DBH-670A Digital Beachhead

A-PNT Vehicle Computer & Switch

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Key Features

- 16 Ethernet ports
- Support for hardware-based Precision Time Protocol (IEEE-1588v2)
- NXP® i.MX6 quad-core Arm Cortex-A9 processor
- 2 GB DDR3
- 16 GB eMMC flash
- Optional Internal GB-GRAM (Type I/II) SAASM or M-Code GPS receiver
- Chip Scale Atomic Clock
- On-board 10 Degrees of freedom Inertial Measurement Unit
- 8 independent 1PPS signals out and with serial PNT data

Applications

- A-PNT
- Vehicle Management Computer

Overview

The DBH-670A is a highly integrated, multi-functional vehicle computer and Ethernet switch that combines Assured Position, Navigation and Timing (A-PNT) functionality, a powerful Gigabit Ethernet switch, and a power-efficient Arm® computer in a single box.

The DBH-670A is driven by an NXP® i.MX6 processor that features a quad-core Arm Cortex-A9 processor at 800 MHz with 2 GB DDR3 system memory and 16 GB of on-board flash storage, used for storing the operating system, user application, and data. A failsafe boot feature allows an otherwise “bricked” DBH to reload operating software and return to “factory” settings. The vehicle interfaces include multiple CANbus ports, serial ports, and camera interfaces, as well as a local DVI display.

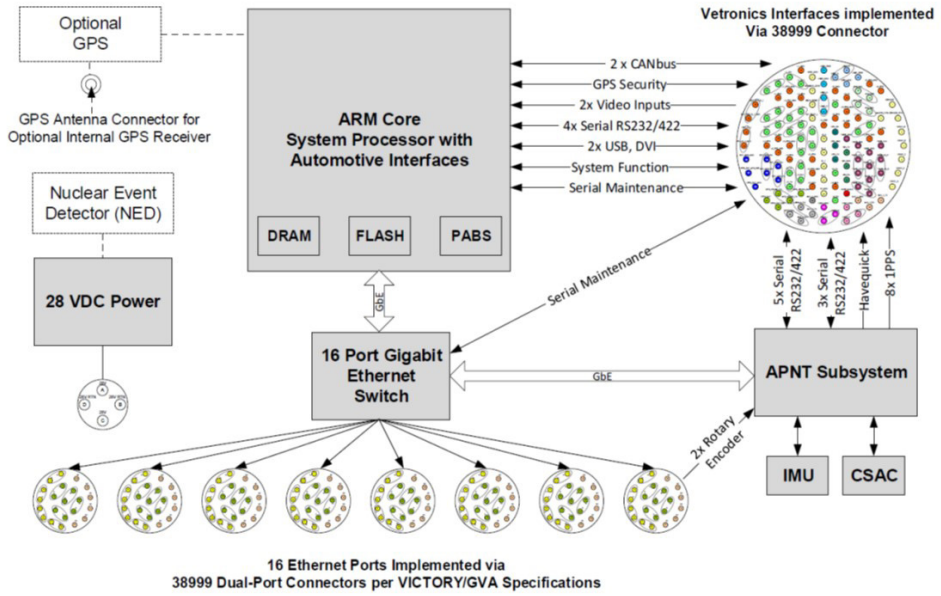
The DBH-670A serves as an excellent high-performance, low-skew clock master powered by a GPS-disciplined Chip Scale Atomic Clock (CSAC), which offers a variety of configurable clock reference sources and support for up to 8 synchronized clock outputs.

With an on-board 10 degree of freedom inertial measurement unit (IMU), the DBH-670A is capable of precise motion tracking in a denied or untrusted GPS environment. Direct connection to an external GPS receiver (NMEA, DAGR, or equivalent) can supply real-time GPS position and time data. Support for an optional on-board GPS Receiver (upgradeable to M-Code) is provided and includes dedicated zeroize and key fill functionality. Both internal and external GPS configurations support a 1PPS reference input from the GPS receiver, which is used by the CSAC and Arm processor to provide a master clock reference for the IEEE- 1588v2 / Precision Time Protocol time server.

