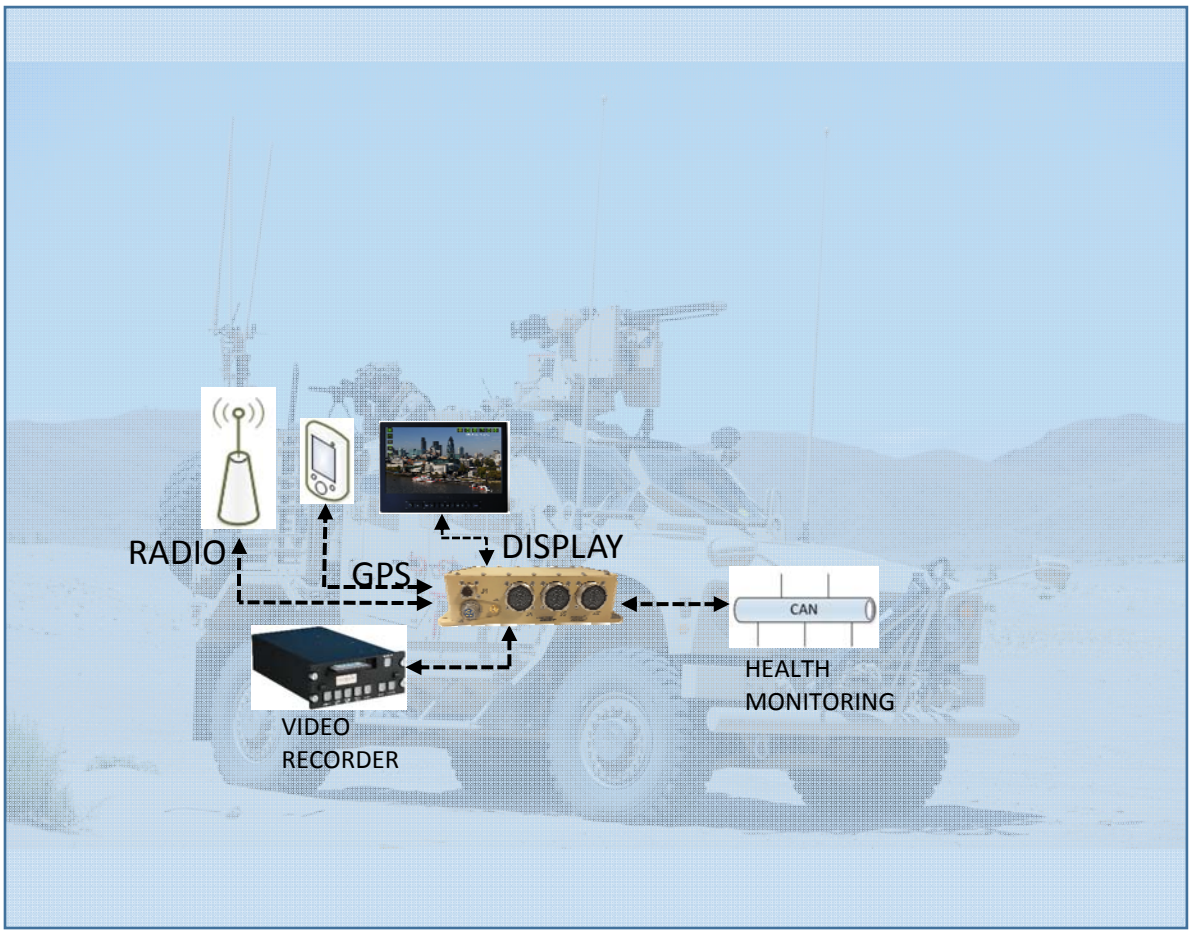
https://www.curtisswrightds.com/products/electronic-systems/networking/switch-router-systems/duradbh-672.html

HARDWARE OVERVIEW

SYSTEM BLOCK DIAGRAMS

The block diagram in **Figure 1** illustrates typical use case device interfaces for the DuraDBH-672. Using the integrated processor and the 16 port gigabit Ethernet switch the DuraDBH-672 is intended to integrate all the vehicle systems and provide consolidated, real time, data to vehicle operators. It provides integrated CAN bus interfaces to monitor vehicle health as well as RS232/422/485 serial interfaces for legacy equipment. It can then convert and migrate these interfaces to Ethernet to communicate with more modern military equipment. The HDMI interface provides a convenient way to monitor all the vehicle electronics connected to the DuraDBH-672.

Figure 1. DuraDBH-672 system application block diagram



THEORY OF OPERATION

The DuraDBH-672 consists of two main subsystems. The processor subsystem consists of a quad-core ARM Cortex A9 running at 800MHz. This provides standard user interfaces such as USB, HDMI, serial ports, CANbus, and optionally audio input and output. The processor natively runs a Linux operating system and optional VICTORY software as well as any other user applications that may be required.

Another key feature is the mini-PCIe and mSATA expansion capability. Customers can select any COTS or custom mini-PCIe card allowing a broad array of interfaces and features. Anything from video capture and CODEC cards, analog IO, or specialized DSP/FPGA based cards.

