# Avionics Interface Computer Rugged

## Hardware Manual

**Model: BU-67124W**


ETHERNET
MIL-STD-1553
MIL-STD-1760
ARINC 429
ARINC 717
DISCRETE
CANbus

DDC's Rugged Avionics Interface Computer (AIC-R) provides a flexible and scalable platform that supports a wide range of data network communications. The system combines best-in-class performance from Intel's embedded computing architecture and the I/O flexibility of DDC's High Density Multi-Protocol XMC module, to deliver unmatched avionics connectivity in a small form factor, deployable, rugged enclosure.

### Applications

- Military Aerospace
  - Fixed Wing
  - Rotary
- UAVs
- Commercial Aerospace
  - Fixed Wing
  - Rotary
- Ground Vehicles

**Need a Custom Solution?**
DDC can customize designs for all products, ranging from simple modifications of standard products to fully customized solutions for commercial, military, aerospace, and industrial applications.

**For more information:** www.ddc-web.com/BU-67124W

# DDC's Data Networking Solutions

## MIL-STD-1553 | ARINC 429 | Fibre Channel | Ethernet

As the leading global supplier of data bus components, boards, modules, computers, and software solutions for the military and commercial aerospace markets, DDC's data bus networking solutions encompass the full range of data interface protocols to support the real-time processing demands of field-critical data networking between systems and subsystems on the platform. These products, along with our traditional MIL-STD-1553 solutions, represent a wide and flexible array of performance and cost solutions, enabling DDC to support multi-generational programs.

Whether employed in increased bandwidth, high-speed serial communications, or traditional avionics and ground support applications, DDC's data bus solutions fulfill the expanse of military, civil aerospace, and space requirements including reliability, determinism, low CPU utilization, real-time performance, and ruggedness within harsh environments. Our use of in-house intellectual property ensures superior multi-generational support, independent of the life cycles of commercial devices. Moreover, we maintain software compatibility between product generations to protect our customers' investments in software development, system testing, and end-product qualification.

### *MIL-STD-1553*

DDC, the world leader in MIL-STD-1553 technology, provides the broadest selection of quality MIL-STD-1553 rugged embedded and lab grade computers, boards and components to meet your data conversion and data interface needs. Our 1553 data bus board solutions are integral elements of military, aerospace, and industrial applications. Our extensive line of military and space grade components provide MIL-STD-1553 interface solutions for microprocessors, PCI buses, and simple systems. Our 1553 data bus solutions are designed into almost every aircraft, helicopter, unmanned vehicle, missile programs, and space system that utilizes MIL-STD-1553.

### *ARINC 429*

DDC has a wide assortment of quality ARINC 429 embedded and lab grade boards, LRUs, and components, to serve your data conversion and data interface needs. DDC's ARINC 429 components ensure the accurate and reliable transfer of flight-critical data. Our 429 interfaces support data bus development, validation, and the transfer of flight-critical data aboard commercial aerospace platforms.

### *Fibre Channel*

DDC has developed its line of high-speed Fibre Channel network access controllers and switches to support the real-time processing demands of field-critical data networking between sensors, computer nodes, data storage, displays, and weapons, for air, sea, and ground military vehicles. Fibre Channel's architecture is optimized to meet the performance,reliability, and demanding environmental requirements of embedded, real time, military applications, and designed to endure the multi-decade life cycle demands of military/aerospace programs.

### *Ethernet*

DDC offers convenient solutions to convert MIL-STD-1553, ARINC 429, and Ethernet protocol in any direction, in real-time, without a host computer, enabling seamless and cost saving multi-protocol connectivity for test and embedded applications.

### *Extensions to MIL-STD-1553*

DDC offers a wide variety of solutions based on extensions of MIL-STD-1553 for emerging aerospace applications. Turbo 1553 increases the data rate of 1553 from 1 Mbps to 5 Mbps while maintaining the architectural features of MIL-STD-1553. Hyper 1553 provides high speed communication (50 to 100+ Mbps) over MIL-STD-1553 buses while operating concurrently with legacy 1 Mbps 1553 (similar to ADSL for telephone networks).

### *Form Factors, Software, & Drivers*

DDC supplies MIL-STD-1553 and ARINC 429 board level products in a variety of form factors including USB, PCI-Express, PCMCIA, ExpressCard, AMC, PMC, XMC, PCI-104, PC/104-Plus, PC/104, PCI, cPCI, VME, and ISAbus boards. Our laboratory simulation and in-flight products include multi-function and single-function for system integration and production test environments. Our extensive line of military and space grade components provide MIL-STD-1553 interface solutions for microprocessors and simple systems. Our software is supplied in the form of menus, libraries, and drivers. We also offer additional software to expand our data networking range of options.

# BU-67124W102L-601
# RUGGED AVIONICS INTERFACE COMPUTER
# HARDWARE MANUAL

## MN-67124W-001



**105 Wilbur Place**
**Bohemia, New York 11716-2426**
**Tel: (631) 567-5600, Fax: (631) 567-7358**
**World Wide Web -** http://www.ddc-web.com

**For Technical Support -** 1-800-DDC-5757 ext. 7771
**United Kingdom -** Tel: +44-(0)1635-811140, Fax: +44-(0)1635-32264
**France -** Tel: +33-(0)1-41-16-3424, Fax: +33-(0)1-41-16-3425
**Germany** Tel: +49-(0)89-15 00 12-11, Fax: +49-(0)89-15 00 12-22
**Japan -** Tel: +81-(0)3-3814-7688, Fax: +81-(0)3-3814-7689
**Asia -** Tel: +65-6489-4801
**India -** Tel: +91 80 30110368

| Revision | Date | Pages | Description |
|---|---|---|---|
| Pre Rev A | 1/2015 | All | Preliminary Release |
| Rev A | 11/2017 | All | Initial Release |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# 1 PREFACE

This manual uses typographical conventions to assist the reader in understanding the content. This section will define the text formatting used in the rest of the manual.

## 1.1 Text Usage

- BOLD–indicates important information and table, figure, and chapter references.
- Courier New–indicates code examples.
- <…> - indicates user-entered text or commands.

## 1.2 Standard Definitions

| | |
|---|---|
| **XMC** | PCI-e Mezzanine Card |
| **Mini PCI-e** | Small form factor Peripheral Component Interconnect Express |

## 1.3 Trademarks



## 1.4 What is included in this manual?

This manual contains a complete description of the Avionic Interface Computer's hardware installation and use.

## 1.5 Technical Support

In the event that problems arise beyond the scope of this manual, you can contact DDC by the following:

US Toll Free Technical Support:
1-800-DDC-5757, ext. 7771

Outside of the US Technical Support:
1-631-567-5600, ext. 7771

Fax:
1-631-567-5758 to the attention of DATA BUS Applications

DDC Website:
www.ddc-web.com/ContactUs/TechSupport.aspx

Please note that the latest revisions of Software and Documentation are available for download at DDC's Web Site, www.ddc-web.com.

# 2 SYSTEM OVERVIEW

The highly scalable Rugged Avionics Interface Computer (R-AIC) product family is based on the COMe module (Type 6) with a specialized carrier board assembly. It is available with a vehicle grade +28VDC power input, I/O interface options, thermal solutions, and mounting configurations. The compact footprint and power-to-performance optimization make it the ideal solution for applications requiring high performance, reduced size-weight-power in an environmentally ruggedized platform. The design flexibility ensures fast time-to-market for many applications in the following segments: military, avionics, commercial avionics, mining, smart grid, homeland security, transportation (rail), and oil & gas.

To meet the severe environment operational demands found in these industries, the Rugged AIC platform operates reliably in a multitude of conditions including extreme temperatures, shock, vibration and EMI. At the heart of the Rugged AIC system is a COM Express® Type 6 module that features ECC, TPM and 100% extended temp screening at the module level. The system has the option of removable or fixed SSDs and/or fixed mSATA storage onboard. Windows or Linux operating system and software support packages are also available. The unique carrier board design maximizes the system's capabilities with mezzanine profile options while minimizing its overall size and still meeting high temperature and shock and vibration conditions.

## 2.1 Product Description

The Rugged AIC product family is based on the COMe module (Type 6), with a specialized baseboard assembly, ruggedized I/O, power, and packaging. The product is targeted at various applications in the following markets: the military, aerospace, commercial avionics, transportation (rail & vehicle), and energy (oil & gas). Each market and system application has its own requirements for power conditioning, I/O requirements, connector selection, and certification. The Rugged AIC is the ideal system level building block for these applications which require a high compute platform to survive in this type of harsh environment.

The base system implements an Intel high performance embedded processor with integrated memory controller and graphics which is then coupled with the highly integrated Intel® Platform Controller Hub. Numerous I/O is supported including GbE, USB (2.0, 3.0), SATA III, PCIe (inter-board), RS-422/485, GPIO, etc. The Rugged AIC comes with EFI BIOS and supports Linux and Windows operating systems running on x86 CPU architecture.

## 2.2 Top-Level Block Diagram

The Rugged AIC leverages state-of-the-art Commercial Off-the-Shelf (COTS) hardware to establish a versatile, high performance computer system as shown in the following top-level functional block diagram in Figure 1.

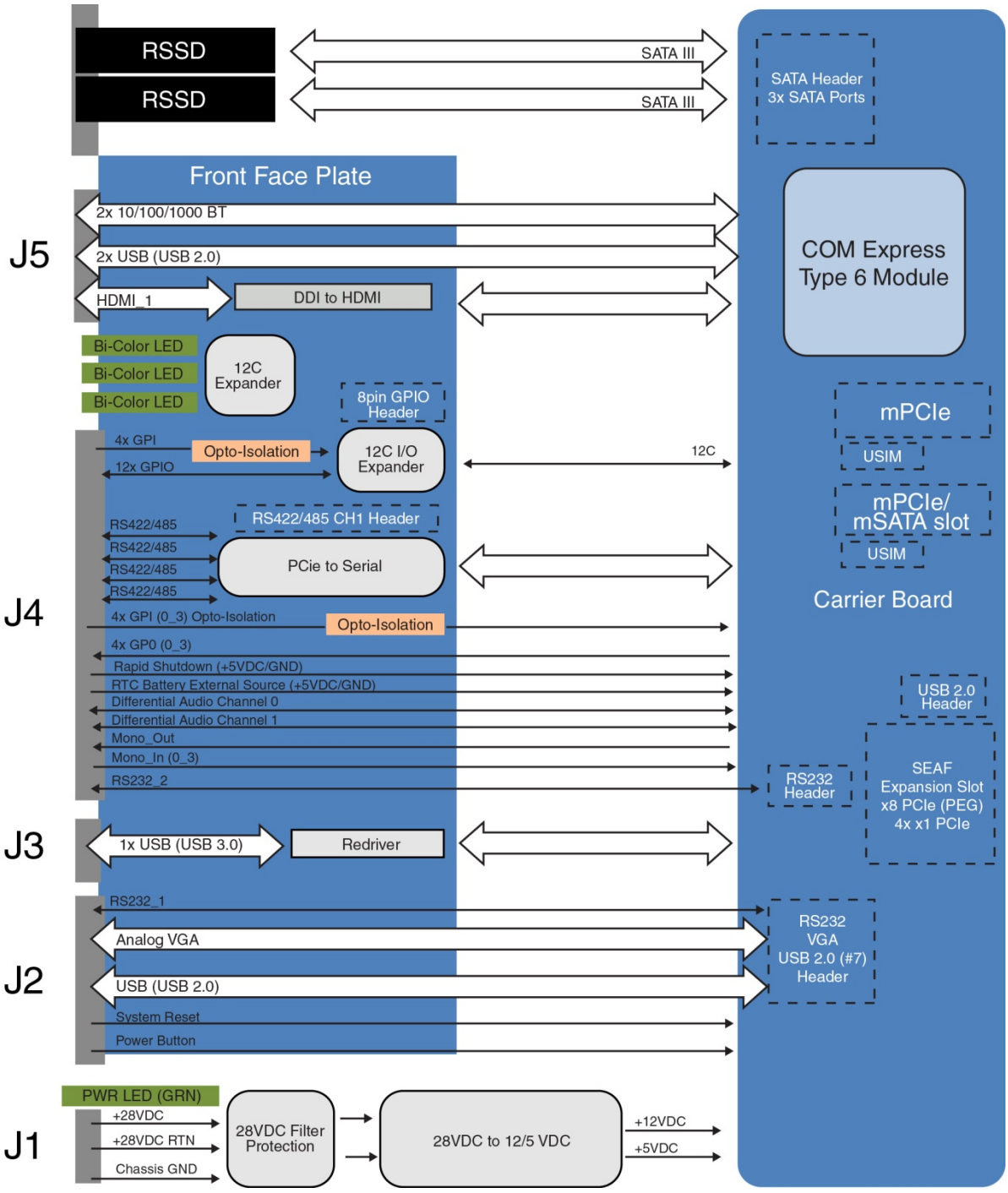


**Figure 1. Rugged Avionics Interface Computer Block Diagram**

## 2.3 Features

### General

- Processor Option:
  - Intel® Core™ i5-4422E ComExpress form factor
- 16GB of DDR3 - 1333 MHz System Memory
- Ethernet Ports: 2x GbE (10/100/1000 BaseT)
- Serial: 4x Serial Ports configurable for RS422 and/or RS485 (user configurable), 2x Standard RS232 interface Data Only (Tx/Rx)
- USB: 1x USB 3.0, 3x USB 2.0 interface
- Mass Storage: 2x Fix or Front removable Solid State Drives (SSD)
- Audio: Intel® High Def Audio, 2x Differential Out; 1x Single End (SE) Out, 4x Single End (SE) In
- Discrete I/O: Reset, Power Enable, 4x GPI (In) and 4x GPO (Out), single ended LVTTL, 16x General Purpose I/O Single Ended (SE) LVTTL, Rapid Shutdown, 4x pins for remote battery (RTC) option
- Video Output: 1x VGA, 1x HDMI (via Intel® HD Graphics DP++)
- Power Input: Integrated +28VDC input (+18VDC to +36VDC) power supply and EMI filtering supports MIL-STD-704, MIL-STD-461 and DO160
- MIL-STD-1553 and ARINC 429 via DDC XMC/PCI-e cards

# 3 DETAILED ARCHITECTURE

If using DDC cards, additional details for the ARINC 429 and MIL-STD-1553 portions can be found in the hardware manuals for the cards installed in the AIC. The DDC card's manuals can be found on the DDC website at www.ddc-web.com.

