USER GUIDE

# AF4608 User Guide

User Guide, Doc. Rev. A1

Doc. ID: [73002008-UG]

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# AF4608 USER GUIDE - USER GUIDE

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# Revision History

| Revision | Brief Description of Changes | Date of Issue |
|---|---|---|
| A | Initial Release | 2017-July-25th |
| A1 | Updates to the following Sections for clarity:<br>3.3 Cellular Modems<br>3.7.6 Modem Disable/Enable | 2018-June-19th |
| | | |
| | | |

# Symbols

The following symbols may be used in this manual

| | |
|---|---|
| ⚠DANGER | DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury. |
| ⚠WARNING | WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. |
| ⚠CAUTION | CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. |
| NOTICE | NOTICE indicates a property damage message. |
|  | **Electric Shock!**<br>This symbol and title warn of hazards due to electrical shocks (> 60 V) when touching products or parts of them. Failure to observe the precautions indicated and/or prescribed by the law may endanger your life/health and/or result in damage to your material.<br>Please refer also to the "High-Voltage Safety Instructions" portion below in this section. |
|  | **ESD Sensitive Device!**<br>This symbol and title inform that the electronic boards and their components are sensitive to static electricity. Care must be taken during all handling operations and inspections of this product in order to ensure product integrity at all times. |
|  | **HOT Surface!**<br>Do NOT touch! Allow to cool before servicing. |
|  | This symbol indicates general information about the product and the user manual.<br>This symbol also indicates detail information about the specific product configuration. |
|  | This symbol precedes helpful hints and tips for daily use. |

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# 1. Introduction

This user guide provides general information, hardware instructions, operating instructions and functional description of the ACE Flight 4608 system.

This user guide is written to cover, as much as possible, the range of people who will handle or use the system, from unpackers/inspectors, system engineers and installation technicians to hardware and software engineers. Most chapters assume a certain amount of knowledge on the subject of single board computer architecture, interfaces, peripherals, system, cabling, grounding and aircraft systems.

## 1.1 STANDARDS

Table 1: Standards

| Standard | Description |
|---|---|
| ARINC 763-3 | Network Server System |
| D6-36440 | Boeing Standard Cabin Systems Requirement Document FED-STD-595 Colors Used in Federal Procurement |
| ARINC 429P2 | Mark 33 Digital Information Transfer System (DITS), Part 2 – Discrete Data Standards |
| ARINC 600 | Air Transport Avionics Equipment Interfaces |
| ADB.111 | Airbus Requirements Document |
| RTCA/DO-836 | Cabin Standard Enclosures – Modular Rack Principle (MRP) |
| RTCA/DO-160G | Environmental Conditions and Test Procedures For Airborne Equipment |
| RTCA/DO-178C | Software Considerations in Airborne Systems and Equipment |
| RTCA/DO-254 | Design Assurance Guidance for Airborne Electronic Hardware |
| FAR-25.853a | Federal Aviation Regulations for Flammability ISO 9001/2008 International Organization for Standardization, Quality Management ANSI/IPC-A-620 Acceptability of Electronic Assemblies ANSI/J-STD-002 Solderability Tests for Component Leads MIL-C-5542 Chemical Conversion Coatings on Aluminum and Aluminum Alloys |
| FAR 25.869 | Federal Aviation Regulations Electrical System Fire and Smoke Protection |

| | |
|---|---|
| RTCA/DO-313 | Certification Guidance for Installation of Non-Essential, Non-Required Aircraft Cabin Systems & Equipment |

## 1.2 SUPPORT DOCUMENTATION

Documentation listed available under NDA

Table 2: Support Documentation

| Document Number | Description |
|---|---|
| 73002008 | ACE Flight 4608 LRU Drawing (installation drawing) |
| 73002008-QTR | ACE Flight 4608 DO-160G Qualification Test Report |
| 73002008-DDP | ACE Flight 4608 Declaration of Design and Performance |
| 73002008-MDL | ACE Flight 4608 Master Data List |
| 73002008-FMEA | Failure Mode and Effects Analysis |
| FASTPATH CLI GUIDE | Ethernet Switch CLI Reference Manual |
| FASTPATH CONFIGURATION GUIDE | Ethernet Switch FASTPATH Configuration Guide |

**NOTICE** Check with the factory for latest product revisions or for additional documentation

## 1.3 TECHNICAL SUPPORT

The team of Product Specialists, Engineers and Technical support personnel at Kontron and/or its subsidiaries are available for technical support. We are committed to making our product easy to use and will help you use our products in your systems.

Please consult our Web site at http://www.kontron.com/support for the latest product documentation, utilities, drivers and support contacts.

## 1.4 IMPORTANT INSTRUCTIONS

The following general instructions should always be followed in order to assure the proper operation of the unit, the safety of operators and the preservation of warranty coverage.

Only a competent technician familiar with electro-mechanical assemblies should be performing any testing or troubleshooting of the unit.

Do not remove any identification plates, serial numbers or warning labels

## 1.5 PRECAUTIONS FOR INSTALLING THE SYSTEM


Follow the corresponding instructions in this manual when installing/mounting the system.

Observe all specified dimensions required for mounting included in the LRU drawing (PN: 73002008) with outline dimensions

Observe all specified dimensions required for mounting included in the drawing with outline dimensions. The system is designed to mate to an ARINC 600, 4MCU equipment tray.

The Server requires a minimum of 10CFM of forced air cooling and can support either direction of airflow, draw-through or blow-through.

Leave approximately 4.0” (100 mm) of free space to the front of the unit in order to have access to the front door.

Follow the local/national regulations for grounding. A ground bonding measurement (between chassis ground and the mounting surface) should be conducted to ensure proper safety and EMI characteristics are maintained.

The voltage feeds must not be overloaded. Adjust the cabling and the external overcharge protection to correspond with the electrical data indicated on the type label.

# 2. Product Description

The Server is a network distribution system designed specifically for rugged airborne applications.

The Server Unit includes a high-end eight core processor, a multi-port Gigabit Ethernet Switch, and removable mass storage for content. The Server can be used as head end component of an In-flight Entertainment System, data distribution system or other flight communication server applications.

The Server Unit includes aircraft level discrete inputs and outputs to facilitate event notification and equipment status to and from other aircraft systems, including remote control ON/OFF. The product is equipped with a power supply unit capable of operating at 115Vac, 360 – 800Hz power with a 200msec holdup capability for power interruptions. The Server Unit can communicate with other elements of the aircraft data distribution system over10/100/1000Base-T Ethernet ports.


Figure 1 In-Flight Entertainment Equipment Diagram

## 2.1 GENERAL

The Server leverages state-of-the-art Commercial Off-the-Shelf (COTS) hardware to establish a versatile, high performance network Server Unit. Figure 2 depicts the system block diagram of the Server Unit.

## 2.2 MAIN FEATURES

The main features of the Server include:

- Form Factor: ARINC 600, 4MCU, Air-Flow-Through
- Processor: Intel® Broadwell D-1539, 8 Core, 1.6Ghz, COM Express® form factor
  - 32GB of DDR4 System Memory
- Discrete Inputs/Outputs: 6 Discrete Input and 4 Outputs per ARINC 763
- Aircraft Data Bus: 6 Rx and 1 Tx/Rx ARINC 429 channels
- Ethernet Ports:
  - Ten Rear 10/100/1000BaseT ports to interface to other airborne components.
  - One Front Panel 10/10/1000BaseT port
- Mass Storage:
  - 2x Front removable Solid State Drives (SSD)
  - 2x Internal Fixed Solid State Drive (SSD)
- Front Panel Universal Subscriber Interface Module (USIM) Card accessibility
- Analog audio outputs to drive PA loudspeakers
- 2x M.2 card slot for cellular modems
- Internal (AC/DC) power with 200msec of interruption holdup capability

The system consists of the following major components and subsystems:

- Carrier with COM Express Processor Module, ARINC 429 module and fixed storage
- Power Supply Unit (PSU) with built-in hold-up (200msec)
- 16-port Ethernet Switch
- 2x Removable Solid State Drives (ordered separately)
- Signal Interface Board (SIB)
- Front I/O Board & Status Indicator LED
- External Connectors: ARINC 600 connector, Front Panel Maintenance (USB, RS232, RJ45), and USIM slots