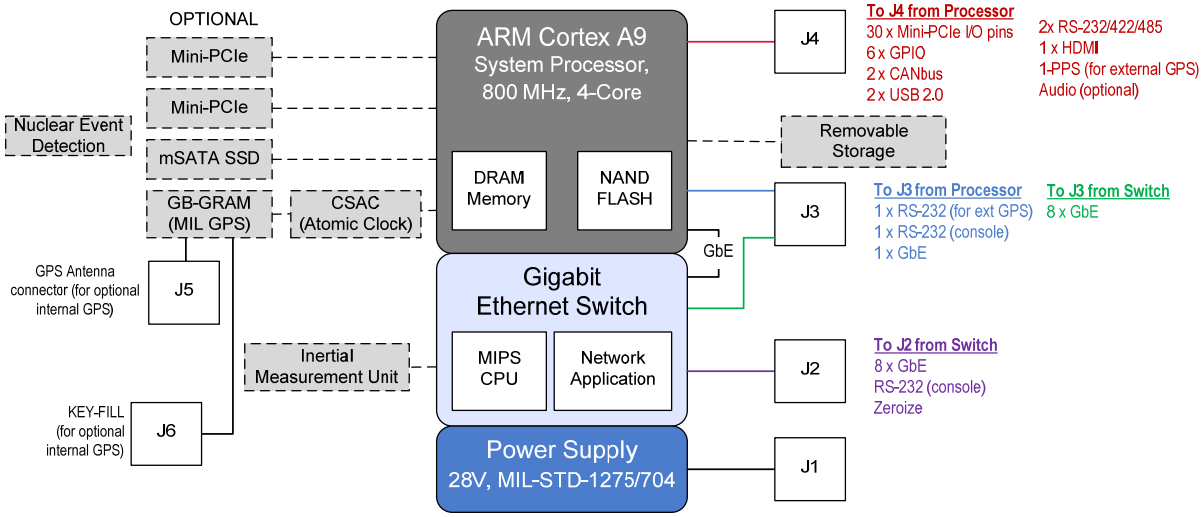


Figure 2 DuraDBH-672 system architecture block diagram

The second subsystem consists of 16-port gigabit Ethernet switch. The processor subsystem and Ethernet subsystem are connected together via an internal Ethernet port. This fully managed Layer 2 Gigabit 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), SNMPv1/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 unicast static routing for IP routing to attached WAN / radio ports.

MODULARITY AND EXPANDABILITY

The DuraDBH-672 provides a powerful and flexible platform to integrate a variety of devices based on mini PCIe form factor. The DuraDBH-672 supports two (2) miniPCIe sockets that can be used for a variety of additional functionality and/or IO without increasing the size of the unit.

The product also supports an expansion slot for mSATA SSDs and SAASM GPS modules. The figure below shows the expansion capability of the main circuit board.

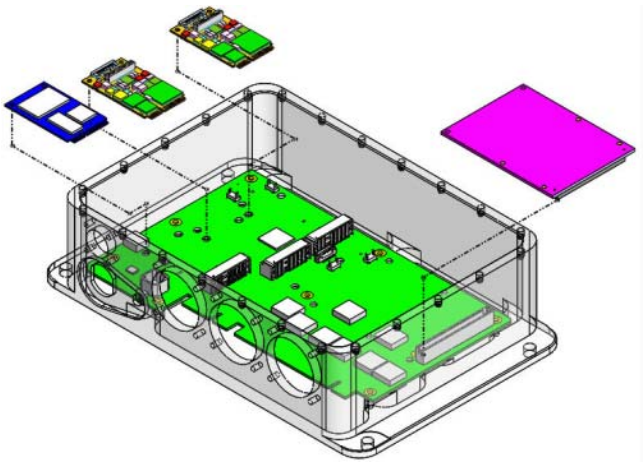
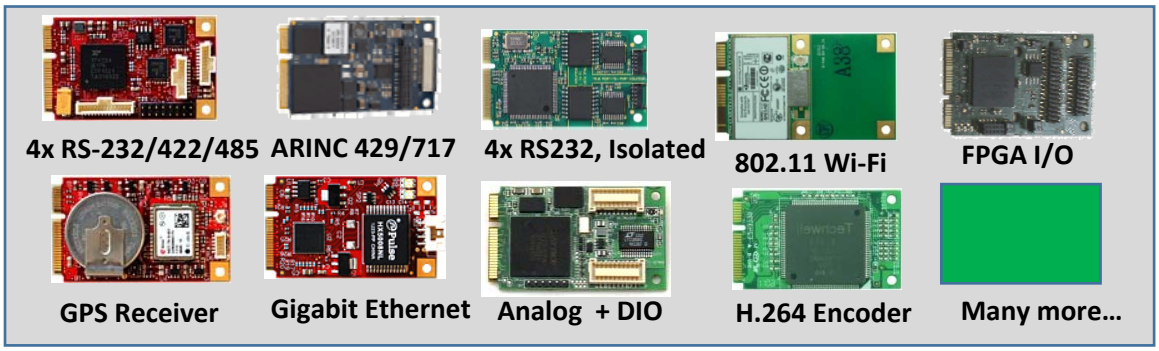