## 3.1 Hardware

The R-AIC has two (2x) ***BU-67114H200L*** Mini PCI-e cards installed, as well as a ***BU-67118Y500L*** Multi IO XMC card installed.

These boards installed provide the following IO:

- 8 dual redundant MIL-STD-1553 channels
- 18 Programmable ARINC 429 channels
    - 2 channels which are also programmable to ARINC 717
- 6 Avionics IO
- IRIG-B
- Tx Inhibit & BC Disable on 1553 channels 1 through 4.

These IO are pinned out to connector J6. Please see Section 7.2.6 for pinout information.

## 3.2 Mechanical Design

### 3.2.1 Physical Characteristics and Dimensions

***Note:*** *All dimensions are in Inches(mm)*
*8.5 x 6.5 x 3.9 (215.6 x 165.1 x 99.1)*

#### 3.2.1.1 Front

The front contains a factory installed connector I/O panel that is adequately secured for compression of the gasket for environmental compliance. There are fixed locations for the ground stud connector locations and symbols are used to identify the connectors


**Figure 2. Front View of Avionics Interface Computer**

### 3.2.1.2 Mechanical Outline

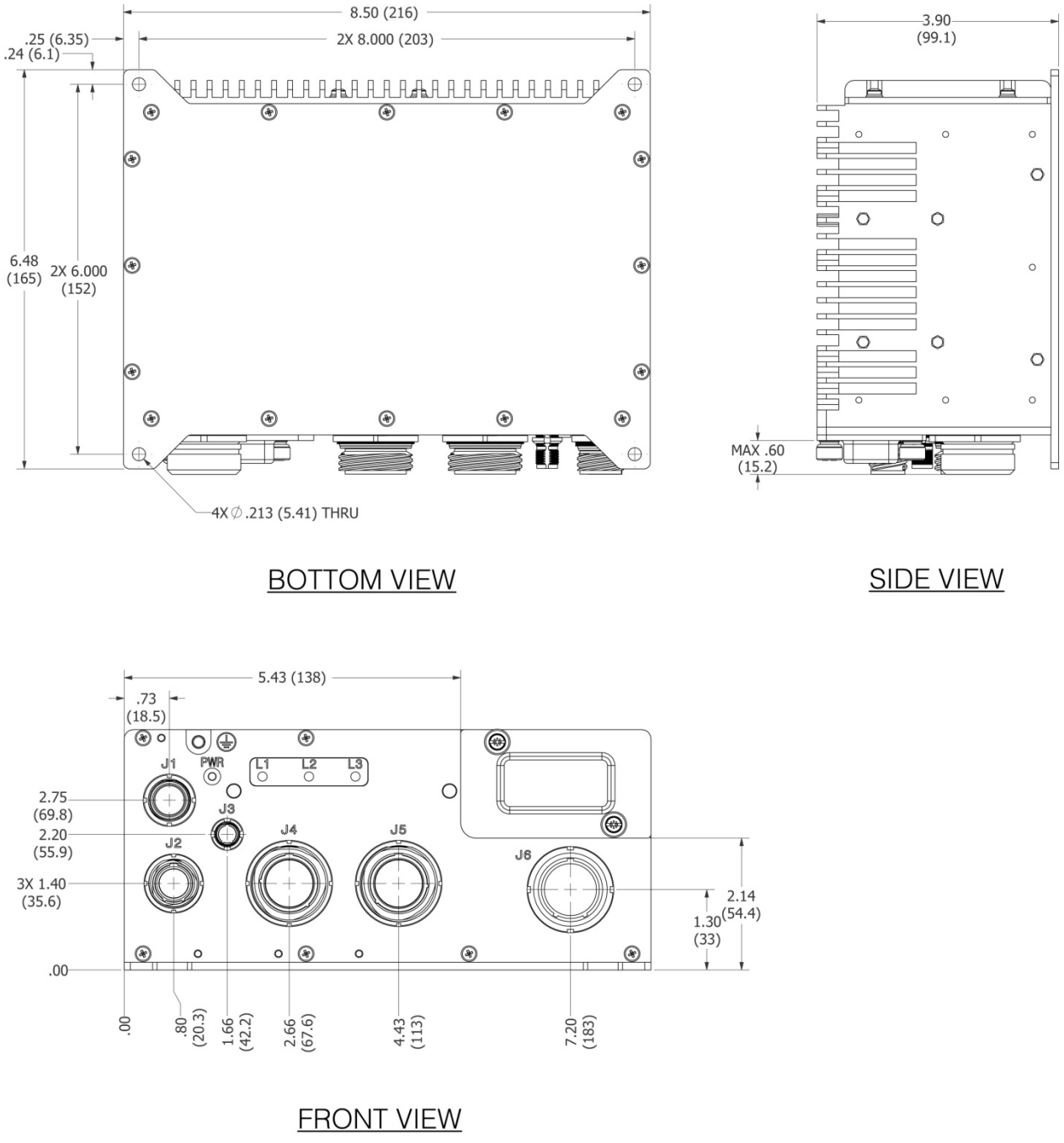


**Figure 3. Mechanical Outline of Avionics Interface Computer**

### 3.2.2 Installation

The system provides four mounting thru-holes on bottom with tool access from the top for mounting to any flat surface.

**Figure 4. Bottom View of Avionics Interface Computer**

## 3.3 Rugged Carrier Board

The system contains a space optimized ruggedized carrier board that is designed to support a Type 6 ComExpress module. It is designed for the unique thermal and shock/vibration requirements for the environment specified and provides additional circuitry and break-out signal connections to the external connectors. There is flexibility in the design to support additional features and typical modifications for application specific requirements. All configuration options are factory configured and

any modification by the customer may void the warranty. Please contact the factory for further information regarding modification options of the system.

## 3.4 ComExpress Module RXT

The ComExpress module is based on the RXT product family that is designed for -40C to +85C temperature range, has a rapid shutdown design and ECC memory. These modules are 100% screened for the temperature range.

The following Comparison table provides the ComExpress Module main parameters.

| Parameters | COMe-bHL6RXT i5-4422E |
|---|---|
| Processor | i5-4422E |
| # of Cores | 2 |
| # of Threads | 4 |
| Clock Speed | 1.8 GHz (Base)<br>2.9GHz (Max Turbo) |
| L2 Cache | 3 MB |
| Memory Type | 16 GB DDR3-1333 ECC |
| Chipset | Intel® Mobile QM87 |
| Ethernet (NIC) | Intel® i218-LM |
| Graphics Controller | Intel® HD Graphics 4600 |
| Sound | Intel® High Definition Audio |
| Security Features | Atmel TPM |
| Instruction Set | 64-bit |
| Lithography | 22 nm |

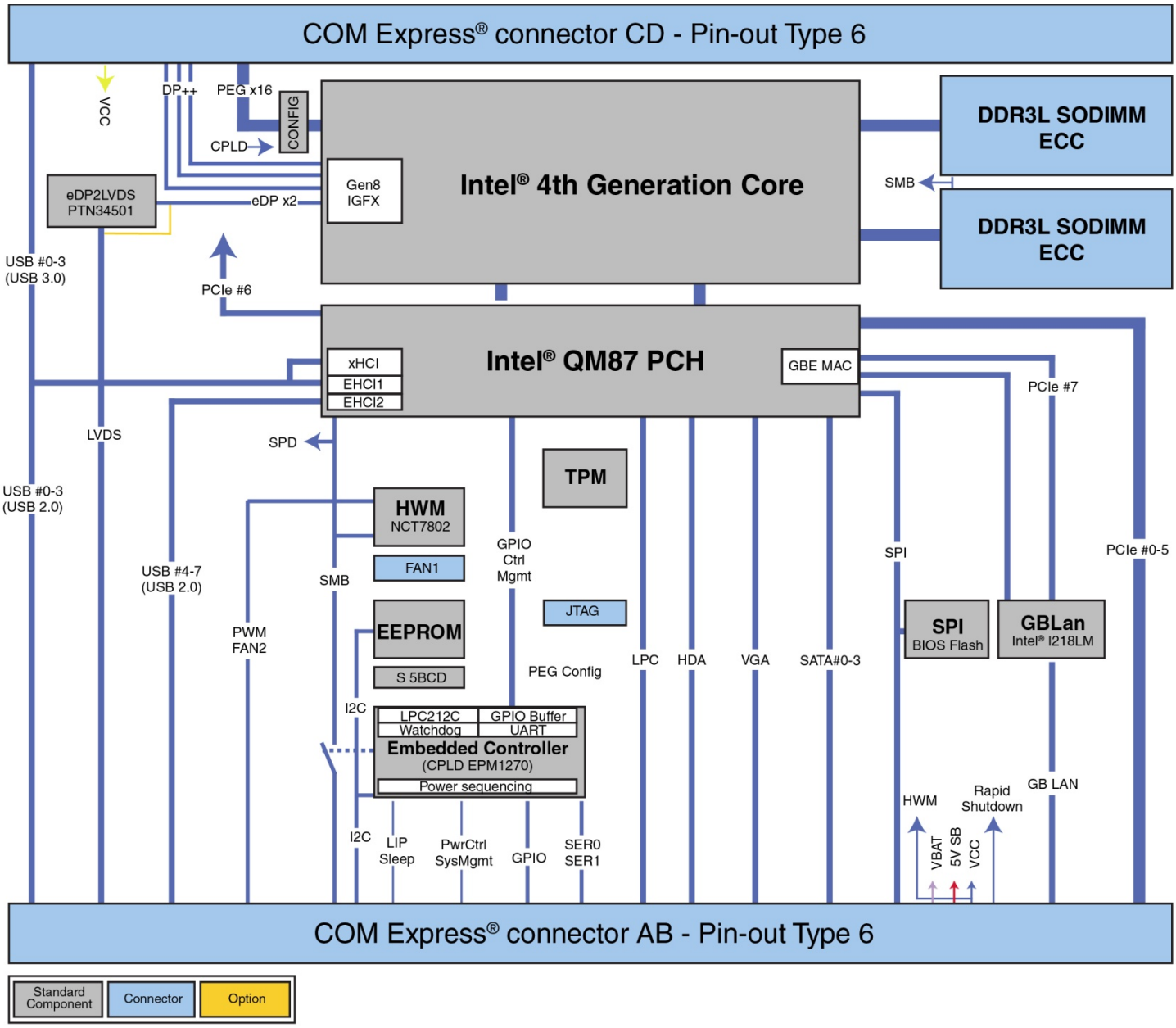


**Figure 5. COMe-bHL6RXT i5-4422E Block Diagram**

## 3.5 Power

The 28VDC power input system utilizes a100W 18VDC-36VDC power module that supplies conditioned +12V and +5V output to the carrier board. There is 3A maximum available for 5V and this is used to power VGA (1A max), USB (1A max each) and additional +5V (1.5A max each) out.

### 3.5.1 Power Input Wiring

The Filter board is wired directly from the J1 power interface connector, to the DC/DC board and then the +12V and +5V output is wired directly to the baseboard. An external power (28VDC) good indicator LED is wired to the visible green LED on the front panel to indicate external power status.

During initial boot-up, the system requires an in-rush of 6 Amps peak. System rebooting may occur if there is current limiting of less than 6 Amps during this time.

### 3.5.2 Power Input Protection

The 28VDC input to the PSU Filter board is designed for dual over current protection via factory programmable surge limiting devices and active fuses. The system will continue to operate during high voltage surges of short duration such as those found in vehicles and regulates the output to a safe voltage value during an overvoltage event. The power input is also protected for reverse voltage polarity.

As a secondary protection mechanism, the filter board, and carrier board within the system use slow blow fuses which are only intended to protect the electronics from secondary damage in the unlikely event of an internal circuit failure. Any type of internal circuit failure would require replacement and repair at the service center. There is also input current limiting on the filter board (auto recovery) and on the carrier board (resettable).

### 3.5.3 Over-Under Temperature Protection

The DC/DC board has an over-under temperature protection shutdown feature that disables the DC power output above +100°C and below -40°C +/-5°C.