## 2.3 FUNCTIONAL BLOCK DIAGRAM

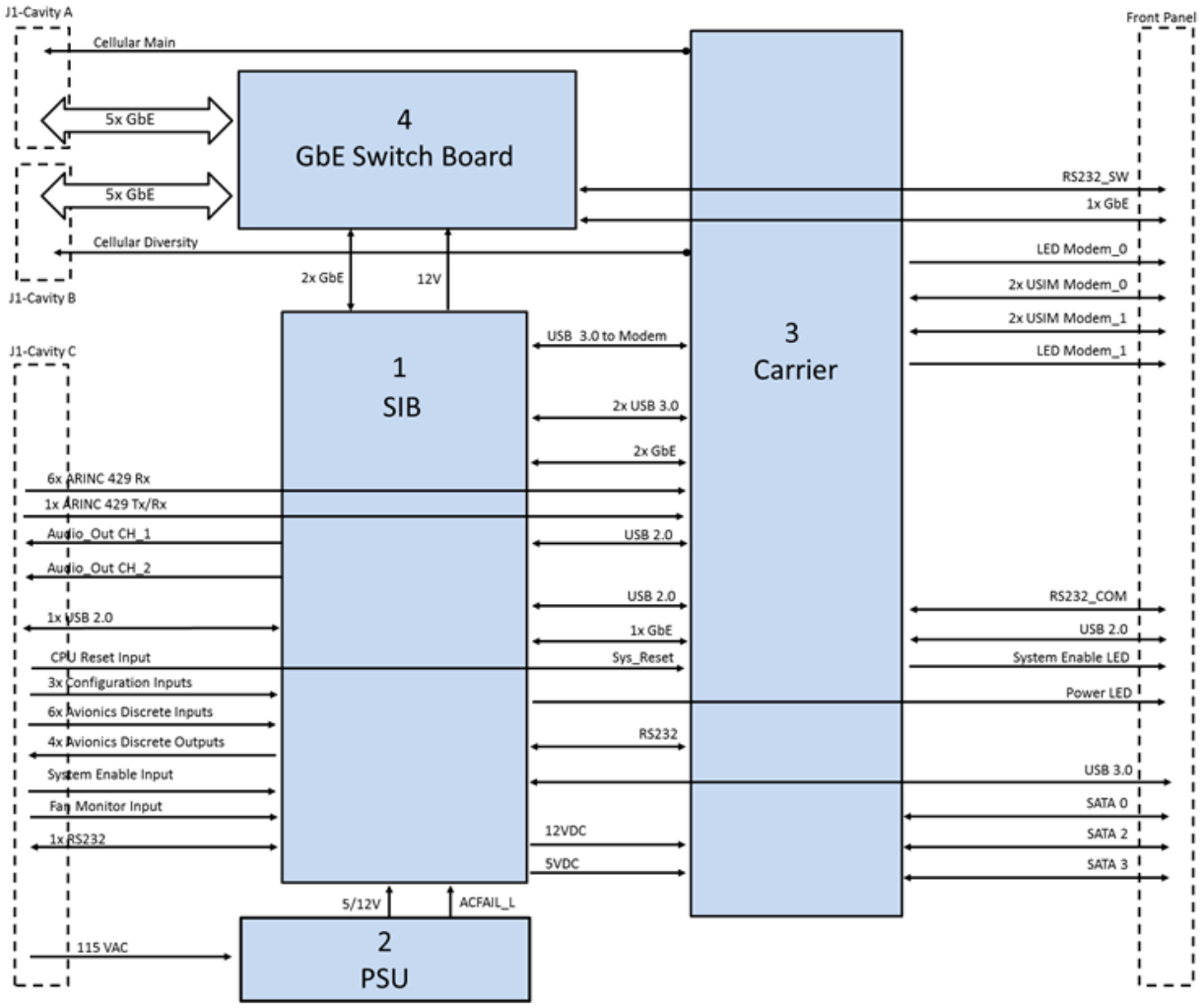



Figure 2 System Block Diagram

## 2.4 ORDERABLE PART NUMBERS

The following part numbers are available to order.

Table 3: Orderable part numbers

| Model Number | Description |
|---|---|
| 73002008-104 | LRU, SERVER, ACE FLIGHT 4608, 4G |
| **Removable Solid State Drives (RSSD)** | |
| 5140550-3 | SSD ASSY, REMOVABLE, 800GB |
| 5140550-4 | SSD ASSY, REMOVABLE, 1.6TB |
| **LAB EQUIPMENT** | |
| 73002008-004 | LRU, SERVER, ACE FLIGHT 4608, 4G, NO PMA |
| 73002008-500 | AIR TRAY & BREAKOUT CABLE ASSY |
| 5156700-1 | TEST BOX, ACE FLIGHT SERVER |

## 2.5 PHYSICAL CHARACTERISTICS

The system has the following characteristics.

Table 4: Physical Characteristics

| Feature | Description |
|---|---|
| Input Power | 97-134 AC Volts, 47-800Hz<br>90W (0.8A) max power |
| Electrical Interfaces | J1: ARINC CONNECTOR<br>Front I/O (behind access door):<br>Ethernet (RJ45), USB 3.0, DB-26 (Serial, USB 2.0), USIM, Removable Drive Bay (RSSD) |
| Weight | 12.4 Lbs \| 5.6 KG (fixed SSD only) |
| Dimensions | 4.88” W x 7.64” H x 12.65” L<br>123.95mm W x 194.06mm H x 321.31mm L<br>ARINC 600, 4MCU compliant |
| Operating Temperature | -15°C to +55°C |
| Storage Temperature | -40°C to +85°C |

## 2.6 SOFTWARE COMPONENTS

The ACE Flight Server is delivered with a pre-configured Linux software load installed on the internal mSATA SSD. This software allows the user to boot and use the system with minimal configuration steps.

The ACE Flight Server software components are as follows:

- Linux OS, 64-bit, based on Ubuntu 16.0.4 LTS
- uEFI BIOS
- ARINC 429 driver libraries
- Cellular Modem firmware
- Signal Interface Board (SIB) software
- Ethernet Switch Firmware
- Utilities and test code to support system validation

Additional information on the COMe-Module is found on the Kontron Customer Section website (customer account required):

- http://emdcustomersection.kontron.com

For additional software or API support, please contact Kontron technical support.

# 3. Hardware Components

## 3.1 PROCESSOR MODULE

The processor module is based on a Kontron COM Express module that is Type 6 compatible to the PICMG specification COM.0 Rev 2.1 and has the following main features:

| Feature | Description |
|---|---|
| Intel Processor | D-1539 (Intel® Xeon® Processor D Family) |
| # of Cores | 8 |
| # of Threads | 16 |
| Clock Speed | 1.6 GHz (Max Turbo Frequency 2.20 GHz) |
| L2 Cache | 12 MB |
| Memory Type | 32 GB DDR4-2133 |
| Ethernet (NIC) | Intel I210 Gigabit Ethernet Controller |
| Security Features | Infineon SLB9665XT 2.0 |
| Instruction Set | 64-bit |
| Lithography | 14 nm |

The 14nm Intel® Xeon® processor D-1500 product family with 37.5mm x 37.5mm package size (1667 Ball FCBGA) supports:

- Performance:
  - Intel® 64
  - Intel® Turbo Boost Technology 2.0
  - Intel® Advanced Vector Extensions 2 (AVX2)
  - Memory Bandwidth Monitoring
  - Xeon Class Reliability Availability Serviceability (RAS) includes:
  - Error-Correcting Code (ECC) Single Device Data Correction (SDDC),
  - Memory Demand and Patrol Scrubbing,
  - Data Scrambling with address,
  - End-to-end Cyclic Redundancy Check (ECRC) on PCIe,
  - PCIe and GbE Advanced Error Reporting (AER),
  - Intel® Corrected Machine Check Interrupt (CMCI) Virtualization.
- Virtualization:
  - Intel® Virtualization Technology (VT-x)
  - Advanced Programmable Interrupt Controller virtualization (APICv)
  - Intel® Virtual Machine Control Structure Shadowing (Intel® VMCS Shadowing)
  - Intel® Virtualization Technology for Directed I/O (VT-d)
  - Extended Page Table Accessed and Dirty bits (A/D bits for EPT)
  - Posted Interrupts,
  - Single-Root Input/Output Virtualization (SR-IOV)
  - VT Cache Quality of Service (QoS) and QoS Monitoring/Enforcement
- Security:
  - Intel® Trusted Execution Technology (TXT) (requires custom BIOS)
  - Intel® Advanced Encryption Standard New Instructions (AES-NI) (requires custom BIOS)

    - Intel® OS Guard (Supervisor Mode Access Protection (SMAP))
    - Intel® Secure Key (RDSEED)
- Intel® Hyper-Threading Technology
- Configurable Thermal Design Power (cTDP)
- Intel® Thermal Monitoring Technologies
- Node Manager Base Power Management (ME FW)

For further information on the Kontron COM Express module, reference the COMe-bBD6 User Guide from the Kontron website or contact Kontron Technical Support.