Figure 3 DuraDBH-672 Modularity



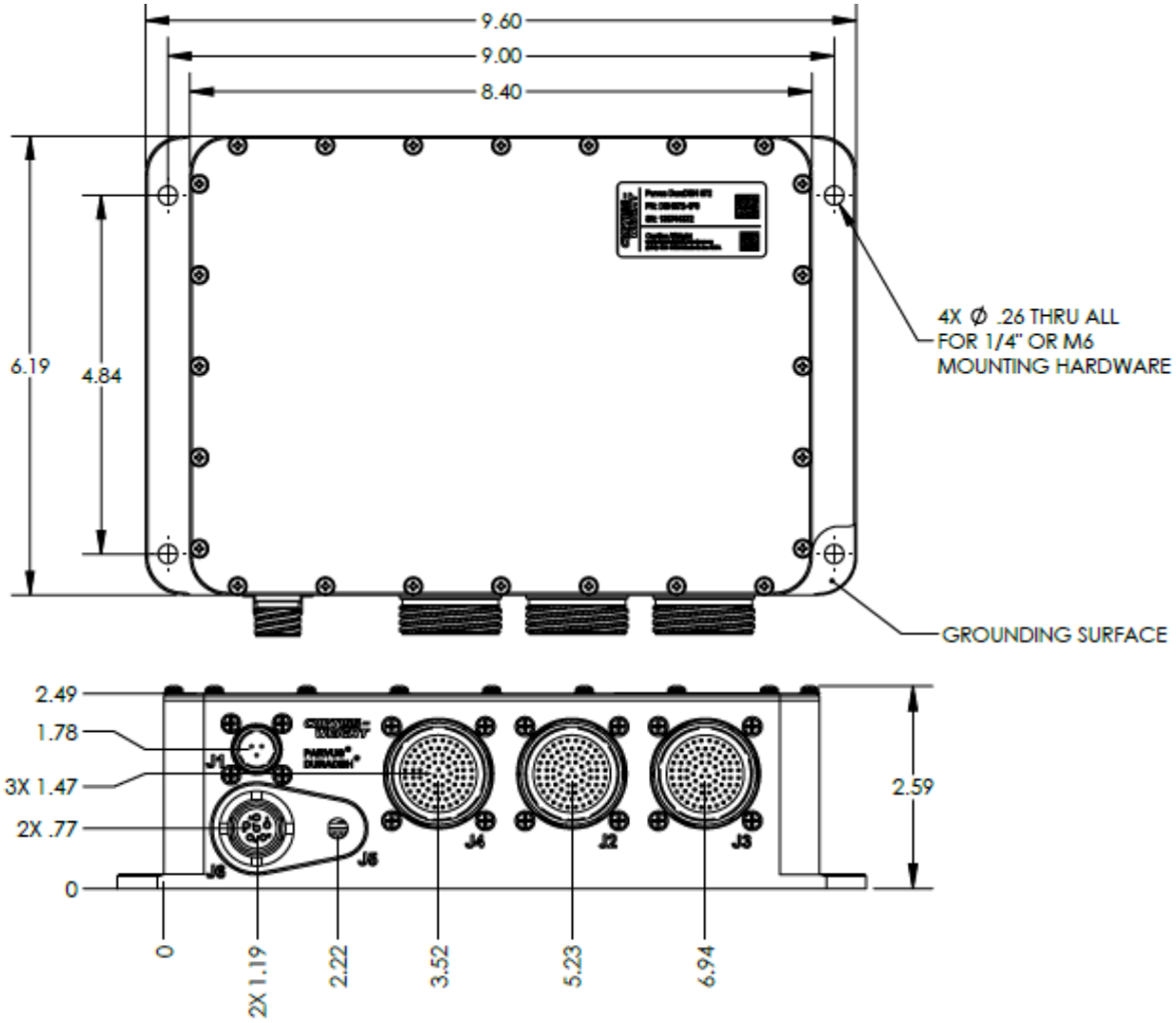
POWER

- Power input: 28 VDC nominal steady state; input range: 9-36VDC
- MIL-STD-704F 28 VDC compliant for aircraft electrical operation: over/under voltages, spikes, and 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 undervoltage surges, starting disturbances, and electrostatic discharge (ESD) immunity
- Power consumption (estimated): 20-23W typical; < 28W maximum, excluding GPS or Mini-PCIe I/O
- Support for Energy Efficient Ethernet (IEEE 802.3az), Vitesse ActiPHY and PerfectReach technologies to reduce active Ethernet power for unused / idle links and/or shorter cable lengths

PHYSICAL SPECIFICATIONS

- Dimensions (approx.) (H x D x W, excluding connectors and mounts): 2.53 x 6.19 x 8.4” (~6.43 x ~15.72 x ~21.33 cm) – see line drawings below
- Weight: approx. 4.0 lbs (1.81 kg)
- Installation: base flange mount with 4 x mounting holes
- Ingress protection: dust and water proof (similar to IP67)
- Connectors: MIL-DTL-38999 series III (for computer + switch I/O, power), SMA (for GPS antenna), MIL-DTL-55116 (for KEY-FILL port)
- Cooling: passive natural convection without forced air or fans; no moving parts
- Enclosure/finish: corrosion resistant, aluminium alloy with Chemical Agent Resistant Coating (CARC)
- Human factors: designed to MIL-STD-1472 for sequenced connector spacing, rounded corners

The DuraDBH-672 exterior dimensions are shown in the figure below.



ENVIRONMENTAL SPECIFICATIONS

Qualified to meet MIL-STD-810G:

- Operating temperature: -40 to +71°C (-40 to +160ºF) ambient (per MIL-STD-810G Methods 501.5 and 502.5)
- Storage temperature: -46 to +85ºC (-51 to +185ºF) per MIL-STD-810G Method 502.5 and Method 501.5
- Humidity (operating/transport): up to 100% RH, non-condensing (per MIL-STD-810G, Method 507.5, Procedure II)
- 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
- 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)
- Transit drop, transportation shock: per MIL-STD-810G
- Random vibration: 3 axes, 1 hour/axis (per MIL-STD-810G, Method 514, per Procedures I and II 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)
- 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: +50,000 ft (15,240 meters) per MIL-STD-810G, Method 500.5, Procedures I-II
- Storage altitude: up to 60,000 ft (18,288 meters) per MIL-STD-810G, Method 500.5, Procedures I-II
- Salt-fog, fungus, ozone, fluid contamination: per MIL-STD-810G (qual by analysis)

EMI/EMC SPECIFICATIONS

Qualified to meet MIL-STD-461F:

- Conducted emissions MIL-STD-461F, CE102, power leads, 10 KHz to 10 MHz, basic curve, fig CE102-1
- 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, 10k-200MHz; 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, 10k-100MHz; transient, figures 1-2
- Radiated emissions MIL-STD-461F, RE102, electric field, 10 KHz to 18 GHz, fixed wing internal < 25 meters, figure RE102-3
- Radiated susceptibility MIL-STD-461F, RS103, electric field, 2 MHz to 18 GHz, 200 V/m, table VII, RS103 limits

QUICK START PROCEDURE

This chapter describes how to connect and power-up the DuraDBH-672.