The temperature is measured at the DC/DC board (internal system temp).

Note: The Power Input LED (Green) will still be active when the system is in an over-under temperature state since LED indicates live DC power to the system.

## 3.6 Signal Interface Board

The signal interface board (SIB) is a connector board that provides the interface to the carrier board and the four rugged external circular connectors, J2, J3, J4, and J5. All necessary signals, grounding, shielding, isolation, etc is provided at this board level.

## 3.7 Fixed Storage Device

The solid state drive (SSD) technology is designed for the unique capacity and workload requirements of a broad range of embedded systems. The SSDs are designed to meet the critical storage demands of read-intensive and boot applications.

- Storage Sizes Available: 64GB, 128GB, 256GB, 512GB
- S.M.A.R.T reporting;
- SATA 3.1 (6 GBps)
- Sequential performance:
  - Read: 530 MB/s
  - Write: 300 MB/s
- Random Performance:
  - Read IOPS: 65,000
  - Write IOPS: 3,000

### 3.7.1 Removable Storage (RSSD)

The Removable Solid State Drives (RSSD) are small form factor 1.8" Serial ATA drives that are housed in independent aluminum enclosures. This specialized enclosure is designed to install easily into the R-AIC front removable drive bay and supports high shock and vibration requirements.

The removable drive has a size of 256 GB.

2K insertion/extraction cycles of the RSSD connector

10K insertion/extraction cycles of the mate connector in the Drive Bay Housing

## 3.8 Audio

This card supports multiple input and output channels connected through a Cirrus Logic 4207 Audio codec device. Control of this audio device is done by the HDA controls on the COMe module.

- 4 Analog input channels
- 1 Analog output channel
- 2 differential output channels

## 3.9 Video

The R-AIC supports VGA and HDMI. The standards of each of those video mediums are followed.

HDMI can support the following resolutions:

4096×2160 @24Hz

3840×2160 @60Hz

***Note:*** *Some older HDMI displays may not work properly with the system.*

## 3.10 GPIO

Supports all 4 GPO and 4 GPI ports from the COMe card and additionally has 16 independently controlled GPIO using I2C to GPIO based on TI 9552 devices.

- 4 GPO 3.3 volt LVTTL outputs from COMe (Buffered 5V tolerant)
- 4 GPI 3.3 inputs (Buffered 5V tolerant)
- 16 GPIO 3.3 volt output (5V tolerant)

## 3.11 RTC Battery

There is an RTC battery installed in the system. The RTC circuit power consumption is specified at 500 mA, giving an expected duration of more than 10 years in the absence of external power.

## 3.12 Front Panel LEDs

There are four front panel LEDs. The Power LED lights up Green when there is 28VDC input power applied to the system.

The other three LEDs are tri-colored (green/red/orange) and can be configured by the user via software.

User must have root privileges in order to configure the LED gpio controls.

LED L3 is controlled by GPIO's 496 & 497

LED L2 is controlled by GPIO's 498 & 499

LED L1 is controlled by GPIO's 500 & 501

| GPIOxxx | GPIOxxx | LED state/color |
|---|---|---|
| 0 | 0 | Off |
| 1 | 0 | Green |
| 0 | 1 | Red |
| 1 | 1 | Orange |

Below is sample code for a linux bash script:

```
#!/bin/sh
#LED tester

echo "### Setting LED L3 to Green ###"
echo 1 > /sys/class/gpio/gpio496/value
echo 0 > /sys/class/gpio/gpio497/value

echo ""

echo "### Changing LED L3 to Red after 2 seconds ###"
sleep 2
echo 0 > /sys/class/gpio/gpio496/value
echo 1 > /sys/class/gpio/gpio497/value
```

# 4 START UP

J1 is the power connector. See Section 6.2.1 for J1.

After powering up the R-AIC you will be able to log into the Ubuntu 16.04 operating system.

It is a GUI based operating system, as opposed to command line based like DDC's other AIC products.

The following credentials are used as the username and password:

Username: **ddc** Password: **ready2go**

Root password is also **ready2go**.

The 1553 and 429 IO is controlled via the v3.13.6 combined SDK.

This SDK is located in the **/home/ddc/1553_429/** directory.

# 5 SOFTWARE

For information about R-AIC SDK software, refer to the BU-69092Sx AceXtreme SDK Software Manuals and the DD-42992Sx Multi-IO SDK manual.

These can be found on the website at these locations:

1553: http://www.ddc-web.com/Products/172/Default.aspx

429: http://www.ddc-web.com/Products/173/Default.aspx

## 5.1 Software Requirements

### 5.1.1 System Software – OS

The Rugged AIC is configured with Ubuntu 16.04 64-bit.

***Note:*** *This OS runs a 4.x kernel version.*

### 5.1.2 Linux System 1553 and 429 Driver Support

DDC's BU-69092S1 and DD-42992S1 SDK packages are combined into a single location.

These SDK's contain the following folders:

**Table 1. Avionics Interface Computer SDK Directory Structure**

| Folder Name | Description of Contents |
|---|---|
| /home/ddc | Main User DDC Home Directory. |
| /home/ddc/1553_429 | Contains the SDK's for 1553, 429, bridging |
| /home/ddc/1553_429/ddccm | Contains code to rebuild the card manager |
| /home/ddc/1553_429/docs | Contains package documentation. |
| /home/ddc/1553_429/drivers | Contains the acex and legacy drivers. Legacy drivers consist of the acexusb, emapci and e2mausb drivers. |
| /home/ddc/firmware | Contains firmware for DDC devices, not utilized in the R-AIC. |
| /home/ddc/1553_429/libraries/dd429 | ARINC 429 library folder. |
| /home/ddc/1553_429/libraries/emacepl | MIL-STD-1553 AceXtreme library folder. |
| /home/ddc/1553_429/samples/dd429 | Samples on using DDC's ARINC 429 SDK directly. |
| /home/ddc/1553_429/samples/emacepl | Samples on using DDC's MIL-STD-1553 SDK directly. |

### 5.1.3 BIOS Configuration

The BIOS can be entered by pressing F2 at boot time.

**It is not recommended to modify any settings in the BIOS.**

## 5.2 Software Installation

The system is delivered with a pre-configured Linux software load installed on the internal storage device. This software allows the user to boot and use the system with no additional configuration steps.

The default standard operating system is Linux using the Ubuntu 16.0.4 LTE (Debian Based) version for Long Term Support (LTS) release.

The operating system uses standard Linux drivers as the installed drivers set, to support hardware devices such as I/O. (eg. tty, usb, etc).

The installation of an operating system is dependent of the OS software and is not addressed in this manual. Refer to appropriate OS software documentation for installation.

# 6 CONNECTORS AND PINOUTS

The BU-67124Wx is a ruggedized box. When using the BU-67124Wx, the following should be observed:

- **ALWAYS** take proper precautions to guard against static damage.
- **ENSURE** power adaptor is properly connected to device.

## 6.1 Introduction to Connectors

The system includes interface connectors, ground stud and LEDs which are on the front of the system. All connectors and interfaces meet the environmental and conformity specifications. Connectors are keyed to avoid insertion of incorrect interface cables.

The rugged MIL-Circular locking connectors are environmentally sealed and provide a triple-start coupling thread that resists cross-threading and allows for fast mating. The ratcheting anti-decoupling mechanism prevents coupling nut back-off when subjected to vibration. The connector saves size and weight compared to other MIL-circular locking connectors. A red full-mate indicator band helps to visibly show the connector interfaces are completely mated.

**Table 2. Connectors**

| LOC | Connection Type | Pins | Part Number |
|---|---|---|---|
| J1 | Power Connector | 8-pin | 805-004-07M10-28PA |
| J2 | Maintenance Connector | 26-pin | 805-005-07M12-26SA |
| J3 | USB Connector | 10-pin | 881-019RB-G10M-MG-.175 |
| J4 | I/O Connector | 85-pin | 805-005-07M19-85SD |
| J5 | User I/O Connector | 85-pin | 805-005-07M19-85SC |
| J6 | 1553 & 429 IO | 85-pin | 805-005-07M19-85SA |

## 6.2 Connector Pinouts

### 6.2.1 Rugged AIC J1 Connector

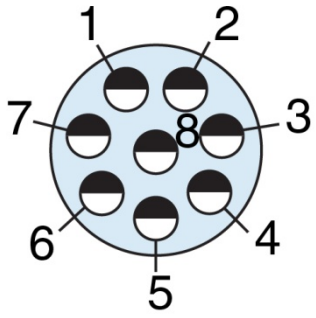


**Figure 6. Rugged AIC J1 8-Pin Power Connector**

| Table 3. Rugged AIC J1 8-Pin Power Connector | | |
|---|---|---|
| **J1 Power Connector Pin** | **Signal** | **Description** |
| 1 | +28VDC | +28 Volt Input |
| 2 | +28VDC | +28 Volt Input |
| 3 | +28VDC_RTN | +28 Volt Return |
| 4 | +28VDC_RTN | +28 Volt Return |
| 5 | NC | NC |
| 6 | NC | NC |
| 7 | NC | NC |
| 8 | CHASSIS | Chassis Ground |

### 6.2.2 Rugged AIC J2 Connector

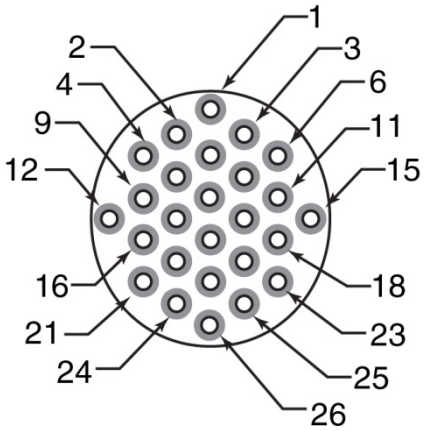


**Figure 7. Rugged AIC J2 26-Pin Maintenance Cable**

| Table 4. Rugged AIC J2 26-Pin Maintenance Connector | | |
|---|---|---|
| **J2 Pin** | **Signal** | **Description** |
| 1 | GND | Digital Ground |
| 2 | VGA_HSYNC | VGA Receive Sync |
| 3 | COM1_RX | COM1 Receive Signal |
| 4 | GND_VGA | VGA Ground Signal |
| 5 | GND | Digital Ground |
| 6 | COM1_TX | COM1 Transmit Signal |
| 7 | GND_VGA | VGA Ground Signal |
| 8 | GND | Digital Ground |
| 9 | VGA_SYNC | VGA Vertical SYNC |
| 10 | VGA_BLU | VGA BLUE |
| 11 | GND | Digital Ground |
| 12 | VGA_I2C_CK | VGA I2C Clock |
| 13 | VGA_I2C_DAT | VGA I2C Data |
| 14 | GND | Digital Ground |
| 15 | USB7_5V | 5V Signal for USB |
| 16 | VGA_5V | 5V Signal for VGA |
| 17 | GND | Digital Ground |
| 18 | USB7_D- | USB Data Signal |
| 19 | GND | Digital Ground |
| 20 | GND | Digital Ground |
| 21 | VGA_GRN | VGA GREEN |
| 22 | VGA_RED | VGA RED |
| 23 | USB7_D- | USB Data Signal |
| 24 | SYS_RESET# | System Reset |
| 25 | GND | Digital Ground |
| 26 | PWR_BTN# | Power Button |

### 6.2.3 Rugged AIC J3 Connector

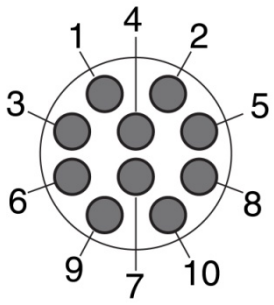


**Figure 8. Rugged AIC J3 10-Pin USB Connector**

**Table 5. Rugged AIC J3 10-Pin USB Connector**

| J3 USB Pin | Signal | Description |
|---|---|---|
| 1 | USB0_5V | 5V signal for USB |
| 2 | USB0_D- | USB Data Signal |
| 3 | USB0_SS_L_RX- | USB Data Signal |
| 4 | GND | Digital Ground |
| 5 | USB0_D+ | USB Data Signal |
| 6 | USB0_SS_L_RX+ | USB Data Signal |
| 7 | GND | Digital Ground |
| 8 | USB0_SS_L_TX- | USB Data Signal |
| 9 | NC | No Connection |
| 10 | USB0_SS_L_TX+ | USB Data Signal |