## 3.2 ETHERNET SWITCH MODULE

The Ethernet switch has a total of 16-ports, ten (10/100/1000) ports and a single (10/100) port are available on the ARINC 600 connector (J1) as standard Quadrax type contacts (one port is a direct connection to the processor module).

The following documentation is available for more details on the Ethernet Switch interface:

- Ethernet Switch CLI Reference Manual
- Ethernet Switch FASTPATH Configuration Guide

The Ethernet switch has the following features:

- Ports: 16-ports all 10/100/1000Mbps, BaseT
- Interface Ports: Reset, RJ-45 (10/100/1000Mbps), RS232 Console
- Management: CLI, HTTP/HTTPS, SNMP
- MAC Address Table Size: 8K
- Network Protocols:
    - 802.3 Ethernet
    - 802.1w Rid Spanning Tree
    - 802.3u Fast Ethernet
    - 802.1s Multiple Spanning Tree Group
    - 802.3ad Gigabit Ethernet
    - 802.1d Spanning Tree
    - 802.1p Priority Tags
    - 802.1Q VLAN
    - 802.3ad Link Aggregation Control
    - 802.1X Authentication Support
- Spanning Tree Support: 802.1d Standard STP; 802.1w Rid STP; 802.1s Multiple STP
- QoS: On all ports
- IPv6 frames
- VLANs: Supports up to 4K VLAN groups
- Link Aggregation: 802.3ad and LACP support
- IGMP Snooping: Supports up to 8K L2 multicast groups; Multicast and broadcast storm control, as well as flooding control.

### 3.2.1 Ethernet Switch Configuration

The Ethernet Switch can be monitored via remote SNMP. Please refer to the Ethernet Switch CLI Reference Manual for a more comprehensive description.

This section provides instructions for initially accessing the CLI of the Ethernet Switch using either in-band access via an Ethernet port or the out-of-band management interface (serial port) from the front panel.

The CLI is required for configuring the Ethernet Switch.

### 3.2.2 Out-of-Band CLI Access

The CLI can be accessed via the front panel serial port via the DB26 Front Maintenance I/O connector and maintenance cable assembly. Install correctly the cable to the front panel and to the serial port on a PC. Open a terminal application and set the console port settings as follows:

- Port: COMx (COM port dependent on user connection)
- Baud Rate: 115200
- Data: 8 bit
- Parity: None
- Stop: 1 bit
- Flow: None

### 3.2.3 In-Band CLI Access

The Ethernet switch network port (in-band management access) has no IP address set by default, it is necessary to assign an IP address either statically or by using DHCP to the network port. Access using the serial port is initially required.

After logging in to the CLI as described in the previous section, enter privileged mode by typing **'enable'** (no password required by default)

Set IP address, netmask and default gateway (see below example)

The Ethernet management interface is available from now on. Alternatively, DHCP can be set for the network port.

An IP address will be given to the network port by a DHCP server.

Save the configuration by using the 'write mem' command and confirm 'y'

To access the CLI via the Ethernet in-band network port, open a telnet connection to the configured IP address, port 23.

```
(Ethernet Fabric) #network protocol dhcp

(Ethernet Fabric) #write mem
```

*This operation may take a few minutes. Management Interfaces will not be available during this time.*

```
Are you sure you want to save? (y/n) y
Config file 'current/startup-config' created successfully.
Configuration Saved!
(Ethernet Fabric) #
```

By setting appropriate VLANs, it is possible to separate the management network from the data path.

For additional information on the system configuration, refer to the Ethernet Switch CLI Reference Manual.

### 3.2.4 Ethernet Switch Firmware

The system provides for reliable field upgrades. Dual boot images with roll-back capability is supported along with management via SNMP and Command Line Interface. System access is possible via TELNET, SSH and serial line.

Two independent system partitions, containing active system and backup system firmware is used to ensure a reliable and failsafe update.

The active image is stored in flash mtb partitions mtd0-4. The backup system is an exact copy of the active system and is stored in flash partition mtd5 as a whole. This allows flash recovery from the redundant system in case that update fails due to power loss or similar errors.

The system update package (res-system-<release>.pkg) contains an image of the bootloader, kernel, root file-system and config partition as well as MD5 checksum for consistency check.

When performing a firmware update, the software package is loaded from a remote TFTP server. A software update of the system is performed by using the following steps:

1. Log in to the exec mode of the CLI of the switch board

2. Copy system image into the active image of the flash memory

```
(Ethernet Fabric) #copy tftp://192.168.50.154/res-system-GA2.00.pkg active

(Ethernet Fabric) #
```

3. Check availability of valid boot image in active image using the command ‘show bootvar’

```
(Ethernet Fabric) #show bootvar

(Ethernet Fabric) #reload
```

4. In case of problems with booting the system, last working backup image will automatically be copied to the active image. This procedure restores normal system behavior. Configuration settings made with active image are lost and should be save by copying the active image to backup image before.

5. It is recommended to copy the active image to the backup image to have a fully redundant system

```
(Ethernet Fabric) #copy active backup

Copying active image to backup image

(Ethernet Fabric) #
```

### 3.2.5 Ethernet Switch Mapping

The following table provides the port mapping from the L2/L3 Ethernet switch.

| Ethernet Switch Port Software Assignments iaw CLI and web-interface | Ethernet Switch Ports of P1-00435-001 Gig-E Switch Baseboard | Associated ARINC 600 Quadrax Contacts of Air Tray | Ethernet Port Destination (Air-Tray Connector Labeling) |
|---|---|---|---|
| 0/1 | GBE1 | J1-B-KK, GG | RJ45 - Air Tray P1 (GIGE #1) |
| 0/2 | GBE2 | J1-B-HH, EE | RJ45 - Air Tray P2 (GIGE #2) |
| 0/3 | GBE3 | J1-B-LL, JJ | RJ45 - Air Tray P3 (GIGE #3) |
| 0/4 | GBE4 | J1-B-DD, AA | RJ45 - Air Tray P4 (GIGE #4) |
| 0/5 | GBE5 | J1-B-FF, CC | RJ45 - Air Tray P5 (GIGE #5) |
| 0/6 | GBE6 | N/C | Front Panel RJ45 Jack |
| 0/7 | GBE7 | N/C | N/C |
| 0/8 | GBE8 | N/C | N/C |
| 0/9 | GBE9 | J1-A-KK, GG | RJ45 - Air Tray P9 (GIGE #6) |
| 0/10 | GBE10 | J1-A-HH, EE | RJ45 - Air Tray P10 (GIGE #7) |
| 0/11 | GBE11 | J1-A-LL, JJ | RJ45 - Air Tray P8 (GIGE #8) |
| 0/12 | GBE12 | J1-A-DD, AA | RJ45 - Air Tray P12 (GIGE #9) |
| 0/13 | GBE13 | J1-A-FF, CC | RJ45 - Air Tray P13 (GIGE #10) |
| 0/14 | GBE14 | N/C | COM Express Module (eth0 - Linux) (Ethernet - Windows) |
| 0/15 | GBE15 | N/C | Carrierboard (eth1 - Linux) (Ethernet 2 - Windows) |
| 0/16 | GBE16 | N/C | N/C |

For further information on the Kontron Ethernet Switch module, reference the User Guide from the Kontron website or contact Kontron Technical Support.