TEST EQUIPMENT

To use the DuraDBH-672 in a lab environment, recommended equipment includes:

- Appropriate cables, such as the CBL-DBH672-4B starter breakout cable set or custom cables
- A power source applied at connector J1, 9-36VDC input, 28V nominal. A power cable is included with the Breakout Cable Set.
- A host PC with a free RS-232 port and/or an Ethernet port

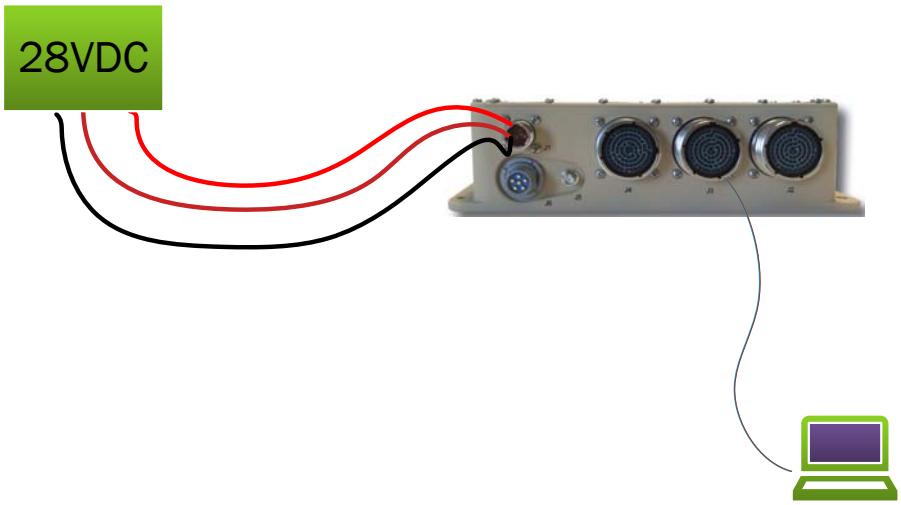


Figure 4. Connection the DuraDBH-672

POWER-ON SEQUENCE

To configure the DuraDBH, you need a serial or Ethernet connection to a host PC. These instructions cover both types of connections.

Follow these steps:

1. Connect the cable set to the DuraDBH-672
2. Connect the other end of the power cable to the **unpowered** DC power source.

Caution! Make sure that the DC power source is set to provide 9 to 36VDC (28V nominal).

3. Connect the DuraDBH-672 to the host PC. Use the switch management serial interface to configure the switch, or the Processor management serial interface to configure the processor.
4. Apply power.
5. Connect Ethernet devices to the ports on J2 and/or J3.