Built around a non-blocking core fabric, the 16-port Ethernet switch provides tri-speed operation (10/100/1000 Mbps) with auto-negotiation and auto MDIX. Its feature-rich networking includes support for IPv4/v6, VLANs, IGMP multicast, QoS, MSTP/RSTP, link aggregation, port mirroring, and jumbo frames. Switch configuration and management is enabled by powerful in-band (HTTP/Telnet/SNMP) and out-of-band (RS-232). The network switch also includes full support for hardware-based Precision Time Protocol (IEEE-1588v2), enabling the network nodes to synchronize with nanoseconds of accuracy.

The DBH-670A is part of a family of A-PNT products that includes the VPX3-673 (and future VPX3-673A) module. These products leverage Common A-PNT Software Load (CASL). Additional information regarding CASL capabilities and performance available separately under NDA Currently, the DBH-670A is only available with CASL-US software (making it available for U.S. opportunities only). Contact Factory for availability of exportable commercial (CASL-C) version and Software Development Kit options.

The DBH-670A will be offered with various combinations of internal peripherals. The standard configuration does not include an internal GPS receiver or the Nuclear Event Detection (NED) circuitry.



DBH-670A block diagram

Specifications

Ethernet Switch Features

Switching Fabric

- Carrier Grade L2 Gigabit Ethernet Switch
  - Fully non-blocking wire performance support for all ports and all frame sizes
  - 4 Mb integrated shared packet memory

Management / Control Processor

- Embedded MIPS processor
  - + 128 MB DDR2 DRAM
  - + 16 MB flash

External Ports

- 16 tri-speed 1000BASE-T ports supporting
  - 10BASE-T per IEEE 802.3
  - 100BASE-TX per IEEE 802.3U
  - 1000BASE-T per IEEE 802.3ab
- Auto-MDI / MDIX crossover
- Max 200m segment length
- Energy Efficient Ethernet (EEE) per IEEE-802.3az with ActiPHY

Switch Maintenance Port

- RS-232 Serial Port

Layer 2 Switch

- Support for IPv4 and IPv6
- Automatic switch learning and aging with up to 8,192 MAC addresses
- Support for jumbo frames up to 9,600 bytes
- QoS support with 8 traffic classes
- Link Aggregation (802.3ad) for increased bandwidth and load sharing
- Port Mirroring
- Rapid and Multiple Spanning Tree protocol (802.1w, 802.1s)
- IEEE 802.3 3x flow control and back-pressure support

VLANs

- 4,096 VLANs per 802.1Q
  - VLAN broadcast, 802.1Q VLAN tagging, and double tagging

Multicast

- 8K L2 multicast groups, 8k IPv4/v6 multicast groups
- IGMPv2/v3, MLDv1/v2 snooping for forwarding of multicast traffic
- GMPR for multicast registration propagation

Layer 3 Routing

- IPv4 Unicast Static Routing

Other

- IEEE-1588v2 Precision Time Protocol (PTP) with support for 1-step and 2-step clock sync
- DHCP Client

Management

- Port-based security per 802.1X
- RADIUS accounting, TACACS+ authentication
- Web access security via HTTPS and SSHv2
- Web and CLI user login security
- SNMP v1/v2/v3, syslog, RMON

Processor Features

Processor

- Quad-core Arm Cortex-A9 Processor
  - 800 MHZ core speed
  - 2 GB DDR3 DRAM
  - 16 GB Flash
- Multi-standard HW video codec
- 2D, 3D, and vector graphics accelerators
- PABS (failsafe boot)

Interfaces

Gigabit Ethernet Controller connected internally to Ethernet (does not use any of the 16 external ports)

- 2 CANbus ports
- 2 video inputs (RS-170)
- 4 Serial ports (2 RS232 & 2 RS422)
- 2 USB 2.0 ports
- DVI
- Processor RS-232 serial maintenance (console)

Graphics

- Multi-standard HW video codec
  - Real-time MPEG and H.264 encode & decode
  - Up to 1080p resolution
- 2D, 3D, and vector graphics accelerators
- Dual independent image processing units for video resizing, rotation, inversion, blending, de-interlacing and image enhancement