## 3.3 CELLULAR MODEMS

The system includes two cellular modems (Sierra Wireless EM7430 and EM7455) to provide global cellular coverage. The default configuration is that only one modem is active at a time and only when the aircraft is on the ground. There is an internal RF switch that controls which modem Tx/Rx port is routed to the RF coax connection to the ARINC 600 connector on the system. There are two (2) RF coax connections (for diversity mode) on the ARINC 600 connector for remote antenna connection. Each modem supports 2x USIMs (micro-USIM) that are accessible via the front access door.

For further information on how to manage/operate the modems, see AF4608 Dual T-Modem Operation Application Note.

See Section 3.7.6 Modem Disable/Enable for information on how to disable and enable the cellular modems.

### 3.3.1 EM7430 Cellular Modem

The Sierra Wireless EM7430 Embedded Module is an M.2 module that provides LTE, UMTS, TD-SCDMA, and GNSS connectivity over several radio frequency bands.

Table 5: EM7430 Supported RF Bands

| Technology | Bands | | | | | | | | | | | | | | | Data Rates / Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 3 | 5 | 6 | 7 | 8 | 9 | 18 | 19 | 21 | 28 | 38 | 39 | 40 | 41 | |
| **LTE** | F | F | F | | F | F | | F | F | F | F | T | T | T | T | Data rates:<br>• Downlink (Cat 6): FDD: 300 Mbps TDD: 222 Mbps<br>• Uplink (Cat 6): FDD: 50 Mbps TDD: 26 Mbps<br>Notes:<br>• Downlink MIMO support (2x2; 4x2)<br>• F=FDD; T= TDD |
| **DC-HSPA+ HSPA+ HSPA UMTS** | Y | | Y | Y | | Y | Y | | Y | | N/A | | | | | Data rates:<br>• Downlink (Cat 24): Up to 42 Mbps<br>• Uplink (Cat 6): Up to 5.76 Mbps<br>Notes:<br>• Diversity support |

#### *3.3.1.1 Regulatory Compliance*

This module is designed to meet, and upon commercial release, will meet the requirements of the following regulatory bodies and regulations, where applicable:

- The National Communications Commission (NCC) of Taiwan, Republic of China
- Ministry of Internal Affairs and Communications (MIC) of Japan
- Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive of the European Union

This cellular module has obtained the following industry certifications where applicable:

- GCF

### 3.3.2 EM7455 Cellular Modem

The Sierra Wireless EM7455 Embedded Module is an M.2 module that provides LTE, UMTS, TD-SCDMA, and GNSS connectivity over several radio frequency bands.

Table 6: EM7455 Supported RF Bands

| Technology | Bands | | | | | | | | | | | | | | | Data Rates/Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 7 | 8 | 12 | 13 | 20 | 25 | 26 | 29 | 30 | 41 | |
| **LTE** | F | F | F | F | F | F | F | F | F | F | F | F | F | F | T | Data rates:<br>• Downlink (Cat 6): FDD: 300 Mbps TDD: 222 Mbps<br>• Uplink (Cat 6): FDD: 50 Mbps TDD: 26 Mbps<br>Notes:<br>• Downlink MIMO support (2x2; 4x2)<br>• F=FDD; T= TDD |
| **DC-HSPA+ HSPA+ HSPA UMTS** | Y | Y | Y | Y | Y | | Y | | | | | N/A | | | | Data rates:<br>• Downlink (Cat 24): Up to 42 Mbps<br>• Uplink (Cat 6): Up to 5.76 Mbps<br>Notes:<br>• Diversity support |

#### *3.3.2.1 Regulatory Compliance*

The system contains an EM7455 modem (from Sierra-wireless, FCC Id N7NEM7455, transmitter module IC: 2417C-EM7455 where 2417C-EM7455 is the module's certification number) which has been granted modular approval for mobile applications.

This cellular module meets the requirements of the following regulatory bodies and regulations, where applicable:

- Federal Communications Commission (FCC) of the United States
- The Certification and Engineering Bureau of Industry Canada (IC)
- The National Communications Commission (NCC) of Taiwan, Republic of China
- Ministry of Internal Affairs and Communications (MIC) of Japan
- Radio Equipment and Telecommunications Terminal Equipment (R&TTE) Directive of the European Union

This cellular module has obtained the following industry certifications where applicable:

- GCF
- PTCRB

This equipment complies with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

The following conditions should be met in order to be FCC part 15 compliant:

1) At least 20 cm separation distance between the antenna and the user's body must be maintained at all times.
2) To comply with FCC / IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed:

   Table 7: Antenna Gain Specifications

| Technology | Band | Frequency (MHz) | Maximum antenna gain (dBi) |
|---|---|---|---|
| **LTE** | 2 | 1850-1910 | 6 |
| | 4 | 1710-1755 | 6 |
| | 5 | 824-849 | 6 |
| | 7 | 2500-2570 | 9 |
| | 12 | 699-716 | 6 |
| | 13 | 777-787 | 6 |
| | 25 | 1850-1915 | 6 |
| | 26 | 814-849 | 6 |
| | 30 | 2305-2315 | 1 |
| | 41 | 2496-2690 | 9 |
| **UMTS** | 2 | 1850-1910 | 6 |
| | 4 | 1710-1755 | 6 |
| | 5 | 824-849 | 6 |

3) The EM7455 module may transmit simultaneously with other collocated radio transmitters within a host device, provided the following conditions are met:
   - Each collocated radio transmitter has been certified by FCC/IC for mobile application.

- At least 20cm separation distance between the antennas of the collocated transmitters and the user's body must be maintained at all times.
- The output power and antenna gain in a collocated configuration must not exceed the limits and configurations stipulated in the following table

Table 8: Collocated Radio Transmitter Specifications

| Device | Technology | Frequency (MHz) | EIRP Limit (dBm) |
|---|---|---|---|
| **Collocated transmitter** | WLAN | 2400-2500 | 25 |
| | | 5150-5850 | 27 |
| | WiMAX | 2300-2400 | 25 |
| | | 2500-2700 | 25 |
| | BT | 3300-3800 | 25 |
| | | 2400-2500 | 15 |

### 3.3.3 Cellular Modem Use Case Example

The requirement is to guarantee that the Modem will always be disabled during flight. Two Discrete inputs from the aircraft to the Server are used in this example:

- Weight-on-Wheels (WOW) – asserted whenever aircraft is on the ground
- Door Open – asserted whenever aircraft is at gate with door open

WOW is connected to IN0 Discrete input and Door Open is connected to IN1 Discrete input. In this example IN3 is not connected. To tell the Server to "look at" IN0 and IN1, both CONFIG0 and CONFIG1 pins are grounded on the back side of the ARINC600 Air Tray.

The resulting behavior is as follows:

- The modem is enabled only when both WOW and Door Open are asserted. In other words, when the aircraft is on the ground and at the gate with door open.
- If either of these discrete inputs are not asserted, then the modem is disabled. In other words, when the aircraft is in flight or is taxiing to the gate.

Software API calls are provided that can read the state of the Discrete Input signals (IN0, IN1, IN2 plus spares IN3, IN4, IN5). Also, the two internal signals (redundant) that directly drive the modem Disable can be read via software API. This is necessary for DO-178 Level E compliance.

## 3.4 ARINC 429 MODULE

The ARINC 429 card supports 6 receive and 1 transmit channel. Typically only receive channels are used in actual aircraft deployment to avoid any DO-178 safety certification issues. The Server supports software configurations of ARINC 429 high or low speed operation on a channel by channel basis. The ARINC 429 board supports filtering of ARINC 429 labels on receive channels to access aircraft parameters such as latitude, longitude, altitude, airspeed, tail number, etc

For additional support and driver libraries, contact Kontron technical support.