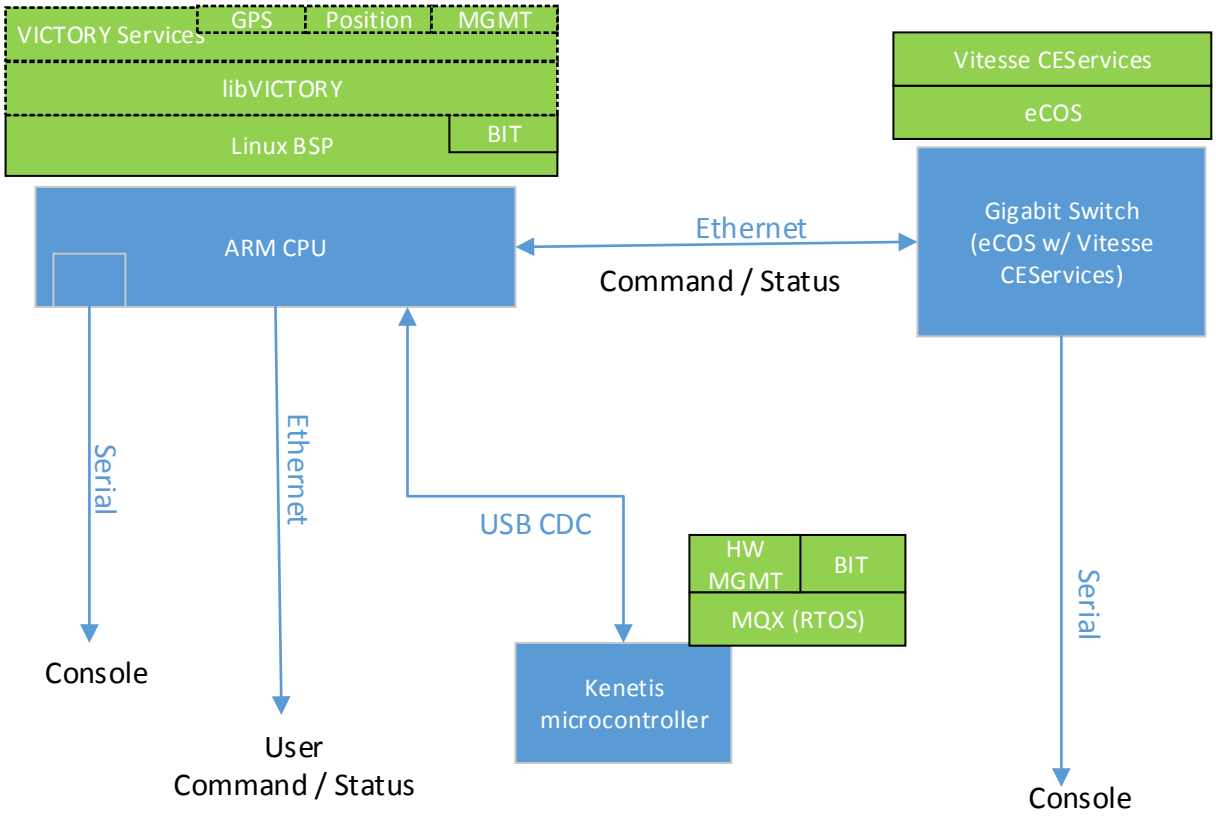
BREAKOUT CABLE SET

You can test the DuraDBH-672 interfaces and cabling prior to installation in the target system to ensure full operational capability. Full bench-top testing can be performed by using an appropriate cable set for this system. CBL-DBH672-4B is available for purchase from Parvus to support lab or bench testing purposes. You can also create a custom set of cables made specifically for the intended target system, vehicle, or craft; refer to Chapter on Connector Descriptions for connector pinouts and descriptions.

Figure 5. DuraDBH Starter Cable Set

MANAGEMENT AND SOFTWARE INTERFACE OVERVIEW

The DuraDBH-672 provides independent console access to the CPU and Ethernet subsystem typically for development and debug purposes. In addition, both subsystems are accessible via Ethernet. A software block diagram is shown below:



CPU MANAGEMENT INTERFACE DESCRIPTION

On the Early Access units, the CPU root account has no password. You will need to connect to the CPU via the RS232 port using TeraTerm or similar terminal program and assign a root password. The terminal interface should be configured at 115200 baud rate with no flow control. See figure below.

Once a root password has been assigned you can connect to the Ethernet port via SSH. Due to security consideration all other remote services (including network services such as FTP, TFTP, etc) are not enabled.

```
root@smarc-samx6i:~#
Poky (Yocto Project Reference Distro) 1.6.3 smarc-samx6i /dev/ttymxc0

smarc-samx6i login: root
root@smarc-samx6i:~# passwd
Changing password for root
Enter the new password (minimum of 5 characters)
Please use a combination of upper and lower case letters and numbers.
New password:
Re-enter new password:
passwd: password changed.
```

SWITCH MANAGEMENT INTERFACE DESCRIPTION

The DuraDBH-672 management interfaces provide the network administrator with a set of comprehensive management functions. The network administrator has a choice of two easy-to-use management interfaces:

- Serial CLI (command line interface)
  - Manages all switch features, including CLI enhancements.
  - Must be used to change the switch IP address from the factory default.
  - Can be used even if there is no network connectivity.
  - Provides brief help on syntax for each command.
- Web GUI (graphical user interface)
  - Manages all switch features except the switch IP address and CLI enhancements.
  - Requires network connectivity.

Provides extensive help on functions and parameters

SERIAL CLI SETUP

1. Connect the DuraDBH-672 Switch serial management port to a serial port on the host PC.
2. Power-on the DuraDBH-672.
3. Open a terminal emulator on the host PC, such as TeraTerm or PuTTY on Windows, or Minicom on Linux.
4. In the PC terminal emulation software, configure the serial port to 115200 baud, 8 data bits, 1 stop bit, no parity, no flow control.

CLI QUICK START

The instructions in this section provide step-by-step instructions on how to use the most critical CLI commands. This section describes how to:

Remember that **bold** identifies what you should type exactly as shown; ***bold italic*** marks a parameter you should provide, such as ***<address>***.

Log In

When the card powers on, the switch boots through RedBoot to the switch CLI and the following messages are displayed on the console:

```
RedBoot> go
Parvus version 1.0.0
Press ENTER to get started
```

1. Press Enter one or more times until the Username: prompt appears.

```
Username:
```

1. Type **admin** and press Enter.

```
Username: admin
Password:
```

2. At the Password prompt, press Enter. (There is no default password.) This completes the login sequence. The prompt changes to SWITCH-XXXX#.

```
Username: admin
Password:
SWITCH-XXXX#
```

At this point the admin user is operating at the highest privilege level, level 15. This means the admin has full control over the switch and its configuration.

ZEROIZATION

For data security, the DuraDBH-672 provides zeroization capability which erases all user configurable data on the system. Not all data contained in Non-volatile memory is erased, the system software persists through zeroization.

CLI COMMANDS

Enabling/Disabling the zerioization feature. By default, zeroization is enabled.

```
!  This example assumes the session is initially unprivileged.

!  Step 1: Raise privilege level:
> enable
Password: ***

!  Step 2: Enter Global Configuration mode:
# configure terminal

!  Step 3 (To Enable Zeroization): Input configuration command
(config)# parvus zeroize

-or-

!  Step 3 (To Disable Zeroization): Input configuration command
(config)# no parvus zeroize
```

ZEROIZATION INTERFACE

Zeroization is initialized by shorting ZERIOZE to ZEROIZE_GND. The ZEROIZE pin is internally pulled to +3.3v. Alternately, the system can be zeroized via the CLI:

```
!  This example assumes the session is initially unprivileged.

!  Step 1: Raise privilege level:
> enable
Password: ***

!  Step 2: trigger zeroization
# parvus dozeroize
```

LINUX BSP

This chapter describes configuration and building of the included linux BSP. The BSP is based on Yocto Linux, with board specific customizations.