### 6.2.4 Rugged AIC J4 Connector

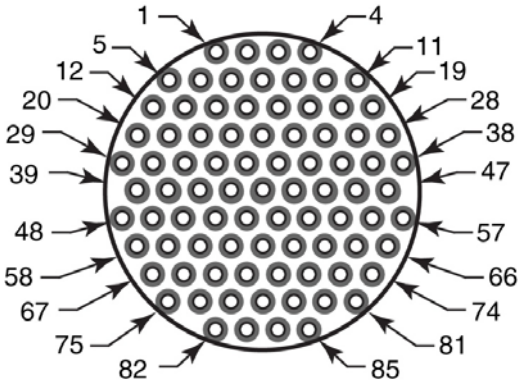


**Figure 9. Rugged AIC J4 85-Pin I/O Connector**

| Table 6. Rugged AIC J4 85-Pin I/O Connector | | |
|---|---|---|
| **J4 85-Pin I/O Pin** | **Signal** | **Description** |
| 1 | COM2_TX | COM Port 2 Transmit |
| 2 | GND | Digital Ground |
| 3 | COM3_422_TX+ | RS-422 Port 3 Transmit + |
| 4 | COM3_422_TX- | RS-422 Port 3 Transmit - |
| 5 | AUD_MONO_IN3 | Mono Audio In Port 3 |
| 6 | COM3_422_RX+ | RS-422 Port 3 Receive + |
| 7 | COM2_RX | COM Port 2 Receive |
| 8 | COM4_422_TX+ | RS-422 Port 4 Transmit + |
| 9 | COM4_422_RX+ | RS-422 Port 4 Receive + |
| 10 | COM4_422_RX- | RS-422 Port 4 Receive - |
| 11 | COM5_422_TX+ | RS-422 Port 5 Transmit + |
| 12 | GND | Digital Ground |
| 13 | AUD_MONO_IN2 | Mono Audio In Port 2 |
| 14 | COM3_422_RX- | RS-422 Port 3 Receive - |
| 15 | GND | Digital Ground |
| 16 | COM4_422_TX- | RS-422 Port 4 Transmit - |
| 17 | GND | Digital Ground |
| 18 | COM5_422_TX- | RS-422 Port 5 Transmit - |
| 19 | GND | Digital Ground |
| 20 | AUD_OUT_DIFF0+ | Differential Audio Out 0+ |
| 21 | GND(AUDIO) | Ground (Audio) |
| 22 | GND(AUDIO) | Ground (Audio) |

| Table 6. Rugged AIC J4 85-Pin I/O Connector | | |
|---|---|---|
| **J4 85-Pin I/O Pin** | **Signal** | **Description** |
| 23 | COM6_422_TX+ | RS-422 Port 6 Transmit + |
| 24 | COM6_422_TX- | RS-422 Port 6 Transmit - |
| 25 | COM5_422_RX+ | RS-422 Port 5 Receive + |
| 26 | COM5_422_RX- | RS-422 Port 5 Receive - |
| 27 | GND | Digital Ground |
| 28 | GPI3_ISOL | Opto-Isolated GPI 3 |
| 29 | AUD_OUT_DIFF0- | Differential Audio Out 0- |
| 30 | GND(AUDIO) | Ground (AUDIO) |
| 31 | AUD_MONO_IN1 | Mono Audio In Port1 |
| 32 | COM6_422_RX+ | RS-422 Port 6 Receive + |
| 33 | COM6_422_RX- | RS-422 Port 6 Receive - |
| 34 | RAPID_SHDN | Rapid Shutdown |
| 35 | GND | Digital Ground |
| 36 | GPO0 | General Purpose Output 0 |
| 37 | GND | Digital Ground |
| 38 | GPI2_ISO | Opto-Isolated GPI2 |
| 39 | GND(AUDIO) | Ground (Audio) |
| 40 | AUD_MONO_IN0 | Mono Audio In Port0 |
| 41 | GND(AUDIO) | Ground (Audio) |
| 42 | GND | Digital Ground |
| 43 | GPO3 | General Purpose Output 3 |
| 44 | GPO2 | General Purpose Output 2 |
| 45 | GPO1 | General Purpose Output 1 |
| 46 | GND | Digital Ground |
| 47 | GND | Digital Ground |
| 48 | AUD_OUT_DIFF1+ | Differential Audio Out 1+ |
| 49 | GND(AUDIO) | Ground (Audio) |
| 50 | AUD_OUT_MONO | Mono Audio Out |
| 51 | I2C_GPIO12 | General Purpose I/O 12 ($I^2C$) |
| 52 | I2C_GPIO15 | General Purpose I/O 15 ($I^2C$) |
| 53 | I2C_GPIO13 | General Purpose I/O 13 ($I^2C$) |
| 54 | GND | Digital Ground |
| 55 | I2C_GPIO14 | General Purpose I/O 14 ($I^2C$) |
| 56 | GND | Digital Ground |

| Table 6. Rugged AIC J4 85-Pin I/O Connector | | |
|---|---|---|
| **J4 85-Pin I/O Pin** | **Signal** | **Description** |
| 57 | GPI1_ISOL | Opo-Isolated GPI 1 |
| 58 | AUD_OUT_DIFF1- | Differential Audio Out 1- |
| 59 | GND(AUDIO) | Ground (Audio) |
| 60 | I2C_GPIO8 | General Purpose I/O 8 ($I^2C$) |
| 61 | I2C_GPIO9 | General Purpose I/O 9 ($I^2C$) |
| 62 | GND | Digital Ground |
| 63 | I2C_GPIO10 | General Purpose I/O 10 ($I^2C$) |
| 64 | I2C_GPIO11 | General Purpose I/O 11 ($I^2C$) |
| 65 | GND | Digital Ground |
| 66 | GPI0_ISOL | Opo-Isolated GPI 0 |
| 67 | GND | Digital Ground |
| 68 | GND | Digital Ground |
| 69 | GND | Digital Ground |
| 70 | I2C_GPIO6 | General Purpose I/O 6 ($I^2C$) |
| 71 | I2C_GPIO7 | General Purpose I/O 7 ($I^2C$) |
| 72 | GND | Digital Ground |
| 73 | GND | Digital Ground |
| 74 | GND | Digital Ground |
| 75 | I2C_GPIO4 | General Purpose I/O 4 ($I^2C$) |
| 76 | I2C_GPIO5 | General Purpose I/O 5 ($I^2C$) |
| 77 | GND | Digital Ground |
| 78 | GND | Digital Ground |
| 79 | GND | Digital Ground |
| 80 | I2C_GPI1_ISOL | Opo-Isolated GPI 1 ($I^2C$) |
| 81 | I2C_GPI0_ISOL | Opo-Isolated GPI 0 ($I^2C$) |
| 82 | GND | Digital Ground |
| 83 | I2C_GPI3_ISOL | Opo-Isolated GPI 3 ($I^2C$) |
| 84 | I2C_GPI2_ISOL | Opo-Isolated GPI 2 ($I^2C$) |
| 85 | V_RTC | Real Time Clock Voltage |

### 6.2.5 Rugged AIC J5 Connector

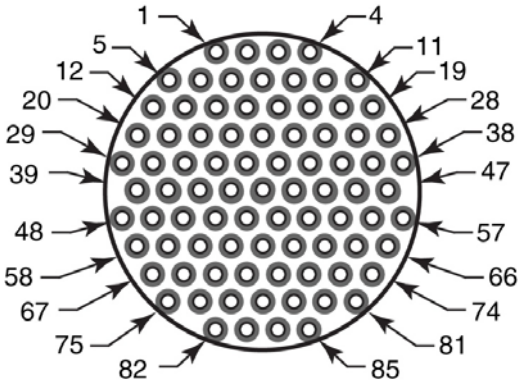


**Figure 10. Rugged AIC J5 85-Pin I/O Connector**

| Table 7. Rugged AIC J5 85-Pin I/O Connector | | |
|---|---|---|
| **J5 85-Pin I/O Pin** | **Signal** | **Description** |
| 1 | HDMI1_DATA2- | HDMI Signal |
| 2 | GND | Digital Ground |
| 3 | GBE0_LINK# | GigE 0 Signal |
| 4 | GBE0_MDI1+ | GigE 0 Signal |
| 5 | HDMI1_DATA0- | HDMI Signal |
| 6 | GND | Digital Ground |
| 7 | HDMI_DATA2+ | HDMI Signal |
| 8 | GND | Digital Ground |
| 9 | GBE0_MDI1- | GigE 0 Signal |
| 10 | GND (GBE0) | GigE 0 GND |
| 11 | GBE0_ACT# | GigE 0 Signal |
| 12 | GND | Digital GND |
| 13 | HDMI1_DATA0+ | HDMI Signal |
| 14 | GND | Digital Ground |
| 15 | V_5V0_HDMI 1 | HDMI VIN |
| 16 | GND | Digital Ground |
| 17 | GND (GBE0) | GigE 0 GND |
| 18 | GBE0_MDI3- | GigE 0 Signal |
| 19 | GBE0_MDI3+ | GigE 0 Signal |
| 20 | HDMI1_CLK- | HDMI Signal |
| 21 | GND | Digital Ground |
| 22 | GND | Digital Ground |

| Table 7. Rugged AIC J5 85-Pin I/O Connector | | |
|---|---|---|
| **J5 85-Pin I/O Pin** | **Signal** | **Description** |
| 23 | HDMI1_DATA | HDMI Signal |
| 24 | GND | Digital Ground |
| 25 | GBE0_MDI0- | GigE 0 Signal |
| 26 | GND (GBE0) | GigE 0 GND |
| 27 | GND (GBE0) | GigE 0 GND |
| 28 | GND (GBE0) | GigE 0 GND |
| 29 | HDMI1_HPD | HDMI SIGNAL |
| 30 | HDMI1_CLK+ | HDMI Signal |
| 31 | GND | Digital Ground |
| 32 | HDMI1_DATA1- | HDMI Signal |
| 33 | HDMI1_SCL | HDMI Signal |
| 34 | GND | Digital Ground |
| 35 | GBE0_MDI0+ | GigE 0 Signal |
| 36 | GND (GBE0) | GigE 0 GND |
| 37 | GBE0_MDI2- | GigE 0 Signal |
| 38 | GBE0_MDI2+ | GigE 0 Signal |
| 39 | GND | Digital Ground |
| 40 | GND | Digital Ground |
| 41 | GND | Digital Ground |
| 42 | GND | Digital Ground |
| 43 | HDMI_SDA | HDMI Signal |
| 44 | GND | Digital Ground |
| 45 | GND (GBE1) | GigE 1 GND |
| 46 | GND (GBE0) | GigE 0 GND |
| 47 | GND (GBE0) | GigE 0 GND |
| 48 | GND | Digital Ground |
| 49 | GND | Digital Ground |
| 50 | V_5V0_USB2 | USB2 VIN |
| 51 | V_5V0_USB3 | USB3 VIN |
| 52 | GND | Digital Ground |
| 53 | GND | Digital Ground |
| 54 | GBE1_MDI1- | GigE 1 Signal |
| 55 | GND (GBE1) | GigE 1 GND |
| 56 | GBE1_MDI0- | GigE 1 Signal |

| Table 7. Rugged AIC J5 85-Pin I/O Connector | | |
|---|---|---|
| **J5 85-Pin I/O Pin** | **Signal** | **Description** |
| 57 | GBE1_MDI0+ | GigE 1 Signal |
| 58 | GND | Digital Ground |
| 59 | USB2_D+ | USB Port 2 Signal |
| 60 | GND | Digital Ground |
| 61 | USB3_D+ | USB Port 3 Signal |
| 62 | GND | Digital Ground |
| 63 | GBE1_MDI1+ | GigE 1 Signal |
| 64 | GND (GBE1) | GigE 1 GND |
| 65 | GND (GBE1) | GigE 1 GND |
| 66 | GND (GBE1) | GigE 1 GND |
| 67 | GND | Digital Ground |
| 68 | USB2_D- | USB Port 2 Signal |
| 69 | GND | Digital Ground |
| 70 | USB3_D- | USB Port 3 Signal |
| 71 | GND | Digital Ground |
| 72 | GND (GBE1) | GigE 1 GND |
| 73 | GBE1_MDI2- | GigE 1 Signal |
| 74 | GBE1_MDI2+ | GigE 1 Signal |
| 75 | GND | Digital Ground |
| 76 | GND | Digital Ground |
| 77 | GND | Digital Ground |
| 78 | GND | Digital Ground |
| 79 | GBE1_MDI3- | GigE 1 Signal |
| 80 | GND (GBE1) | GigE 1 GND |
| 81 | GBE1_ACT# | GigE 1 Signal |
| 82 | GND | Digital Ground |
| 83 | GND | Digital Ground |
| 84 | GBE1_LINK# | GigE 1 Signal |
| 85 | GBE1_MDI3+ | GigE 1 Signal |