## 3.5 FIXED STORAGE (SSD)

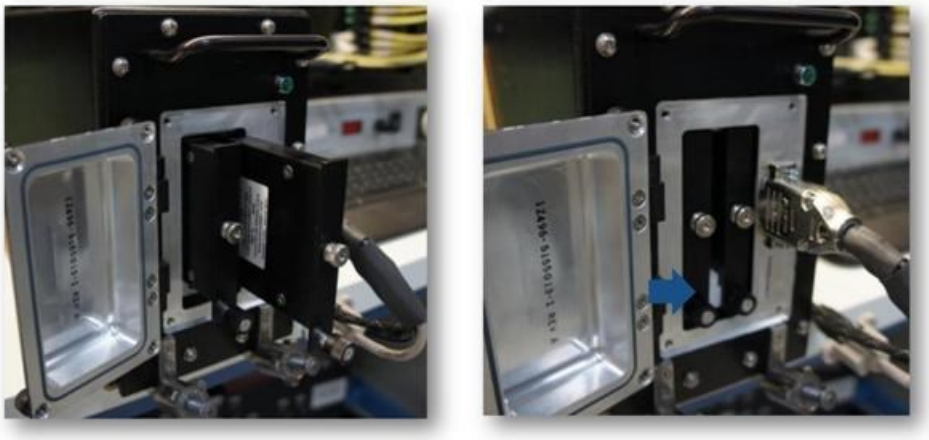
The system has two fixed storage devices installed:

- 128GB mSATA
- 800GB 2.5” SSD

The 128GB mSATA is used for storing the main operating system and system software application

## 3.6 REMOVABLE STORAGE (SSD)

The system has a drive bay to house the optionally ordered Removable Solid State Drives (RSSD) and supports SATA 3 (6Gbs) speeds. This drive bay is easily assessable via the front access door.



The front access door has 4x knurled captive thumbscrews with a #4-40 Philips head. To open the door, fully loosen each captive thumbscrew and open the hinged door. When closing the door, make sure there are no obstacles in the way and fully seat the door flush to the server. Then secure the front door by hand tightening the 4x knurled captive thumbscrews. All four thumbscrews should be started before fully tightening each thumbscrew. Caution should be taken when tightening down the thumbscrews so that cross threading does not occur or that the hardware is not over tightened. If using a Philips driver to tighten down the hardware, do not exceed 40 in-oz of torque.

The removable Solids State Drives are small form factor 2.5” Serial ATA drives that are housed in ruggedized aluminum canisters with a special high insertion/extraction connector.

## 3.7 SIGNAL INTERFACE BOARD (SIB)

The Signal Interface Board (SIB) is located internal to the Server fixed to the ARINC600 connector. The discrete I/O interface from the Server processor to the SIB is RS232 serial.

The primary interfaces and other devices supported on the SIB are:

- Aircraft Discrete I/O
- Supports software monitoring of Aircraft Discrete inputs – typically used for Weight-on-Wheels, Door Open, Brake Set, PA On, etc

- Supports software control of Aircraft Discrete outputs – typically used to drive status/control panel indicators or control external relays
- Note, the Aircraft Discretes described here that are used on the SIB are not associated to the ARINC 429 device.
- Front Panel LED control
- Power Supply Unit (PSU) status signals (FAIL, Under Temp, AC Fail, etc) & voltage level monitoring.
- Monitoring of Server internal temperature
- Modem enable/disable

### 3.7.1 Discretes

All discrete return-paths are isolated from chassis ground and DC return/ground. Therefore, the discrete inputs and discrete outputs must reference at least one of the discrete isolated returns in order to function properly.

The discrete isolated returns are available at the following rear ARINC Connector Cavity-C Pins J1, J2, J3, and J4. These pins are themselves tied-together within the server, so only one is required to reference as a return-path to complete the discrete circuits.

Note, installers may elect to connect the server's isolated discrete return bus to the common aircraft chassis ground in order to simplify installation.

#### *3.7.1.1 Discrete Inputs*

The server provides for six standard ground/open type discrete inputs as defined in ARINC 763-3, paragraph 2.9.6. These signals are user-defined and can be asserted for a variety of functions including aircraft key lines (e.g. Weight-on-Wheels, Door Open, Brake Set, etc.). These signals are IN_0, IN_1, IN_2, IN_3, IN_4, IN_5.

The server's discrete input pins are located at the rear ARINC Connector J1-C-XX (F1, F2, F3, E3, E4 and E5). The discrete return bus pins are located at rear ARINC Connector J1-C-XX (C-J1, J2, J3 and J4).

#### *3.7.1.2 Discrete Outputs*

The server provides four standard ground/open type discrete outputs as defined in ARINC 763-3, paragraph 2.9.5. These signals are user-defined and can be asserted (active low) for a variety of LRU status functions. These signals are OUT_0, OUT_1, OUT_2, OUT_3.

The server's discrete output pins are located at the rear ARINC Connector J1-C-XX (G1, G2, G3, and G4). The discrete return bus pins are located at rear ARINC Connector J1-C-XX (C-J1, J2, J3 and J4).

### 3.7.2 Configuration Signals

The SIB accepts three dedicated Configuration Signals (Inputs). These discrete signals provide for standard ground/open type discrete inputs as defined in ARINC 763-3, paragraph 2.9.6. The logic state can be read over the computer interface at any time. These signals are CONFIG_0, CONFIG_1, CONFIG_2.

The server's Configuration Bit pins are located at the rear ARINC Connector J1-C-XX (H3, H4 and H5). The CONFIG bits must reference a return-path back to one of the "Chassis-Ground" pins which are available at the following rear ARINC Connector Cavity-C Pins J1-C-XX (A5, B5, C5, D5, F5, G5, J5 or K5).

Note, E5 and H5 are specifically excluded here, as they are not chassis grounds.

### 3.7.3 System Enable

The System Enable discrete must be connected to Chassis Ground in order for the system to turn on. The System Enable pin is located at the rear ARINC Connector J1-C-F4. The chassis ground pins are located at the rear ARINC Connector Cavity-C Pins J1-C-XX (A5, B5, C5, D5, F5, G5, J5 or K5).

### 3.7.4 Remote CPU Reset

The Signal Interface Board (SIB) includes circuitry to affect a remote CPU Reset. This reset sequence is asserted via a command over the RS232 serial link from the SIB to the control processor on the ACE Flight baseboard. The remote CPU Reset can be asserted by a momentary ground (Low) on pin C-H1 of the ARINC 600 Connector

### 3.7.5 PSU Status & Voltage Monitoring

The SIB monitors three status signals from the Power Supply Unit (PSU). The three PSU status signals are described below.

PSU Fail (DCFAIL_L) is a power supply output, active low TTL level signal indicating that the power supply has detected an out of tolerance condition with one or more of its power rails.

AC Fail (ACFAIL_L) is a power supply output, active low TTL level signal indicating that the power supply has detected the loss of input power. AC Fail is asserted within 10 msec of the loss of the input power. The PSU continues to operate for at least 200msec after loss of input power.

PSU Over Temperature (OVERTEMP_L) is a power supply output, active low TTL level signal used to indicate that the power supply has detected an internal temperature greater than 90°C. The PSU will continue to operate until a high temperature limit of 100°C internal to the PSU is detected at which point the PSU will shut down.

### 3.7.6 Modem Disable/Enable

The required logic to determine the enable/disable state of the modem is based on three input signals from the aircraft (IN_0, IN_1, IN_2) and three qualifier signals (CONFIG_0, CONFIG_1, CONFIG_2) which allow flexibility under different installation scenarios. These configuration inputs are used to include or exclude IN_0, IN_1, and IN_2 from the logic calculation.

To control the state (On/Off) of the modem, one or more of the Configuration Inputs (CONFIG_0, CONFIG_1, and CONFIG_2) must be set to Low (GND).