REQUIRED HOST EQUIPMENT

- PC or VM running Ubuntu 14.04.
- An internet connection for the initial download of the required packages.
- RS-232 serial port for communicating with the target system

BUILDING AND INSTALLING THE BSP

This guide covers building the BSP using the provided virtual machine. The virtual machine is provided as an OVF, which can be imported by either VMWare or VirtualBox, or any other provider which supports the open virtualization format. At a high level, the operations to build the BSP are:

1. Install the configuration repositories which comprise Yocto Linux with board specific customizations.
2. Setup the environment.
3. Use the Yocto Linux build tool to execute the build which will:
    a. Download the required packages
    b. Securely verify the integrity of the download
    c. Build the packages for the target architecture
    d. Assemble a rootfile system
4. Boot from TFTP and NFS
5. Partition the internal storage
6. Install the rootfs and kernel
7. Configure the bootloader to boot the new system.

INSTALLING REQUIRED SOFTWARE REPOSITORIES

The included software package has a directory named BSP. Copy this directory to your host machine. If possible, it should be located on fast local storage. The faster the storage it is saved on, the faster the build complete.

SETTING UP THE ENVIRONMENT

From the top level of the BSP directory execute the command:

> . ./setup-environment build

This will configure your environment, and put you into a new folder where all of your temporary files will be saved.

EXECUTING THE BUILD

The tool used to orchestrate the build is bitbake. Bitbake will read through the configuration files for the configured target machine, and download and build the required packages.

> bitbake core-image-sato

This command will build the full BSP including the rootfs and kernel. Note: this command will take a long time to complete.

INITIAL BOOT

Once the BSP is built, it is recommended that it is installed to the internal eMMC on the processor module. To do so, you must boot from a secondary storage medium, which in this guide will be the network. The host machine will need to provide a TFTP and NFS server. To boot from the network:

1. On Linux host computer create a directory for NFS root (say /nfsroot) and extract the rootfs image into it. E.g:

   tar -xjpf /path/to/coreimagesatosmarcsamx6i.tar.bz2 -C /nfsroot

2. Then edit file /nfsroot/etc/network/interfaces and add following string at the end of file:

   iface eth0 inet manual

3. And add NFS root directory to /etc/exports and start NFS server.
4. Copy kernel from extracted rootfs image(/boot/uImage-smarc-samx6i.bin) into TFTP server root directory (/var/lib/tfptboot or /tftpboot depending on Linux distribution).
5. Configure and start TFTP server.
6. Copy an appropriate device tree table(e.g. uImage-imx6q-smx6-lcd-pcieswitch.dtb) into TFTP server root directory (/var/lib/tfptboot or /tftpboot depending on Linux distribution).
7. Configure DHCP server to provide IP configuration for SMARC-sAMX6 board and start it.
8. Configure serial connection(see “5.5 U-Boot Access and Startup” in SMARC-sAMX6i User's Guide), then power on the board. Interrupt autoboot process by pressing any key on serial console and check U-boot environment variables with printenv . If needed, modify corresponding variables with setenv command and boot Linux from TFTP server on host by executing:

   setenv bootargs console=ttymxc0,115200 root=/dev/nfs rw ip=dhcp

   nfsroot=<host ip>:<path to unpacked rootfs on host>

   setenv serverip <host ip>

   setenv ipaddr <samx6i ip>

   setenv fdtfile <device tree BLOB copied to tftp>

   setenv uimage <kernle copied to tftp>

   tftp 11000000 ${fdtfile}

   tftp 0x10800000 ${uimage}

   bootm 0x10800000 11000000

   For example:

   setenv bootargs console=ttymxc0,115200 root=/dev/nfs rw ip=dhcp

nfsroot=192.168.11.161:/opt/smarc,v3,tcp

setenv serverip 192.168.11.161

setenv ipaddr 192.168.11.189

setenv fdtfile dtb3

setenv uimage uImage

tftp 11000000 ${fdtfile};

tftp 0x10800000 ${uimage};

bootm 0x10800000 11000000

9. After board booted up, login as user root. No password is needed.

PARTITION THE INTERNAL STORAGE

The partitioning of the internal MMC is achieved by running the command "/configure_emmc.sh". This command wipes out the internal MMC and creates new partitons, and mounts those partitions.

INSTALLING THE ROOTFS

1. Mount your NFS share to /var/volatile/tftpboot:
   mount -t nfs <host ip>:<nfs_root> /var/volatile/tftpboot
2. Extract the rootfs images into both root directories
   a. tar -xf /var/volatile/tftpboot/smarc-image/core-image-sato-smarc-samx6i.tar.bz2 -C /var/volatile/r1
   b. tar -xf /var/volatile/tftpboot/smarc-image/core-image-sato-smarc-samx6i.tar.bz2 -C /var/volatile/r2
3. Install the flattened device tree file:
   a. cp /var/volatile/tftpboot/smarc-image/uImage-imx6q-smx6-lcd-pcieswitch.dtb /var/volatile/r1/boot/dbh.dtb
   b. cp /var/volatile/tftpboot/smarc-image/uImage-imx6q-smx6-lcd-pcieswitch.dtb /var/volatile/r2/boot/dbh.dtb
4. Unmount the eMMC partitions:
   a. umount /dev/mmcblk0p1
   b. umount /dev/mmcblk0p2
5. Clear out the boot environment:
   a. dd if=/dev/zero of=/dev/mtd1

CONFIGURE THE BOOTLOADER

6. Reboot, and stop in the bootloader. Run the following:
   a. setenv fdtfile /boot/dbh.dtb
   b. setenv uimage /boot/uImage
   c. setenv mmcdev 2
   d. setenv mmcroot /dev/mmcblk0p1 rw

e. saveenv
f. reset

At this point, the system is configured with the BSP.