### 6.2.6 Rugged AIC J6 Connector

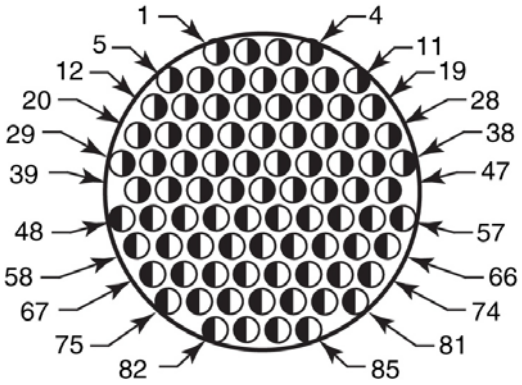


**Figure 11. Rugged AIC J6 85-Pin I/O Connector**

| Table 8. Rugged AIC J6 85-Pin I/O Connector | | |
|---|---|---|
| **J6 85-Pin I/O Pin** | **Signal** | **Description** |
| 1 | 1553_3A | 1553 Channel 3 Bus A+ |
| 2 | 1553_3A_L | 1553 Channel 3 Bus A- |
| 3 | 1553_1B | 1553 Channel 1 Bus B+ |
| 4 | 1553_1B_L | 1553 Channel 1 Bus B- |
| 5 | 1553_3B | 1553 Channel 3 Bus B+ |
| 6 | 1553_3B_L | 1553 Channel 3 Bus B- |
| 7 | AVIO5 | Avionics IO 5 |
| 8 | AVIO2 | Avionics IO 2 |
| 9 | RT_BOOT_L | Do Not Connect |
| 10 | 1553_1A | 1553 Channel 1 Bus A+ |
| 11 | 1553_1A_L | 1553 Channel 1 Bus A- |
| 12 | 1553_4B_L | 1553 Channel 4 Bus B- |
| 13 | 1553_4B | 1553 Channel 4 Bus B+ |
| 14 | AVIO4 | Avionics IO 4 |
| 15 | A429_10A | ARINC 429 Channel 10 |
| 16 | A429_4B | ARINC 429 Channel 4 |
| 17 | A429_5A | ARINC 429 Channel 5 |
| 18 | A429_7A | ARINC 429 Channel 7 |
| 19 | 1553_2B_L | 1553 Channel 2 Bus B- |
| 20 | 1553_4A | 1553 Channel 4 Bus A+ |
| 21 | IRIG_DIG_IN | IRIG Time Standard |

| Table 8. Rugged AIC J6 85-Pin I/O Connector | | |
|---|---|---|
| **J6 85-Pin I/O Pin** | **Signal** | **Description** |
| 22 | A429_6A | ARINC 429 Channel 6 |
| 23 | A429_3A | ARINC 429 Channel 3 |
| 24 | A429_10B | ARINC 429 Channel 10 |
| 25 | A429_4A | ARINC 429 Channel 4 |
| 26 | A429_5B | ARINC 429 Channel 5 |
| 27 | A429_7B | ARINC 429 Channel 7 |
| 28 | 1553_2B | 1553 Channel 2 Bus B+ |
| 29 | 1553_4A_L | 1553 Channel 4 Bus A- |
| 30 | BC_DIS | 1553 Broadcast Disable |
| 31 | TX_INH | 1553 Transmit Inhibit |
| 32 | A429_6B | ARINC 429 Channel 6 |
| 33 | A429_3B | ARINC 429 Channel 3 |
| 34 | A429_8B | ARINC 429 Channel 8 |
| 35 | A429_15A | ARINC 429 Channel 15 |
| 36 | A429_9B | ARINC 429 Channel 9 |
| 37 | A429_9A | ARINC 429 Channel 9 |
| 38 | 1553_2A | 1553 Channel 2 Bus A+ |
| 39 | B_1553_2B+ | Card B 1553 Channel 2 Bus B+ |
| 40 | DGND | Digital Ground |
| 41 | A429_14B | ARINC 429 Channel 14 |
| 42 | A429_14A | ARINC 429 Channel 14 |
| 43 | A429_8A | ARINC 429 Channel 8 |
| 44 | A429_15B | ARINC 429 Channel 15 |
| 45 | A429_16A | ARINC 429 Channel 16 |
| 46 | A429_16B | ARINC 429 Channel 16 |
| 47 | 1553_2A_L | 1553 Channel 2 Bus A- |
| 48 | B_1553_2A- | Card B 1553 Channel 2 Bus A- |
| 49 | B_1553_2B- | Card B 1553 Channel 2 Bus B- |
| 50 | A_1553_TRIG_SS_CH2 | Card A 1553 Trigger Channel 2 |
| 51 | AVIO3 | Avionics IO 3 |
| 52 | A429_18B | ARINC 429 Channel 18 |
| 53 | A429_18A | ARINC 429 Channel 18 |
| 54 | A429_11B | ARINC 429 Channel 11 |
| 55 | A429_11A | ARINC 429 Channel 11 |

| Table 8. Rugged AIC J6 85-Pin I/O Connector | | |
|---|---|---|
| **J6 85-Pin I/O Pin** | **Signal** | **Description** |
| 56 | DGND | Digital Ground |
| 57 | A_1553_1A+ | Card A 1553 Channel 1 Bus A+ |
| 58 | B_1553_2A+ | Card B 1553 Channel 2 Bus A+ |
| 59 | A_1553_TRIG_SS_CH1 | Card A 1553 Trigger Channel 1 |
| 60 | B_1553_TRIG_SS_CH2 | Card B 1553 Trigger Channel 2 |
| 61 | AVIO6 | Avionics IO 6 |
| 62 | A429_13A | ARINC 429 Channel 13 |
| 63 | A429_13B | ARINC 429 Channel 13 |
| 64 | A429_12A | ARINC 429 Channel 12 |
| 65 | A429_12B | ARINC 429 Channel 12 |
| 66 | A_1553_1A- | Card A 1553 Channel 1 Bus A- |
| 67 | B_1553_1B+ | Card B 1553 Channel 1 Bus B+ |
| 68 | B_1553_TRIG_SS_CH1 | Card B 1553 Trigger Channel 1 |
| 69 | A429_1B_A717_1B | ARINC 429/717 Channel 1 |
| 70 | A429_1B_A717_1A | ARINC 429/717 Channel 1 |
| 71 | AVIO1 | Avionics IO 1 |
| 72 | A429_17B | ARINC 429 Channel 17 |
| 73 | A429_17A | ARINC 429 Channel 17 |
| 74 | A_1553_1B- | Card A 1553 Channel 1 Bus B- |
| 75 | B_1553_1B- | Card B 1553 Channel 1 Bus A- |
| 76 | B_1553_1A- | Card B 1553 Channel 1 Bus A- |
| 77 | DGND | Digital Ground |
| 78 | A429_2B_A717_2B | ARINC 429/717 Channel 2 |
| 79 | A429_2A_A717_2A | ARINC 429/717 Channel 2 |
| 80 | A_1553_2A+ | Card A 1553 Channel 2 Bus A+ |
| 81 | A_1553_1B+ | Card A 1553 Channel 1 Bus B+ |
| 82 | B_1553_1A+ | Card B 1553 Channel 1 Bus A+ |
| 83 | A_1553_2B+ | Card A 1553 Channel 2 Bus B+ |
| 84 | A_1553_2B- | Card A 1553 Channel 2 Bus B- |
| 85 | A_1553_2A- | Card A 1553 Channel 2 Bus A- |

## 6.3 Mating Connectors

The following sections describes the connectors on the box as well as their mating connectors.

### 6.3.1 Mating Connector for Rugged AIC J1

Rugged AIC J1 is an 8-Pin Mil style circular connector. The mating connector to J1 is an 8-pin MIL style circular connector (GlenAir 805-002-16M10-28SA). The pinout for Rugged AIC J1 is shown in Table 3.

**Figure 12. Rugged AIC J1 Mating Connector**

#### 6.3.1.1 DDC-80965-1 P1 Power Cable Assembly

DDC-80965-1 is a power cable assembly terminated with banana jacks to provide power to the R-AIC.

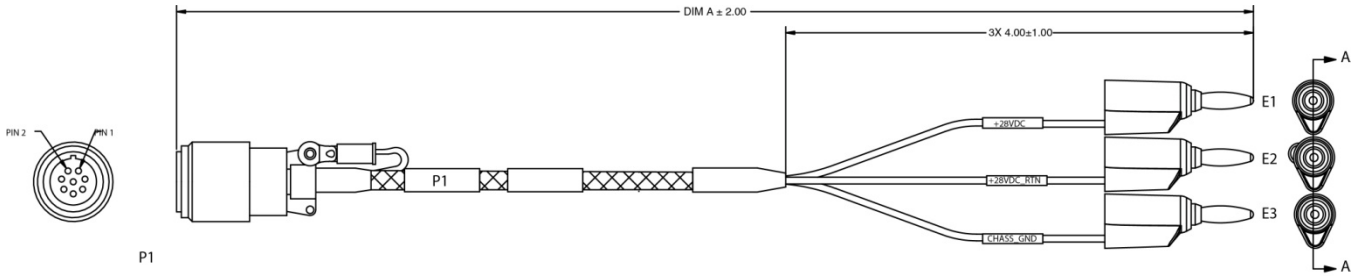


**Figure 13. DDC-80965-1 Cable Assembly**

### 6.3.2 Mating Connector for Rugged AIC J2

Rugged AIC J2 is a 26-Pin MIL style circular connector. The mating connector to J2 is a 26-pin MIL style circular connector (GlenAir 805-001-16M12-26PA). The pinout for Rugged AIC J2 is in Table 5Table 4.

**Figure 14. Rugged AIC J2 Mating Connector**

### 6.3.2.1 DDC-80965-2 P2 Maintenance Cable Assembly

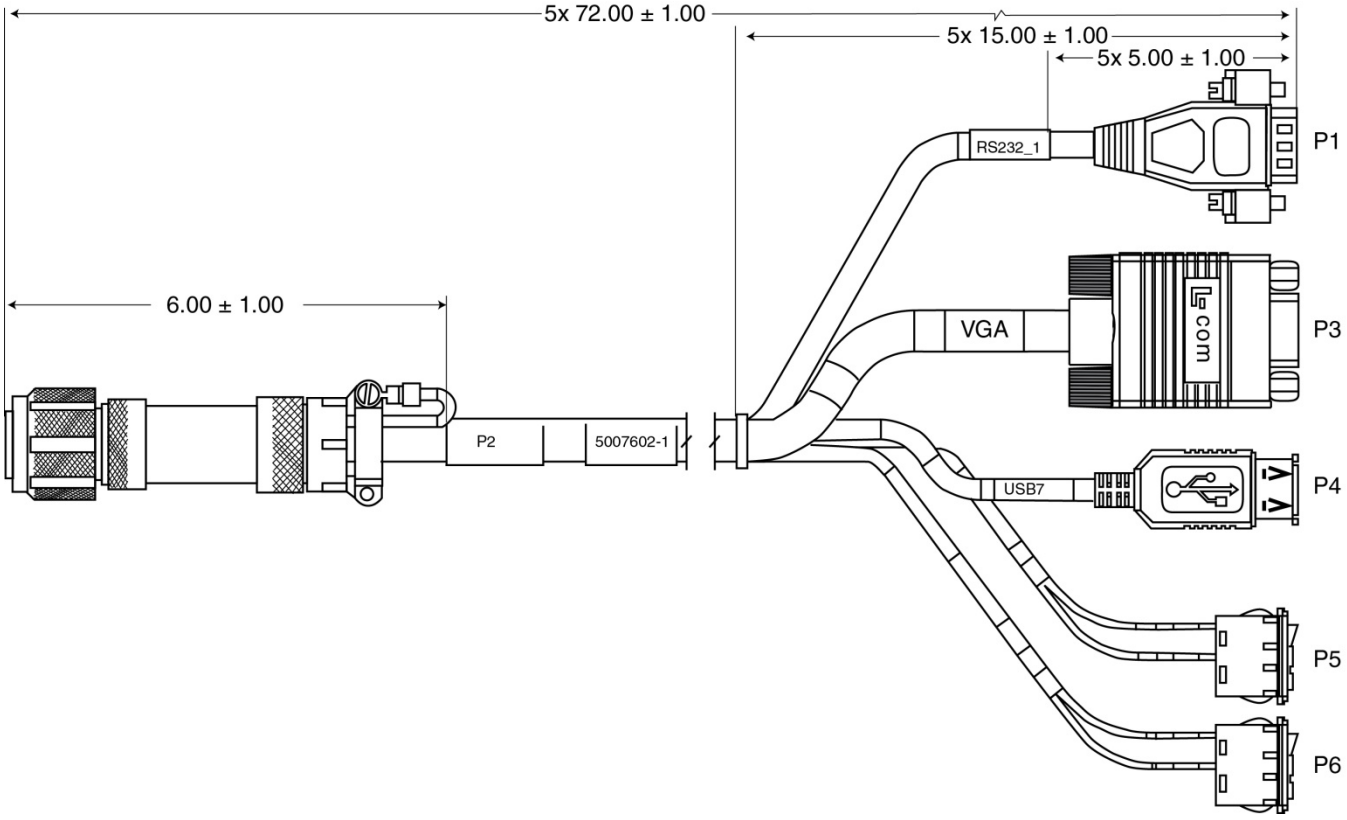


**Figure 15. DDC-80965-2 Cable Assembly**

## 6.3.3 Mating Connector for Rugged AIC J3

Rugged AIC J3 is a 10-Pin MIL style circular Connector. The mating connector to J3 is a 10-pin MIL style circular connector (GlenAir 887-406-M-60). The pinout for Rugged AIC J3 is shown in Table 5.