For example:

- If CONFIG_0 is strapped to GND, then IN_0 controls the state of the modem
- If CONFIG_0 and CONFIG_1 are strapped to GND, then IN_0 and IN_1 control the state of the modem
- If CONFIG_0, CONFIG_1 and CONFIG_2 are strapped to GND, then IN_0, IN_1 and IN_2 control the state of the modem

Once these Configuration Inputs are set, the modem can only be activated if the correct combination of Aircraft Discrete Inputs is asserted. If none of these inputs is asserted, then the modem will remain inactive. In typical use cases, these inputs are connected to signals originating from the aircraft such as Weight-on-Wheels, Door Open, etc. The intent is to allow the modem to activate only when it is certain that the aircraft is on the ground or at the gate.

**NOTICE**

Based upon the hardware logic, if NONE of the Server's Configuration Inputs (CONFIG_0, CONFIG_1, CONFIG_2) are strapped to Chassis Ground, the default state of the internal T-Modem will be ENABLED.

Therefore, even if the Server's application does not intend to utilize the internal T-Modem, the integrator MUST strap at least one of the Server's Configuration Inputs to Chassis Ground (ex. CONFIG_0) and also ensure that the correlating Server Discrete Input (ex. IN_0) is NOT wired to anything in the aircraft (i.e. IN_0 pin is left disconnected so that it cannot connect to Chassis Ground, so that it cannot Enable the T-Modem).

The following Table shows how the Discrete Input signals are included or excluded based on the state of Configuration Inputs.

Modem and Server Unit Configuration Inputs

| Configuration Input | Result |
|---|---|
| CONFIG_0 = L | IN_0 INCLUDED |
| CONFIG_0 = H | IN_0 EXCLUDED |
| CONFIG_1 = L | IN_1 INCLUDED |
| CONFIG_1 = H | IN_1 EXCLUDED |
| CONFIG_2 = L | IN_2 INCLUDED |
| CONFIG_2 = H | IN_2 EXCLUDED |

In this table, "L" indicates an Active Low state (or closed) of the Configuration Input, which is implemented by tying the corresponding pin on the rear of the Server Air Tray to an available GND. An "H" indicates an open state of the Configuration Input, which is implemented by leaving the corresponding pin on the rear of the Server Air Tray as a No Connect. The Configuration Inputs to the ACE Flight Server are set at time of installation onto the aircraft. In general, the Aircraft Discrete Inputs vary depending on the phase of flight or whether the aircraft is on the ground.

The following Table shows how the state of the Discrete Input signals determines whether the modem is enabled or not. This example table is based on CONFIG_0, CONFIG_1 and CONFIG_2 strapped to GND.

Modem and Server Unit Discrete Inputs:

| Discrete Input | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| IN_0 | L | H | L | L | H | H | L | H |
| IN_1 | L | L | H | L | H | L | H | H |
| IN_2 | L | L | L | H | L | H | H | H |
| Modem State | EN | DIS | DIS | DIS | DIS | DIS | DIS | DIS |

In this table, "L" indicates an Active Low state (or closed) of the Aircraft Discrete Input, which is implemented by closure of a switch or relay external to Server. For example, when the aircraft lands, the Weight-on-Wheels switch is closed and the Aircraft Discrete Input is asserted ("L").

An "H" indicates an open state of the Aircraft Discrete Input, which is implemented by opening a switch or relay external to Server. When the aircraft is in flight, the Weight-on-Wheels switch is open and the Aircraft Discrete Input is not asserted ("H").

## 3.8 ANALOG AUDIO OUTPUTS

The Server unit supports two audio output channels. This audio interface can provide up to two independent audio streams to the aircraft PA for distribution in the cabin. For example, music files or recorded safety messages can be stored on the Server SSDs, and played to lavatory and cabin loudspeakers on software command or specific trigger event.

The audio channels are based on a Cirrus Logic CS4207 audio codec, which is used to provide the primary audio stream interface to the Server rear outputs. This device is connected to the CPU High Definition Audio Bus.

The audio output channels can be independently enabled through software control and the sample rate is selectable between 32KHz and 192KHz.

Kontron provides software examples (Linux or Windows) with the Server to demonstrate the functionality of the audio output channels.

| Feature | Description |
|---|---|
| Channels | 2 |
| Line Impedance | 600Ω (nominal) |
| Output Voltage | 0.776 Vrms |
| Frequency Response | 50 to 15KHz |
| Signal-to-Noise Ratio | >60 dB |
| THD | 1% max |
| Crosstalk | < -50dB |

## 3.9 POWER SUPPLY

The system has an internal power supply unit (PSU) that enables the system to operate from a 97-134 Vac, 47-800Hz, single-phase power. The PSU is capable of delivering a maximum of 125 Watts with +5 Vdc and +12Vdc outputs. The PSU provides a minimum holdup capability of 200msec in case of momentary main power source interruptions (per ARINC 763-3, Section 7.3.3).

**NOTICE**

The specified voltage input range is from 97 to 134 VAC, 47 - 800 Hz, single-phase power.

**DO NOT connect to 220 VAC**

The power source must supply a minimum of 100 W.

Ambient temperature must be above -20°C for the system to turn on.

The power supply and power sub-systems have the following built-in protection features:

- In-line AC Fuse for short circuit protection due to catastrophic failures
- PSU Over Voltage Protection for protection against outside failures which cause unregulated AC power IN.
- PSU Over Current Protection for protection against excessive In-Rush currents, and Secondary DC excessive current demand due to internal catastrophic component failures
- High temperature shutoff protection; a thermostatic switch activates (switch closure) if the case temperature exceeds 100°C. Upon activation the switch pulls down the internal operating bias voltage for the power converters shutting them each off independent of any other logic. The switch automatically resets.

# 4.System Interfaces & Dimensions

## 4.1 FRONT PANEL STATUS INDICATOR

There are two front panel LEDs. A green LED (LED 1) illuminates when the server is connected to AC power. This condition indicates that DC power is being applied to the server from the power supply. A blue LED (LED 2) illuminates only if the internal server electronics is switched on via the power discrete that is controlled by the SIB.

## 4.2 CONNECTORS

The following table lists the Server’s external interface connectors.

Table 9: Server Interface Connectors

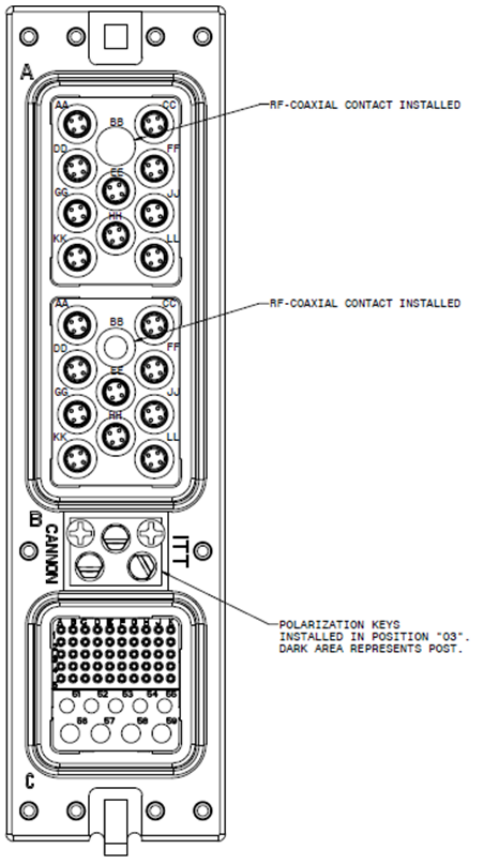
| Connector Type | Part Number | Manufacturer |
|---|---|---|
| **ARINC 600, Shell Size 2** | BKAD2-Q81-30003-F0 | ITT Cannon |
| **RJ45** | Various | Various |
| **DB-26F High Density** | Various | Various |
| **Micro USIM (1 thru 4)** | Various | Various |
| **USB 3.0** | Various | Various |

### 4.2.1 Connector Definition J1 (ARINC 600)

The following diagram provides the signal definitions for the Server J1 ARINC 600