CONNECTOR DESCRIPTIONS

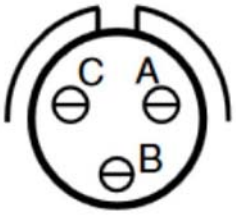
This chapter identifies connector part numbers, locations, and pinouts to facilitate fabrication of cables that can connect to the DuraDBH-672.

PINOUTS

This section provides the pinouts necessary for creating cables that connect properly to this assembly. If custom cabling is not designed and built by Curtiss-Wright, all EMI and EMC considerations must be handled by the customer.

Connector Designator	Switch Connector Part Number	Note
J1	D38999/20FA98AN	Power
J2	D38999/20FG35BN	Ethernet Ports 1-8 and Control
J3	D38999/20FG35BA	Ethernet Ports 9-16 and Management and Control
J4	D38999/20FG35BB	CPU Signals
J5	SMA	GPS Interface
J6	M55116	GPS KeyFill Connector

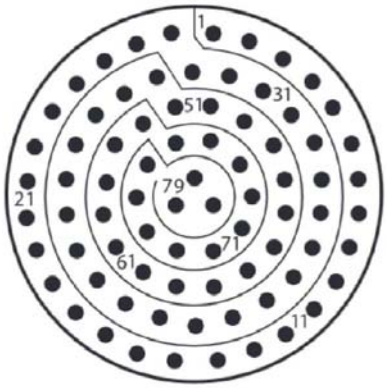
J1 POWER CONNECTOR



FRONT PIN OUT

Pin #	Description
A	Chassis GND
B	28VDC RTN input
C	28VDC DC input

J2 I/O Connector

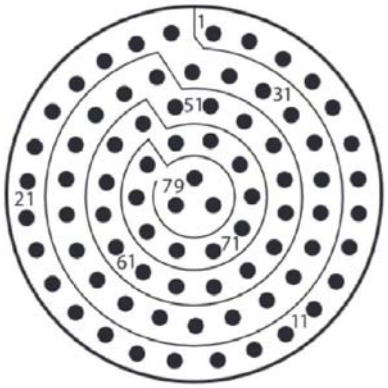


REAR PIN OUT

Pin#	Description	Pin#	Description	Pin#	Description
1	REMOTE_ON_OFF	28	SIGNAL_GROUND	54	RESERVED
2	SIGNAL_GROUND	29	FACTORY_TEST	55	CH 8 C-
3	EXT_PPS_IN	30	ZEROIZE	56	CH 7 B-
4	EXT_PPS_OUT	31	SIGNAL_GROUND	57	CH 7 C+
5	RESERVED	32	SIGNAL_GROUND	58	CH 6 B-
6	CH 8 D+	33	CH 8 D-	59	CH 6 D+
7	CH 8 B+	34	CH 8 C+	60	CH 5 B-
8	CH 8 A+	35	CH 8 B-	61	CH 5 D+
9	CH 8 A-	36	CH 7 B+	62	CH 3 C+
10	CH 7 A+	37	CH 7 A-	63	CH 3 D-
11	CH 6 A+	38	CH 6 B+	64	CH 2 C+
12	CH 6 A-	39	CH 6 C-	65	CH 1 A+
13	CH 6 C+	40	CH 5 B+	66	CH 1 B+
14	CH 5 A+	41	CH 5 C+	67	CH 4 D+
15	CH 5 A-	42	CH 5 D-	68	CH 4 C+
16	CH 5 C-	43	CH 3 B+	69	CH 7 D-
17	CH 3 A+	44	CH 3 C-	70	CH 7 D+
18	CH 3 A-	45	CH 2 B+	71	CH 7 C-
19	CH 3 B-	46	CH 2 C-	72	CH 6 D-
20	CH 2 A+	47	CH 2 D+	73	CH 4 A+
21	CH 2 A-	48	CH 1 A-	74	CH 4 A-
22	CH 2 B-	49	CH 1 D+	75	CH 3 D+
23	CH 2 D-	50	RS232_SW_COM_RX	76	CH 4 D-
24	CH 1 C+	51	CH 1 B-	77	CH 4 C-
25	CH 1 C-	52	SIGNAL_GROUND	78	CH 4 B+