**Figure 16. Rugged AIC J3 Mating Connector**

#### 6.3.3.1 DDC-80965-3 P3 Maintenance Cable Assembly

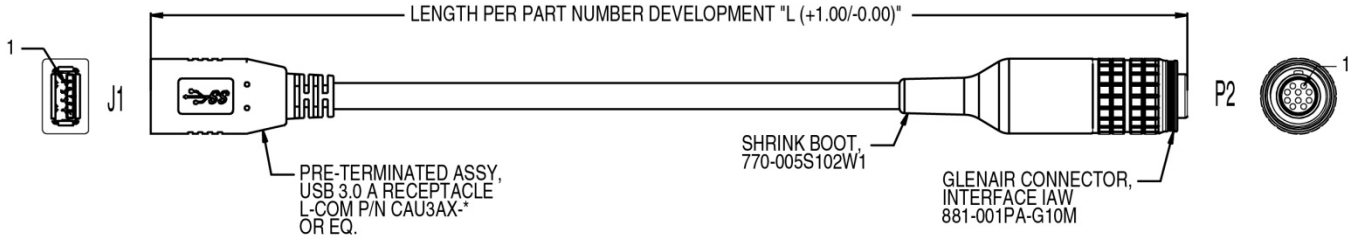


**Figure 17. DDC-80965-3 Cable Assembly**

### 6.3.4 Mating Connector for Rugged AIC J4

Rugged AIC J4 is an 85-Pin MIL style circular connector. The mating connector to J4 is an 85-pin MIL style circular connector (GlenAir 805-001-16M19-85PD). The pin out for AIC J4 is in Table 6.

**Figure 18. Rugged AIC J4 Mating Connector**

### 6.3.4.1 DDC-80965-4 P4 Serial/Audio Cable Assembly

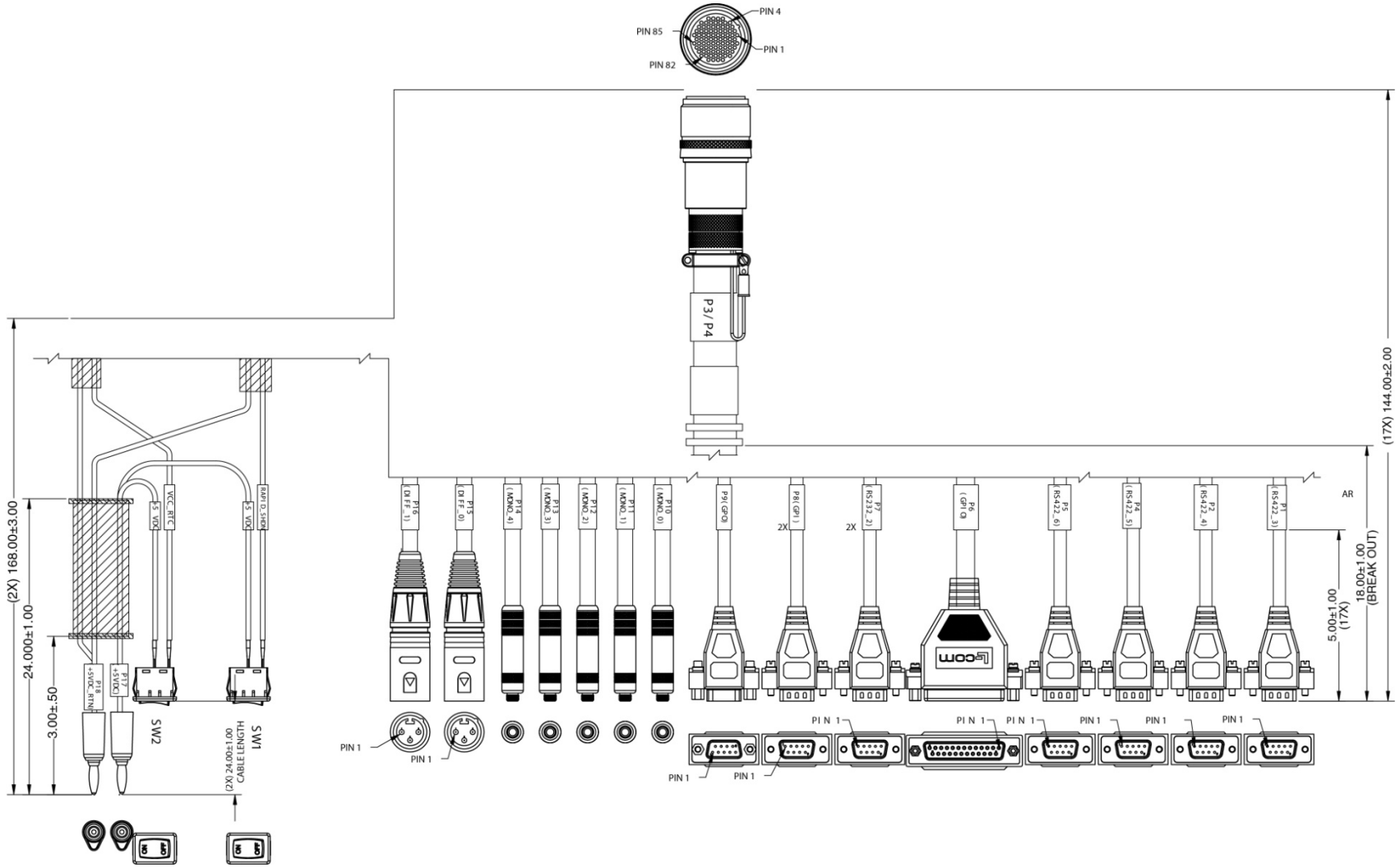


**Figure 19. DDC-80965-4 Cable Assembly**

### 6.3.5 Mating Connector for Rugged AIC J5

Rugged AIC J5 is an 85-Pin MIL style circular connector. The mating connector to J5 is an 85-pin MIL style circular connector (GlenAir 805-001-16M19-85PC). The pin out for AIC J5 is in Table 7.

**Figure 20. Rugged AIC J5 Mating Connector**

#### 6.3.5.1 DDC-80965-5 P5 Ethernet/USB/HDMI Cable Assembly

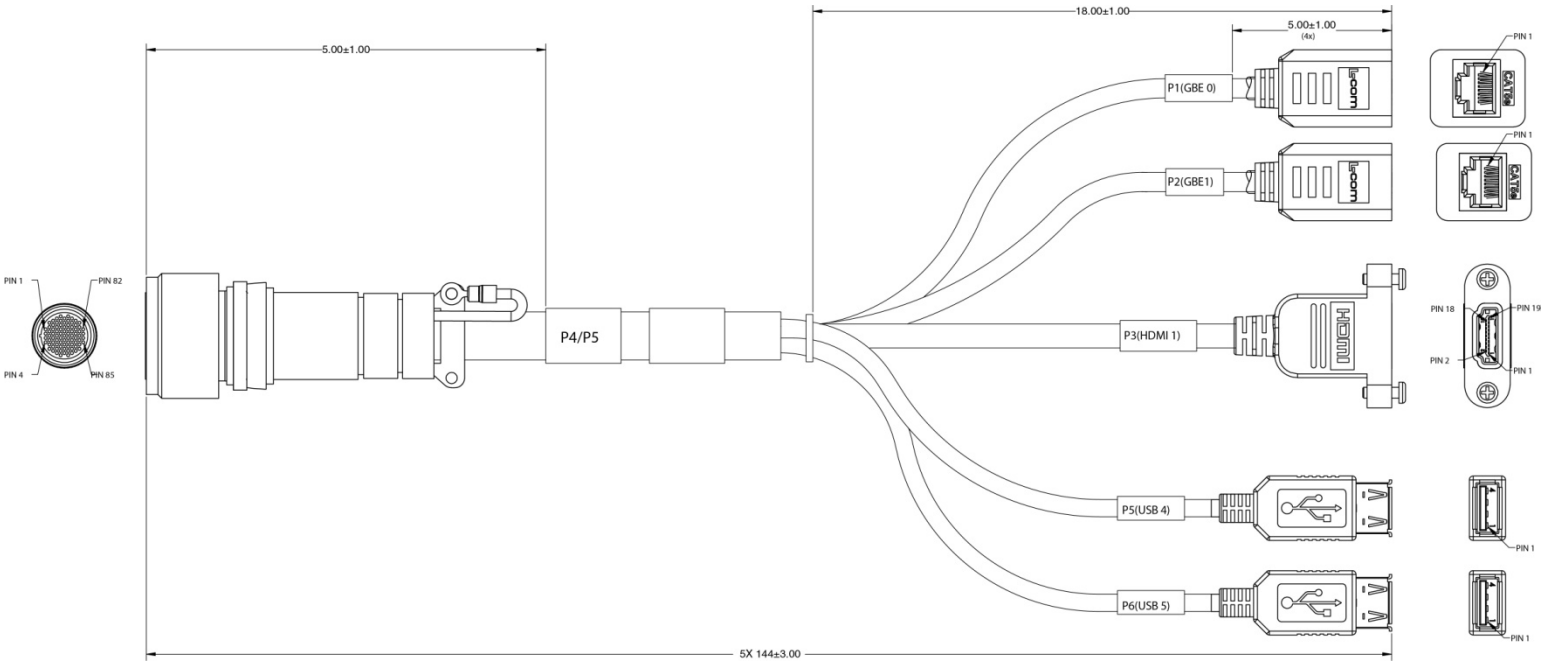


**Figure 21. DDC-80965-5 Cable Assembly**

### 6.3.6 Mating Connector for Rugged AIC J6

Rugged AIC J6 is an 85-Pin MIL style circular connector. The mating connector to J6 is an 85-pin MIL style circular connector (GlenAir 805-001-16M19-85PA). The pin out for AIC J5 is in Table 7.

**Figure 22. Rugged AIC J6 Mating Connector**

#### 6.3.6.1 DDC-82610-1 P6 DDC I/O Cable Assembly

The DDC-82610-1 is a cable assembly for the J6 connector on the R-AIC.

It provides connections to the DDC MIL-STD-1553 and ARINC 429 signals.

P6 is a Military style circular connector, GlenAir 805-001-16M19-85PA.

The other end of the cable are terminated with various D-SUB connectors.

- J1 on the cable is a Female DB-15, Norcomp 172-015-202R001.
  Its mating connector is Norcomp 172-015-102R001.
- J2, J3, J4, & J5 on the cable are Female DB-9, Norcomp 172-009-202R001
  Its mating connector is Norcomp 172-009-102R001.
- J6, J7, & J8 on the cable are Female DB-15, Norcomp 172-015-202R001.
  Its mating connector is Norcomp 172-015-102R001.

| Table 9. DDC-82610-1 Cable Assembly | | |
|---|---|---|
| **P6 – J1 I/O Pin** | **Signal** | **Description** |
| 1 | DGND | Digital Ground |
| 2 | NC | No Connect |
| 3 | B_1553_TRIG_SS_CHx1 | 1553 Channel 1 BC External Trigger/SS_FLAG |
| 4 | A_1553_TRIG_SS_CH3 | 1553 Channel 3 BC External Trigger/SS_FLAG |
| 5 | AVIO_5 | Avionics IO 5 |
| 6 | AVIO_3 | Avionics IO 3 |
| 7 | BC_DIS | Bus Controller Disable |
| 8 | AVIO_1 | Avionics IO 1 |
| 9 | IRIG_DIG_IN | IRIG-B input |
| 10 | B_1553_TRIG_SS_CH2 | 1553 Channel 2 BC External Trigger/SS_FLAG |
| 11 | A_1553_TRIG_SS_CH4 | 1553 Channel 4 BC External Trigger/SS_FLAG |
| 12 | AVIO_6 | Avionics IO 6 |
| 13 | AVIO_4 | Avionics IO 4 |
| 14 | TX_INH | Transmit Inhibit |
| 15 | AVIO_2 | Avionics IO 2 |
| **P6 – J2 I/O Pin** | **Signal** | **Description** |
| 1 | 1553_5A_L | 1553 Channel 5 Bus A- |
| 2 | 1553_5A | 1553 Channel 5 Bus A+ |
| 3 | 1553_5B | 1553 Channel 5 Bus B+ |
| 4 | 1553_5B_L | 1553 Channel 5 Bus B- |
| 5 | DGND | Digital Ground |
| 6 | 1553_6A_L | 1553 Channel 6 Bus A- |
| 7 | 1553_6A | 1553 Channel 6 Bus A+ |
| 8 | 1553_6B | 1553 Channel 6 Bus B+ |
| 9 | 1553_6B_L | 1553 Channel 6 Bus B- |
| **P6 – J3 I/O Pin** | **Signal** | **Description** |
| 1 | 1553_7A_L | 1553 Channel 7 Bus A- |
| 2 | 1553_7A | 1553 Channel 7 Bus A+ |
| 3 | 1553_7B | 1553 Channel 7 Bus B+ |
| 4 | 1553_7B_L | 1553 Channel 7 Bus B- |
| 5 | DGND | Digital Ground |
| 6 | 1553_8A_L | 1553 Channel 8 Bus A- |
| 7 | 1553_8A | 1553 Channel 8 Bus A+ |