Security Support

- CAAM: Cryptographic Acceleration and Assurance Module
  - 16 KB secure RAM
  - True & pseudo random number generator (NIST certified)
- SNVS: Secure Non-Volatile Storage, including secure real-time clock
- TZ: TrustZone® for separation of interrupts, memory mapping, etc.
- CSU: Central Security Unit
  - Configured during boot and by eFUSEs
  - Will determine security level operation and TZ policy
- A-HAB: Advanced High Assurance Boot – HABv4 with SHA-256, 2048-bit RSA key version, warm boot, CSU, and TZ initialization

A-PNT Features

Chip-Scale Atomic Clock (CSAC) – provides precision 1PPS and 10 MHZ outputs

- High stability
- Discipline to a reference clock from
  - GPS (External or Internal)
  - PTP over the network

Inertial Measurement Unit (IMU)

- 10 degrees of freedom
- 3-axis accelerometers
- 3-axis gyros
- 3-axis magnetometers
- Barometric pressure sensor

External Connections

- 8 serial ports
  - 3 RS-232 & 5 configurable RS232/RS422
  - ICD-GPS-153 or NMEA messages
- 8 individually configurable 1PPS / 10PPS / T-Mark
- HAVEQUICK output
- 2 Rotary Shaft Encoder inputs for wheel speed sensing

External GPS Connection

- Direct connect to DAGR (ICD-GPS-153) or commercial GPS (NMEA) via RS-232 / RS-422 and 1PPS input

Internal GPS (Optional)

- Support for:
  - Polaris Link or MPE-S
  - GB-GRAM Type I and Type II, SAASM or M-Code
  - Dedicated zeroize and key fill functionality

1 PPS reference input

- Available from either input or external GPS
- Processor used to provide a master clock reference for the IEEE-1588v2 / Precision Time Protocol time server
- Discipline for the CSAC

Ruggedization

The DBH-670A chassis is designed to meet the most rugged conditions, including IP67 and MIL-STD-810G for environmental and MIL-STD-461-E for EMI/EMC compliance. More specifically, the DBH-670A meets the environmental qualifications for Random Vibration, to a minimum of $0.005g^2/HZ$ at 5Hz and $0.1g^2/Hz$ over 15Hz to 2kHZ on each axis, with 60 minute sweeps on each axis, per MIL-STD-810G method 507.5, Procedure II for general Vibration (wheeled and tracked vehicle).

TABLE 1 Physical and Rugged Qualifications

FEATURE	DESCRIPTION
Size	10.5” x 7.5” x 3.0” (266mm x 190 mm x 76 mm)
Weight	7.5 lbs (3.4 kg)
External Color	Choice of › White IAW Federal Standard 595, paint chip 17925 › Green IAW Federal Standard 595, paint chip 34094
Environmental Thermal	› Operational + Natural Convection: -40 to +71°C + Cold Plate Mounted: -40 to + 80°C › Non-operational: -55 to +125°C
Shock	40g peak per MIL-STD-810F method 516.5
Vibration	10g peak sinusoidal, $0.1g^{2/HZ}$ random, over 15Hz to 2kHz per MIL-STD-810G method 514.5
Additional Qualifications	Designed to meet IP67 and MIL-STD-810G environmental and MIL-STD -561 EMI/EMC specifications. Please contact factory for details.

Power

The DBH-670A’s power is compliant to 28 VDC under MIL-STD-1275D and supports normal, generator, and cranking modes, including spike and transient conditions. It is also compatible with MIL-STD-704A power requirements. The power connector is compliant with Vehicle Integration for C4ISR/EW Interoperability (VICTORY) and Generic Vehicle Architecture (GVA) specifications.

The DBH-670A is designed for low-power operation. Ethernet ports are power optimized per Energy Efficient Ethernet (EEE), and unused ports are automatically powered down. The system processor is a power-efficient Arm processor, which has been configured to reduce power for unused system processing blocks.

TABLE 2 Power Requirements

Input	Estimated Typical Power		Estimated Max Power (W)	
	Power (W)	Current (A) @ 28V	Power (W)	Current (A)
28V	34W	1.20A	43	1.5

Note 1: Values are estimated.

Note 2: Excludes internal GPS

Connectors

All connections are via MIL-STD-38999 rugged connectors. Ethernet connections are also compliant to VICTORY and GVA specifications. Natural convection design ensures reliable operation without forced air or fans.