26	CH 1 D-	53	RESERVED	79	CH 4 B-
27	RS232_SW_COM_TX				

J3 I/O Connector



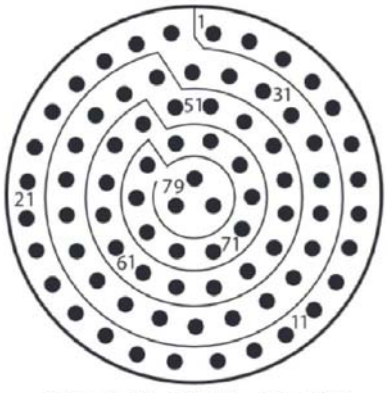
REAR PIN OUT

Connector J3

Pin#	Description	Pin#	Description	Pin#	Description
1	RS232_CPU_COM_TX	28	SIGNAL_GND	54	CPU_MGMT_C_N
2	SIGNAL_GND	29	RESERVED	55	CH 16 C-
3	CPU_MGMT_B_P	30	RS232_CPU_COM_RX	56	CH 15 B-
4	CPU_MGMT_A_N	31	CPU_MGMT_B_N	57	CH 15 C+
5	CPU_MGMT_A_P	32	CPU_MGMT_C_P	58	CH 14 B-
6	CH 16 D+	33	CH 16 D-	59	CH 14 D+
7	CH 16 B+	34	CH 16 C+	60	CH 13 B-
8	CH 16 A+	35	CH 16 B-	61	CH 13 D+
9	CH 16 A-	36	CH 15 B+	62	CH 11 C+
10	CH 15 A+	37	CH 15 A-	63	CH 11 D-
11	CH 14 A+	38	CH 14 B+	64	CH 10 C+
12	CH 14 A-	39	CH 14 C-	65	CH 9 A+
13	CH 14 C+	40	CH 13 B+	66	CH 9 B+
14	CH 13 A+	41	CH 13 C+	67	CH 12 D+
15	CH 13 A-	42	CH 13 D-	68	CH 12 C+
16	CH 13 C-	43	CH 11 B+	69	CH 15 D-
17	CH 11 A+	44	CH 11 C-	70	CH 15 D+
18	CH 11 A-	45	CH 10 B+	71	CH 15 C-
19	CH 11 B-	46	CH 10 C-	72	CH 14 D-
20	CH 10 A+	47	CH 10 D+	73	CH 12 A+
21	CH 10 A-	48	CH 9 A-	74	CH 12 A-

22	CH 10 B-	49	CH 9 D+	75	CH 11 D+
23	CH 10 D-	50	RS232_GPS_IN_RX	76	CH 12 D-
24	CH 9 C+	51	CH 9 B-	77	CH 12 C-
25	CH 9 C-	52	CPU_MGMT_D_N	78	CH 12 B+
26	CH 9 D-	53	CPU_MGMT_D_P	79	CH 12 B-
27	RS232_GPS_IN_TX				

J4 I/O Connector



REAR PIN OUT

Pin#	Description	Pin#	Description	Pin#	Description
1	miniPCIe Expansion S17	28	miniPCIe Expansion S13	54	miniPCIe Expansion S23
2	miniPCIe Expansion S21	29	miniPCIe Expansion S14	55	miniPCIe Expansion S24
3	miniPCIe Expansion D1_P	30	miniPCIe Expansion S18	56	GND
4	miniPCIe Expansion D1_N	31	miniPCIe Expansion S22	57	USB1_P
5	miniPCIe Expansion D3_P	32	miniPCIe Expansion D2_P	58	USB2_P
6	miniPCIe Expansion D3_N	33	miniPCIe Expansion D2_N	59	USB2_P
7	miniPCIe Expansion D4_N	34	miniPCIe Expansion D4_P	60	GND
8	GND	35	GND	61	RS485_RX1_N
9	No Connect	36	GND	62	HDMI_D2_N
10	USB1_5V_OUT	37	GND	63	HDMI_CLK_P
11	USB2_5V_OUT	38	GPIO2	64	GND
12	GPIO1	39	GPIO4	65	miniPCIe Expansion S4
13	GPIO3	40	GPIO6	66	miniPCIe Expansion S8
14	GPIO5	41	RS485_TX2_P	67	miniPCIe Expansion S9
15	RS485_RX2_P	42	RS485_TX2_N	68	miniPCIe Expansion S16
16	RS485_RX2_N	43	HDMI_D2_P	69	miniPCIe Expansion D20
17	HDMI_PWR_OUT	44	HDMI_D1_N	70	GND
18	GND	45	HDMI_CLK_N	71	USB1_N

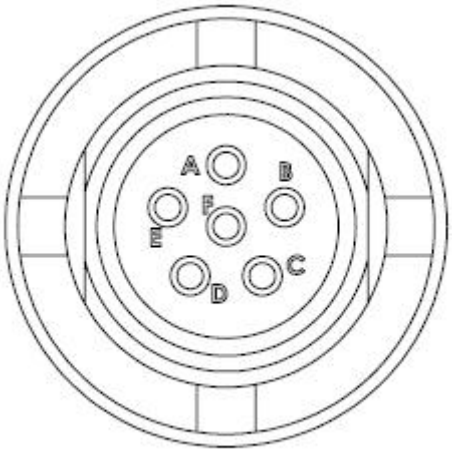
19	HDMI_D1_P	46	HDMI_CEC	72	CAN1_P
20	HDMI_D0_P	47	HDMI_HPD	73	RS485_RX1_P
21	HDMI_D0_N	48	miniPCIe Expansion S3	74	RS485_TX1_N
22	HDMI_SCL	49	miniPCIe Expansion S7	75	RS485_TX1_P
23	HDMI_SDA	50	miniPCIe Expansion S11	76	miniPCIe Expansion S5
24	miniPCIe Expansion S1	51	miniPCIe Expansion S12	77	CAN2_P
25	miniPCIe Expansion S2	52	miniPCIe Expansion D15	78	CAN1_N
26	miniPCIe Expansion S6	53	miniPCIe Expansion D19	79	CAN2_N
27	miniPCIe Expansion S10				

J5 GPS Interface

J5 has a standard pinout for an SMA connector.

J6 GPS Key Fill

J6 has a standard pinout for a GB-GRAM Key Fill connector.



FRONT PINOUT

TROUBLESHOOTING

PRODUCT IDENTIFICATION

The product is labeled with the P/N and serial number. Please refer to this information when communicating with Technical Support.

TECHNICAL ASSISTANCE

If you have a technical question or if you cannot isolate a problem with your product, please call or e-mail the Parvus Technical Support team:

Email	slp_tsupport@curtisswright.com
Phone	1 (801) 433-6322
Fax	1 (801) 483-1523

RETURNING FOR SERVICE

Before returning any product, please fill out a Return Material Authorization (RMA) request form, available for download from the following website under the support section:

www.curtisswrightds.com

Email this form to the Technical Support email address (slp_tsupport@curtisswright.com) to receive authorization for shipment. An RMA number will be emailed back to you as soon as possible.

Note: You must have the RMA number in order to return any product for any reason.

Caution:
Any product returned to Parvus improperly packed will immediately void the warranty for that particular product.

CONTACT INFO

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