| Table 9. DDC-82610-1 Cable Assembly | | |
|---|---|---|
| 8 | 1553_8B | 1553 Channel 8 Bus B+ |
| 9 | 1553_8B_L | 1553 Channel 8 Bus B- |
| **P6 – J4 I/O Pin** | **Signal** | **Description** |
| 1 | A_1553_3A_L | 1553 Channel 3 Bus A- |
| 2 | A_1553_3A | 1553 Channel 3 Bus A+ |
| 3 | A_1553_3B | 1553 Channel 3 Bus B+ |
| 4 | A_1553_3B_L | 1553 Channel 3 Bus B- |
| 5 | DGND | Digital Ground |
| 6 | A_1553_4A_L | 1553 Channel 4 Bus A- |
| 7 | A_1553_4A | 1553 Channel 4 Bus A+ |
| 8 | A_1553_4B | 1553 Channel 4 Bus B+ |
| 9 | A_1553_4B_L | 1553 Channel 4 Bus B- |
| **P6 – J5 I/O Pin** | **Signal** | **Description** |
| 1 | B_1553_1A_L | 1553 Channel 1 Bus A- |
| 2 | B_1553_1A | 1553 Channel 1 Bus A+ |
| 3 | B_1553_1B | 1553 Channel 1 Bus B+ |
| 4 | B_1553_1B_L | 1553 Channel 1 Bus B- |
| 5 | DGND | Digital Ground |
| 6 | B_1553_2A_L | 1553 Channel 2 Bus A- |
| 7 | B_1553_2A | 1553 Channel 2 Bus A+ |
| 8 | B_1553_2B | 1553 Channel 2 Bus B+ |
| 9 | B_1553_2B_L | 1553 Channel 2 Bus B- |
| **P6 – J6 I/O Pin** | **Signal** | **Description** |
| 1 | DGND | Digital Ground |
| 2 | NC | No Connect |
| 3 | A429_6A | ARINC 429 Channel 6A |
| 4 | A429_5A | ARINC 429 Channel 5A |
| 5 | A429_3A | ARINC 429 Channel 3A |
| 6 | A429_2A_A717_2A | ARINC 429/717 Channel 2A |
| 7 | A429_4A | ARINC 429 Channel 4A |
| 8 | A429_1A_A717_1A | ARINC 429/717 Channel 1A |
| 9 | RT_BOOT_L | RT Boot |
| 10 | A429_6B | ARINC 429 Channel 6B |
| 11 | A429_5B | ARINC 429 Channel 5B |
| 12 | A429_3B | ARINC 429 Channel 3B |
| 13 | A429_2B_A717_2B | ARINC 429/717 Channel 2B |

| Table 9. DDC-82610-1 Cable Assembly | | |
|---|---|---|
| 14 | A429_4B | ARINC 429 Channel 4B |
| 15 | A429_1B_A717_1B | ARINC 429/717 Channel 1B |
| **P6 – J7 I/O Pin** | **Signal** | **Description** |
| 1 | DGND | Digital Ground |
| 2 | NC | No Connect |
| 3 | A429_12A | ARINC 429 Channel 12A |
| 4 | A429_11A | ARINC 429 Channel 11A |
| 5 | A429_9A | ARINC 429 Channel 9A |
| 6 | A429_8A | ARINC 429 Channel 8A |
| 7 | A429_10A | ARINC 429 Channel 10A |
| 8 | A429_7A | ARINC 429 Channel 7A |
| 9 | NC | No Connect |
| 10 | A429_12B | ARINC 429 Channel 12B |
| 11 | A429_11B | ARINC 429 Channel 11B |
| 12 | A429_9B | ARINC 429 Channel 9B |
| 13 | A429_8B | ARINC 429 Channel 8B |
| 14 | A429_10B | ARINC 429 Channel 10B |
| 15 | A429_7B | ARINC 429 Channel 7B |
| **P6 – J8 I/O Pin** | **Signal** | **Description** |
| 1 | DGND | Digital Ground |
| 2 | NC | No Connect |
| 3 | A429_18A | ARINC 429 Channel 18A |
| 4 | A429_17A | ARINC 429 Channel 17A |
| 5 | A429_15A | ARINC 429 Channel 15A |
| 6 | A429_14A | ARINC 429 Channel 14A |
| 7 | A429_16A | ARINC 429 Channel 16A |
| 8 | A429_13A | ARINC 429 Channel 13A |
| 9 | NC | No Connect |
| 10 | A429_18B | ARINC 429 Channel 18B |
| 11 | A429_17B | ARINC 429 Channel 17B |
| 12 | A429_15B | ARINC 429 Channel 15B |
| 13 | A429_14B | ARINC 429 Channel 14B |
| 14 | A429_16B | ARINC 429 Channel 16B |
| 15 | A429_13B | ARINC 429 Channel 13B |

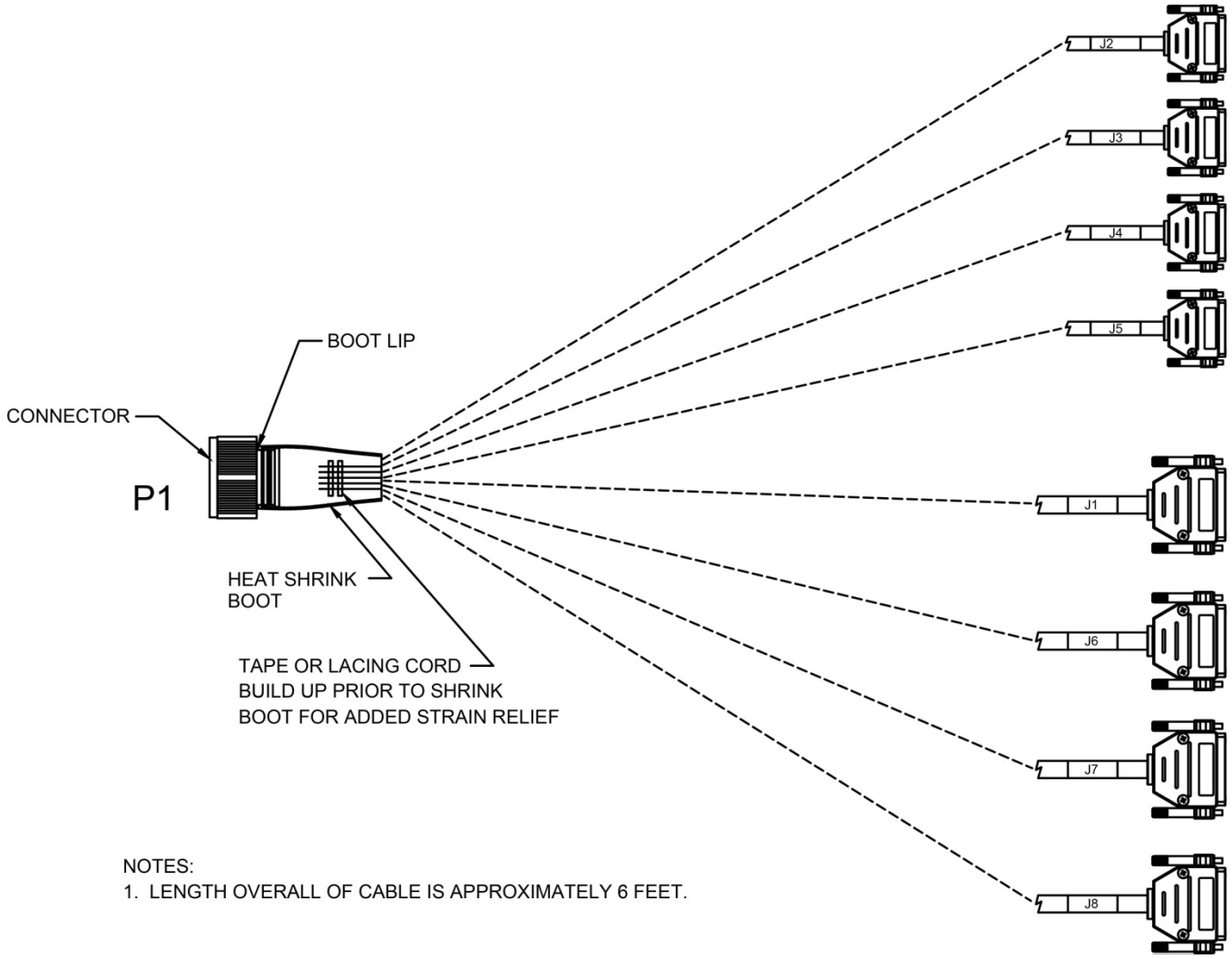


**Figure 23. DDC-82610-1 Cable Assembly**

# 7 ENVIRONMENTAL SPECIFICATIONS

## 7.1 Reliability

The Mean-Time-Between Failures (MTBF) for the system is a minimum of 65,000 operating hours, calculated at 30°C.

## 7.2 Maintainability

The system is considered a Line Replacement Unit (LRU) and is repairable only by Data Device Corporation or an authorized repair facility. Periodic maintenance of the system is not required.

## 7.3 Environmental, Electrical, and Dimensional Specifications

**Table 10. Environmental, Electrical, and Dimensional Specifications**

| | | |
|---|---|---|
| **Shock** | **MIL-STD-810G Method 516.6** | |
| | **Procedure** | **Description** |
| | I | Functional Shock |
| | IV | Transit Drop packaged |
| | V | Crash Hazard |
| | VI | Drop Test & Bench Handling |
| **Vibration** | MIL-STD-810G Method 514.6 | CAT 14 (Helicopter), D-9 |
| | | CAT 4 (2 Wheeled Vehicle), C-7 |
| | | CAT 4 (4 Wheeled Vehicle), C-7 |
| | | CAT 7 (Transport), C-17 |
| | MIL-STD-167 | |
| | RTCA/DO-160-F | Section 8.5.1, 8.6 and 8.7.2<br>CAT S, R, Class C & C1, Aircraft |
| **Acceleration** | MIL-STD-810G | Method 513.6 Procedure II |
| **Bench Handling** | 4” unpackaged drop at 45º angle | |
| **Drop Test (packaged)** | MIL-STD-810G | Method 516.5 Procedure VI |
| **Humidity** | MIL-STD-810G, Method 507.5, Procedure I<br>95% non-condensing for 400 hours | |
| **Rain, moisture, water spray** | IEC 60529 (Edition 2.1) IP67 \| ENMA 250-2008 Type 6 | |
| **Rain** | Per MIL-STD-810G Method 506.5 Procedure I | |
| **Ice and Freezing Rain** | Per MIL-STD-810G Method 521.3 Procedure I | |
| **Fluid Exposure** | Per MIL-STD-810G Method 504.1 Procedure II | |

| Table 10. Environmental, Electrical, and Dimensional Specifications | |
|---|---|
| **Blowing Sand** | Per MIL-STD-810G Method 510.5 Procedure I |
| **Blowing Dust** | Per MIL-STD-810G Method 510.5 Procedure II |
| **Salt Spray / Fog** | Per MIL-STD-810G Method 509.5 5% for 48 hours |
| **Fungal Growth** | Per MIL-STD-810G Method 508.6 duration 28 days |
| **Immersion** | Per MIL-STD-810G Method 512.4 |
| **Altitude** | System designed to support 30,000ft (not tested) |
| **Temperature** | |
| **Storage** | -55°C to +125°C |
| **Operating** | -40°C to 71°C at sea level (natural convection)<br>MIL-STD-810G Method 501.5 Procedure I and II<br>MIL-STD-810G Method 502.5 Procedure I, II and III<br>MIL-STD-810G Method 503.5 Procedure I (Figures 1, 2, and 3)<br>DO-160G Section 4.5.1 thru 4.5.5 and 5.0 |
| **Protection** | Over Temperature protection PSU shutdown above +100°C +/-5°C hysteresis<br>Under Temperature protection PSU shutdown below -40°C +/-5°C hysteresis |
| **Electrical** | |
| **DC Power supply** | +28 VDC input (18VDC – 36VDC)<br>MIL-STD-1275E (vehicle), under normal, generator-only, and cranking conditions, including spike and transients.<br>MIL-STD-704 (aircraft)<br>Max: 35 Watts (Processor Dependent)<br>Typical: 25 Watts (Processor Dependent) |
| **Isolation Resistance** | Bonding as per MIL-STD-1686C Table 3.5-3 (500V to output or enclosure) |
| **Input transient protection** | MIL-STD-704<br>MIL-STD-1275E<br>Unit remains operational with the following input power conditions:<br>Ripple Emission: 50 Hz to 200 kHz @ 4 VPP<br>Ripple Immunity: 50 Hz to 200 KHz @ 4 VPP<br>Spike Immunity: +600V for a 50 micro-second duration (0.15 joules)<br>Sag/Surge Immunity: +24V -> +18 -> +24 V @ 100 milli-second duration<br>Unit survives the following input power conditions:<br>Ripple Immunity: 50 Hz to 200 kHz @ 14VPP<br>Sag/Surge Immunity: 24 ->10 -> 24 V @ 500 milli-second duration<br>Sag/Surge Immunity: 24V -> 100V -> 24V @ 500 milli-second duration |
| **Shutdown** | Over-voltage shutdown with auto-recovery<br>Under-voltage lockout with auto-recovery<br>Dual over current protection with factory programmable surge limiting and active fuses |
| **Reverse Polarity Protection** | <=100V @ <20mA |
| **EMC** | MIL-STD-461E<br>RTCA/DO-160F, Section 20-21 |

| Table 10. Environmental, Electrical, and Dimensional Specifications | | |
|---|---|---|
| **Physical Dimensions** | | |
| **Height** | 3.9” | 99 mm |
| **Depth** | 5.6” | 142 mm |
| **Width** | 8.5” | 216 mm |
| **Weight** | Less than 6 lbs<br>5.25 lbs with one internal SSD | Less than 2.7 kg<br>2.4 kg with one internal SSD |