Status Indicators

The DBH-670A provides LEDs for switch status and processor status. Each Ethernet port has a link status LED. LEDs are normally powered off but can be turned on for status and diagnostics via hardware discrete I/O pin. The Ethernet port status will be on if a link is established and blinking on any port activity.

External Interfaces

Access to the I/O interfaces is via the J1 to J11 connectors. Table 7 provides a summary of the external interfaces available on the CBG-670A.

TABLE 3 External Interface Summary

Function	J1	J2	J3-J6, J8-J10	J7	J11	Total
Power (+28V)	1					1
Gigabit Ethernet			14	2		16
USB		2				2
RS232 Debug Serial		2				2
Auxiliary RS232 Serial		1				1
Auxiliary RS422 Serial		1				1
RS232/RS422 Serial		5				5
RS232 Serial		3				3
GEO ID		4				4
DVI		1				1
Video In		2				2
CANbus		2				2
GPS Security Controls		1				1
EXT GPS		1				1
GPS Uplink		1				1
GPS 1PPS Uplink		1				1
GPS 1PPS Input		1				1
Auxiliary 1PPS Input		2				2
1PPS Output		8				8
RESET		1				1
LED Enables		1				1
Write Protect		1				1
Rotary Shaft Encoder				2		2
GPS Antenna In					1	1

Ordering Information

The DBH-670A is available in a variety of different configurations. The units are currently available only in the United States of America.

TABLE 4 Ordering Information

PART NUMBER	DESCRIPTION
DBH-670A-A01111-E	Digital Beachhead A-PNT System: › Standard enclosure/connectors + Green IAW Federal Standard 595, paint chip 34094 › Integrated inertial measurement unit (IMU), CSAC › SW A-PNT CSAL Software › 16-port Gigabit Ethernet Switch, Managed L2 Services › Quad-core i.MX6 Arm Processor 2 GB DRAM, 16 GB eMMC flash
DBH-670A-A01112-E	Digital Beachhead A-PNT System: › Standard enclosure/connectors + White IAW Federal Standard 595, paint chip 17925 › Integrated inertial measurement unit (IMU), CSAC › SW A-PNT CSAL Software › 16-port Gigabit Ethernet Switch, Managed L2 Services › Quad-core i.MX6 Arm Processor 2 GB DRAM, 16 GB eMMC flash
DBH-670A-A0N111-E	Digital Beachhead A-PNT System: › Standard enclosure/connectors + Green IAW Federal Standard 595, paint chip 34094 › Integrated inertial measurement unit (IMU), CSAC, and NED › SW A-PNT CSAL Software › 16-port Gigabit Ethernet Switch, Managed L2 Services › Quad-core i.MX6 Arm Processor 2 GB DRAM, 16 GB eMMC flash
DBH-670A-A0N112-E	Digital Beachhead A-PNT System: › Standard enclosure/connectors + White IAW Federal Standard 595, paint chip 17925 › Integrated inertial measurement unit (IMU), CSAC, and NED › SW A-PNT CSAL Software › 16-port Gigabit Ethernet Switch, Managed L2 Services › Quad-core i.MX6 Arm Processor 2 GB DRAM, 16 GB eMMC flash

Note: Early Access Units (EAUs), identified by "-E" in their part number, are made available to select customers for the purpose of early development prior to full product release and not intended for deployment. They are built to Curtiss-Wright production processes and tested by Engineering but are not fully qualified. EAUs may not support full product functionality, are provided "as-is", and will not be upgraded to production revisions. More details on the functionality of this EAU will be provided upon request. EAUs carry a 12-month parts & workmanship warranty only.

Accessories Ordering Information

To simplify lab development, the following accessories are available.

TABLE 5 Accessories Ordering Information

PART NUMBER	DESCRIPTION
CBL-DBH-SETA	Digital Beachhead A-PNT Cable Set: › 1 - J1 MIL-STD-38999 size 13/4, Power cable to spade lugs › 1 - J2 MIL-STD-38999 size 25/35, Utility cable, breaks out to various standard connector types › 8 - J3...J10 MIL-STD-38999 size 13/35, Dual Ethernet cable to RJ45 male ends