Table 10: ARINC 600 Signal Definitions

| CAVITY ID | CONTACT | SIGNAL NAME | FUNCTION |
|---|---|---|---|
| CAVITY A | AA | GigE 12B | EHTERNET/CELL |
| | BB | Main RF | |
| | CC | GigE 13B | |
| | DD | GigE 12A | |
| | EE | GigE 10B | |
| | FF | GigE 13A | |
| | GG | GigE 9B | |
| | HH | GigE 10A | |
| | JJ | GigE 11B | |
| | KK | GigE 9A | |
| | LL | GigE 11A | |
| CAVITY B | AA | GigE 4B | ETHERNET |
| | BB | AUX RF (DIVERSITY) | |
| | CC | GigE 5B | |
| | DD | GigE 4A | |
| | EE | GigE 2B | |
| | FF | GigE 5A | |
| | GG | GigE 1B | |
| | HH | GigE 2A | |
| | JJ | GigE 3B | |
| | KK | GigE 1A | |
| | LL | GigE 3A | |




| CAVITY ID | CONTACT | SIGNAL NAME | FUNCTION |
|---|---|---|---|
| Cavity C | A1 | RX4L | A429 CH4 (Rx4) |
| | A2 | RX4H | |
| | A3 | RX7L | A429 CH7 (Rx7) |
| | A4 | RX7H | |
| | A5 | CHAS | CHASSIS GND |
| | B1 | RX5L | A429 CH5 (Rx5) |
| | B2 | RX5H | |
| | B3 | RX8L | A429 CH8 (Rx8) |
| | B4 | RX8H | |
| | B5 | CHAS | CHASSIS GND |
| | C1 | RX6L | A429 CH6 (Rx6) |
| | C2 | RX6H | |
| | C3 | RX9L | A429 CH9 (Rx9) |
| | C4 | RX9H | |
| | C5 | CHAS | CHASSIS GND |
| | D1 | USB_D+ | USB 2.0 PORT |
| | D2 | USB_D- | |
| | D3 | USB_GND | |
| | D4 | USB_VCC | |
| | D5 | CHAS | CHASSIS GND |
| | E1 | TX0L | A429 CH0 (Tx_0) NOTE: CH0 IS SOFTWARE SECLECTABLE BETWEEN Rx AND Tx (DEFAULT IS Tx) |
| | E2 | TX0H | |
| | E3 | IN3 | DISCRETE IN |
| | E4 | IN4 | |
| | E5 | IN5 | |
| | F1 | IN0 | DISCRETE IN |
| | F2 | IN1 | |
| | F3 | IN2 | |
| | F4 | SYS_EN | SYSTEM ENABLE |
| | F5 | CHAS | CHASSIS GND |
| | G1 | OUT0 | DISCRETE OUT |
| | G2 | OUT1 | |
| | G3 | OUT2 | |
| | G4 | OUT3 | |
| | G5 | CHAS | CHASSIS GND |
| | H1 | CPU_RST | CPU RESET |
| | H2 | FAN_MON | FAN MONITOR |
| | H3 | CONFIG_0 | CONFIC BITS 0-2 |
| | H4 | CONFIG_1 | |
| | H5 | CONFIG_2 | |
| | J1 | ISO_DIS_RTN | ISOLATED DISCRETE RETURN BUS(USED FOR BOTH INPUT & OUTPUT) |
| | J2 | ISO_DIS_RTN | |
| | J3 | ISO_DIS_RTN | |
| | J4 | ISO_DIS_RTN | |
| | J5 | CHAS | CHASSIS GND |
| | K1 | AUDIO_0L | AUDIO INPUTS |
| | K2 | AUDIO_0H | |
| | K3 | AUDIO_1L | |
| | K4 | AUDIO_1H | |
| | K5 | CHAS | CHASSIS GND |
| | 51 | AC L | AC LINE |
| | 52 | AC N | AC NEUTRAL |
| | 53 | CHAS | CHASSIS GND |
| | 54-59 | | NC |

### 4.2.2 Front Panel DB-26 Maintenance Connector Pin Definition

Table 11: DB-26 Signal Definitions

| Pin | Signal | Description |
|---|---|---|
| **1** | NC | NO CONNECT |
| **2** | NC | NO CONNECT |
| **3** | NC | NO CONNECT |
| **4** | NC | NO CONNECT |
| **5** | GND | DIGITAL GROUND |
| **6** | GND | DIGITAL GROUND |
| **7** | USB- | USB DATA - |
| **8** | USB+ | USB DATA + |
| **9** | 5V | +5 VOLTS |
| **10** | RXD_PROC | PROCESSOR RS-232 RECEIVE DATA |
| **11** | TXD_PROC | PROCESSOR RS-232 TRANSMIT DATA |
| **12** | NC | NO CONNECT |
| **13** | NC | NO CONNECT |
| **14** | NC | NO CONNECT |
| **15** | NC | NO CONNECT |
| **16** | TXD_ENET | ETHERNET SWITCH RS-232 TRANSMIT DATA |
| **17** | RXD_ENET | ETHERNET SWITCH RS-232 RECEIVE DATA |
| **18** | GND | DIGITAL GND |
| **19-26** | NC | NO CONNECT |

### 4.2.3 Front Panel RJ-45 Connector Pin Definition

The RJ-45 connector (J11) supports 10/100/1000BaseT communications and is connected to the internal GbE switch.

Table 12: RJ45 Signal Definitions

| Pin | Signal | Description |
|---|---|---|
| **1** | TRD1+ | Bi-Directional Pair 1+ |
| **2** | TRD1- | Bi-Directional Pair 1- |
| **3** | TRD2+ | Bi-Directional Pair 2+ |
| **6** | TRD2- | Bi-Directional Pair 2- |
| **4** | TRD3+ | Bi-Directional Pair 3+ |
| **5** | TRD3- | Bi-Directional Pair 3- |
| **7** | TRD4+ | Bi-Directional Pair 4+ |

| | | |
|---|---|---|
| **8** | TRD4- | Bi-Directional Pair 4- |

### 4.2.4 Front Panel micro USIM Card Pin Definition

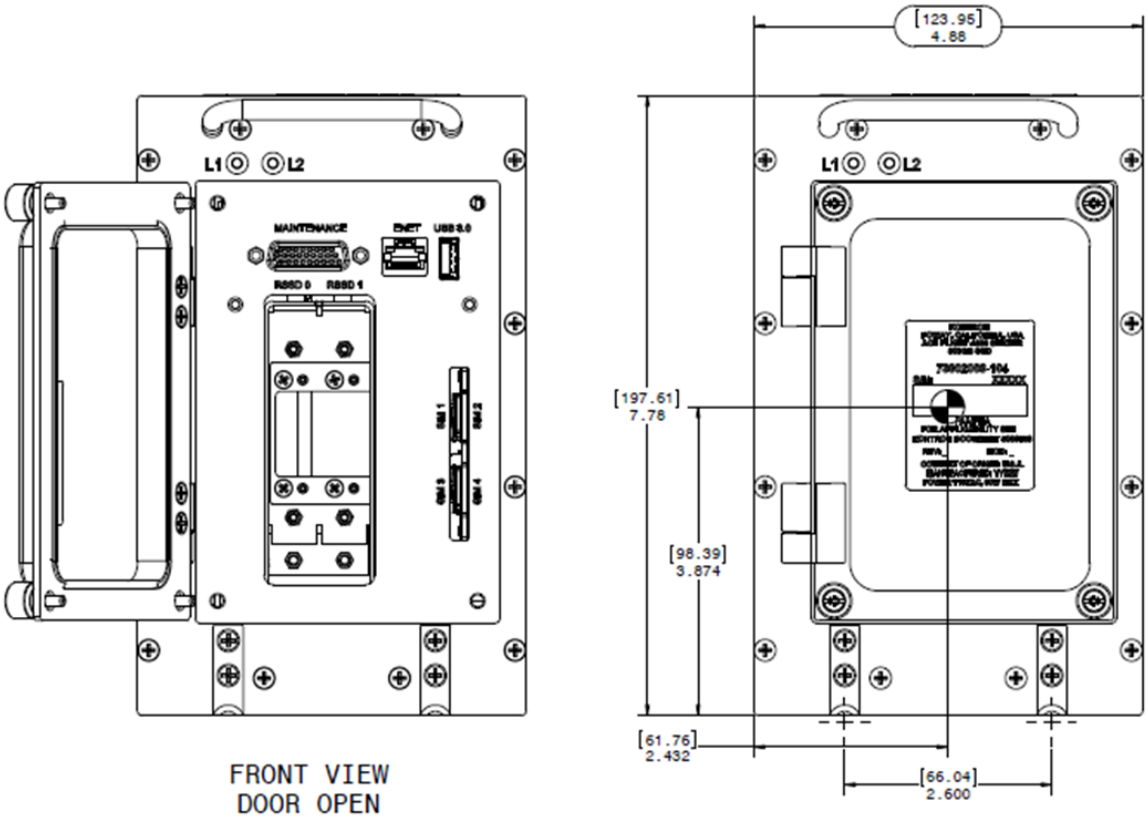
There are four (4) micro USIM card holders in the front panel. The micro USIM card holders are of the push-pull style.