# 8 ORDERING INFORMATION

| Table 11. Part Numbering and BOM | | | | | |
|---|---|---|---|---|---|
| **Part Number** | **Description** | **Processor/RAM** | **Storage** | **Kontron Part Number** | **Notes** |
| BU-67124W101L-C00 | Rugged AIC,HL-i5-4422E,16GB DRAM, 128GB-SSD | COMe-bHL6RXT i5-4422E, 16GB DDR3 SDRAM (ECC) | 128GB mSATA System Storage | 78510901-101 - Base Unit | System can be preinstalled with Ubuntu 14.04 Linux or Windows 7 from Kontron. |
| BU-67124W102L-C00 | Rugged AIC,HL-i5-4422E,16GB DRAM, 128GB-SSD-2xRSSD | COMe-bHL6RXT i5-4422E, 16GB DDR3 SDRAM (ECC) | 128GB mSATA System Storage, with Removable SSD Bay (2x) | 78510901-102 - Base Unit with RSSD | System can be preinstalled with Ubuntu 14.04 Linux or Windows 7 from Kontron. |
| BU-67124W121L-C00 | Rugged AIC,HL-i5-4422E,16GB DRAM, 256GB-SSD | COMe-bHL6RXT i5-4422E, 16GB DDR3 SDRAM (ECC) | 256GB mSATA System Storage | 78510901-101 - Base Unit, with 256GB internal mSATA installed | System can be preinstalled with Ubuntu 14.04 Linux or Windows 7 from Kontron. - Need capability to order and install 256GB mSATA at DDC to lower costs. |
| BU-67124W122L-C00 | Rugged AIC,HL-i5-4422E,16GB DRAM, 256GB-SSD-2xRSSD | COMe-bHL6RXT i5-4422E, 16GB DDR3 SDRAM (ECC) | 256GB mSATA System Storage, with Removable SSD Bay (2x) | 78510901-102 - Base Unit with RSSD, with 256GB internal mSATA installed | System can be preinstalled with Ubuntu 14.04 Linux or Windows 7 from Kontron. - Need capability to order and install 256GB mSATA at DDC to lower costs. |
| BU-67124W131L-C00 | Rugged AIC,HL-i5-4422E,16GB DRAM, 512GB-SSD | COMe-bHL6RXT i5-4422E, 16GB DDR3 SDRAM (ECC) | 512GB mSATA System Storage | 78510901-101 - Base Unit, with 512GB internal mSATA installed | System can be preinstalled with Ubuntu 14.04 Linux or Windows 7 from Kontron. - Need capability to order and install 512GB mSATA at DDC to lower costs. |
| BU-67124W132L-C00 | Rugged AIC,HL-i5-4422E,16GB DRAM, 512GB-SSD-2xRSSD | COMe-bHL6RXT i5-4422E, 16GB DDR3 SDRAM (ECC) | 512GB mSATA System Storage, with Removable SSD Bay (2x) | 78510901-102 - Base Unit with RSSD, with 512GB internal mSATA installed | System can be preinstalled with Ubuntu 14.04 Linux or Windows 7 from Kontron. - Need capability to order and install 512GB mSATA at DDC to lower costs. |

| Table 12. Cable Set Part Numbering and BOM | | | | |
|---|---|---|---|---|
| **Part Number** | **Description** | **Length** | **Connector Part Number** | **Kontron Part Number** |
| DDC-80965-1 | Cable Assy, Rugged AIC, P1 Power Cable, BU-67124W | 6 foot | 805-002-16M8-23 (GlenAir) | 5007687-1 |
| DDC-80965-2 | Cable Assy, Rugged AIC, P2 Maintenance Cable, BU-67124W | 6 foot | 805-002-16M12-26PA (GlenAir) | 5007682-1 |
| DDC-80965-3 | Cable Assy, Rugged AIC, P3 USB 3.0 Cable, BU-67124W | 6 foot | 880-002RA-xxx | |
| DDC-80965-4 | Cable Assy, Rugged AIC, P4 I/O Cable, BU-67124W | 6 foot | 805-002-16M19-85PD (GlenAir) | 5007685-1 |
| DDC-80965-5 | Cable Assy, Rugged AIC, P5, I/O Cable, BU-67124W | 6 foot | 805-002-16M19-85PC (GlenAir) | 5007686-1 |
| DDC-82610-1 | Cable Assy, Rugged AIC, P6, DDC I/O Cable, BU-67124W | 6 foot | 805-001-16M19-85PA (GlenAir) | DDC-82610-1 |

Unique part numbers shall be assigned for the individual cable sets for each Front Panel Interface Connector. Custom cable sets may be required to support specific Customer configuration. Connector part numbers and back shell information shall be documented in the Product Manuals to enable customers to build mating cables for development or deployment.

# Data Device Corporation

## Leadership Built on Over 50 Years of Innovation

### Military | Civil Aerospace | Space | Industrial

Data Device Corporation (DDC) is a world leader in the design and manufacture of high-reliability Connectivity, Power and Control solutions (Data Networking; Power Distribution, Control and Conversion; Motor Control and Motion Feedback) for aerospace, defense, space, and industrial applications. With awards for quality, delivery and support, DDC has served these industries as a trusted resource for more than 50 years... providing proven solutions optimized for efficiency, reliability, and performance. Data Device Corporation brands include DDC, Beta Transformer Technology Corporation, National Hybrid Inc., North Hills Signal Processing Corporation, Pascall Electronics Ltd., and XCEL Power Systems Ltd. DDC is headquartered in Bohemia, NY and has manufacturing operations in New York, California, Mexico, and the United Kingdom.

Beta Transformer Technology Corporation, a subsidiary of DDC and leader in high reliability transformer, magnetic and cable assembly solutions for the aerospace, defense, and space industries, offers field proven transformer solutions for the most demanding industrial environments… extreme temperature, shock, vibration, dust, fluid, and radiation. Beta Transformer developed many of the world's smallest transformers and inductors, and is recognized for superior quality and performance. Beta Transformer headquarters along with their main design and manufacturing operations are located in Bohemia, NY. Beta has expanded production capabilities through their manufacturing operations at Beta Transformer Mexico, S. DE R L. DE C.V., located in Ensenada, Mexico, and North Hills Signal Processing Corporation in H. Matamoros Tamaulipas, Mexico, both subsidiaries of Beta Transformer Technology Corporation.

XCEL Power Systems and Pascall Electronics are divisions of DDC Electronics, Ltd., a subsidiary of Data Device Corporation. DDC Electronics, Ltd. specializes in the design and manufacture of power supply solutions for extreme environments. With over 30 years of experience in the defense, aerospace and industrial sectors, DDC Electronics is a trusted source for complete solutions in the design, development and manufacture of electronic power conversion products – from single converters to complex multi- function conversion systems. DDC Electronics products are the first choice for power with In-Flight Entertainment & Connectivity (IFEC) and defense systems. There are more than 170,000 Pascall power supply units installed on commercial aircraft. XCEL and Pascall power supply units are in service with Ground, Air and Naval forces across the world, powering state of the art electronic systems, and trusted by industry leaders to deliver reliable proven performance in some of the most challenging environments to be found anywhere. DDC Electronics, Ltd. headquarters, along with the XCEL Power Systems design operations and the Pascall Electronics factory are located in the UK.

DDC Microelectronics, a division of Data Device Corporation and formerly the space microelectronics division of Maxwell Technologies, is a leading developer and manufacturer of innovative, cost-effective, space-qualified microelectronics solutions for satellites and spacecraft. DDC Microelectronics has provided space-qualified radiation-tolerant and radiation-shielded products, including semiconductors and single-board computers, to the space industry for more than two decades. DDC radiation mitigated power modules, memory modules, and single board computers incorporate powerful commercial silicon for superior performance and high reliability in space applications. DDC Microelectronics specializes in understanding the radiation performance of commercial semiconductors, qualifying selected components for use in space, integrating them with proprietary radiation mitigation technologies, and manufacturing and screening these products in a DLA approved MIL-PRF-38534 facility, located in southern California.

## Your Solution Provider for... Connectivity, Power, and Control

### Connectivity

**Data Bus Solutions**
DDC is the market leader in high reliability data bus solutions for MIL-STD-1553/1760, ARINC 429, Fibre Channel, Ethernet, CANbus, Serial I/O and other protocols, and is one of the few companies able to provide a full range of computers, boards, hybrids and ASIC solutions for aerospace, defense and space applications.

### Power

**Power Supplies**
DDC supplies highly customized power products to the aerospace, defense, maritime and satellite communications industries.

**Solid-State Power Controllers**
DDC's programmable solid-state power controllers provide simple and reliable power management for aerospace and defense systems.

### Control

**Motor Controllers and Drives**
DDC is the world leader in high reliability torque, speed, and position controllers and drives engineered to operate in demanding environments.

**Motion Feedback**
DDC is the world leader in the design and manufacture of Synchro/Resolver-to-Digital and Digital-to-Synchro/Resolver converters.

### *Certifications*

Data Device Corporation is ISO 9001:2008, AS 9100 Rev C, EN 9100, and JIS Q9100 certified. DDC has been granted certification by the Defense Logistics Agency, Land & Maritime (DLA) for manufacturing Class D, G, H, and K hybrid products in accordance with MIL-PRF-38534. Industry documents used to support DDC's certifications and Quality system are MIL-STD-883, ANSI/NCSL Z540-1, IPC-A-610, MIL-STD-202, JESD-22, and J-STD-020.

Beta Transformer Technology Corporation (BTTC) and its subsidiaries are ISO 9001:2008 and AS 9100 Rev C certified. BTTC has been granted certification as a qualified source of transformers by the Defense Logistics Agency, Land & Maritime (DLA) and is listed on the QPL for products MIL-PRF 21038/27-01 through -31 Product Levels C, M and T.

DDC Electronics, Ltd.'s XCEL Power Systems and Pascall Electronics manufacturing operations are ISO 9001:2008, AS 9100 Rev C, EN9100 and ISO 14001:2004 certified.

Connectivity Power Control

*Your Solution Provider for... Connectivity, Power, and Control*

**The first choice for more than 50 years—DDC**
DDC is the world leader in the design and manufacture of high reliability data interface products, motion control, and solid-state power controllers for aerospace, defense, and industrial automation.

## Inside the U.S. : Call Toll-Free 1-800-DDC-5757

**DDC Headquarters and Main Factory**
105 Wilbur Place, Bohemia, NY 11716-2426
Tel: (631) 567-5600
Toll-Free, Customer Service: 1-800-DDC-5757
www.ddc-web.com

**DDC Microelectronics**
13000 Gregg Street, Suite C, Poway, CA 92064
Tel: (631) 567-5600
Toll-Free, Customer Service: 1-800-DDC-5757

**Beta Transformer Technology Corporation**
40 Orville Drive, Bohemia, NY 11716-2426
Tel: (631) 244-7393
www.BTTC-Beta.com

**Beta Transformer Mexico, S. DE R L. DE C.V.**
Avedina 20 De Noviembre
959 Zona Centro, Ensenada, Baja Mexico
Tel: (631) 244-7393

**North Hills Signal Processing Corporation**
6851 Jericho Turnpike, Syosset, NY 11791
Tel: (631) 244-7393
www.nhsignal.com

**North Hills Signal Processing Corporation**
Avedina Jose Escandon y Helquera No. 21
Km. 8.5 Carretera Lauro Villar
H. Matamoros Tamaulipas, Mexico
Tel: (631) 244-7393

## Outside the U.S. : Call 1-631-567-5600

**DDC Electronics Ltd Headquarters and Pascall Electronics Ltd. Factory**
Westbridge Business Park, Cothey Way
Ryde, Isle of Wight, PO33 1QT, UK
Tel: +44 (0) 1983 817300
www.pascall.co.uk

**United Kingdom: DDC U.K., Ltd**
James House, 27-35 London Road, Newbury,
Berkshire RG14 1JL, England
Tel: +44 1635 811140

**XCEL Power Systems Ltd**
Brunswick Road, Cobbs Wood Industrial Estate
Ashford, Kent, TN 23 1EH, UK
Tel: +44 (0) 1233 656800
www.xcelpower.com

**France: DDC Electronique**
84-88 Bld de la Mission Marchand
92411 Courbevoie Cedex, France
Tel: +33-1-41-16-3424

**Germany: DDC Elektronik GmbH**
Triebstrasse 3, D-80993 München, Germany
Tel: +49 (0) 89-15 00 12-11

**Japan: DDC Electronics K.K.**
Suidobashi Sotobori-dori Bldg, 8F, 1-5,
Koraku 1-chome,
Bunkyo-ku, Tokyo 112-0004, Japan
Tel: 81-3-3814-7688
Web site: www.ddcjapan.co.jp

**Asia: DDC - RO Registered in Singapore**
Blk-327 Hougang Ave 5 #05-164
Singapore 530327
Tel: +65 6489 4801

**India: DDC Electronics Private Limited**
C-31, C/O Quest Offices Pvt. Ltd.
10th Floor, Raheja Towers
M.G Road, Bangalore 560001, India
Tel: +91 080 301 10 200