Table 13: USIM Signal Definitions

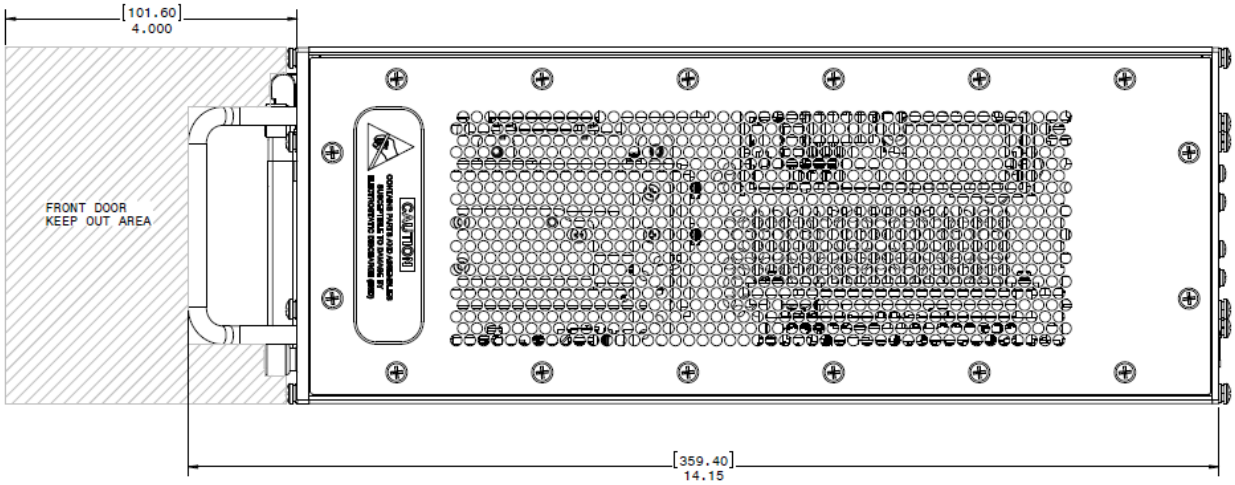
| Pin | Signal | Description |
|---|---|---|
| **1** | VCC | Voltage Supply |
| **2** | GND | Digital Ground |
| **3** | RESET | Reset In |
| **4** | VPP | Programmable Voltage |
| **5** | CLOCK | Clock |
| **6** | I/O-R | Data Input/Output |

## 4.3 MECHANICAL DESIGN & DIMENSIONS

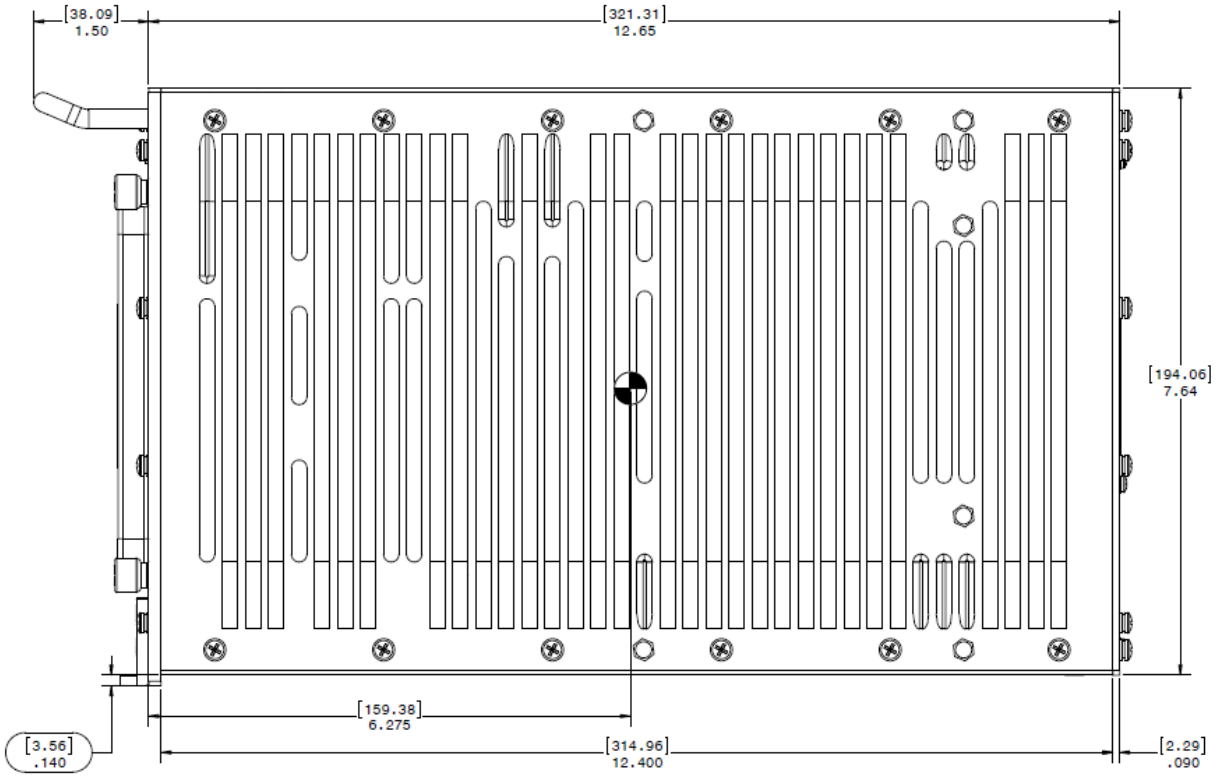
### 4.3.1 Front View




### 4.3.2 Top View



### 4.3.3 Side View



# 5.Starting Up

The system is ready to use out-of-the-box when received directly from Kontron.

The Kontron Lab Air Tray, breakout cable assembly, and test box is recommended for lab development and can be ordered separately (see Orderable Part Numbers).

If you are building your own the cable harness for aircraft installations the pin-out and mating connector information is provided in the Physical I/O section. Contact the factory for additional information as required.

The system is air-cooled and requires 10cfm of airflow. The orderable air tray kit from Kontron includes an integrated fan and provides the appropriate amount of airflow to cool the system.

**NOTICE**

The specified voltage input range is from 97 to 134 VAC, 47 - 800 Hz, single-phase power.

**DO NOT connect to 220 VAC**

The power source must supply a minimum of 100 W.
Ambient temperature must be above -20°C for the system to turn on.

## 5.1 CHECKING THE PACKAGING

Inspecting the packing cartons and verifying their condition is the responsibility of the customer and should be carried out upon delivery.

Inspect the packing and check its condition:

- No broken corners,
- General state of the case (no rips or holes)
- Condition of the bands and the clips

If you wish to report any damage in transit, you should make out a full report, and also note the damage on the packing list that accompanies the equipment. Ensure that the report and the packing list are signed by yourself and also by the transport agent, and send a copy of these documents to:

- The shipping company
- Kontron

## 5.2 UNPACKING THE SYSTEM

Unpacking the equipment should be performed under the supervision of an authorized technician.

- Open the package and take out the items one by one.

- Inspect each item and make a note of any possible defects (scratches, marks or blemishes, damaged cables, etc.). If necessary, make a report of any damage or defects.
- Check the equipment against the packing list and report any missing items.

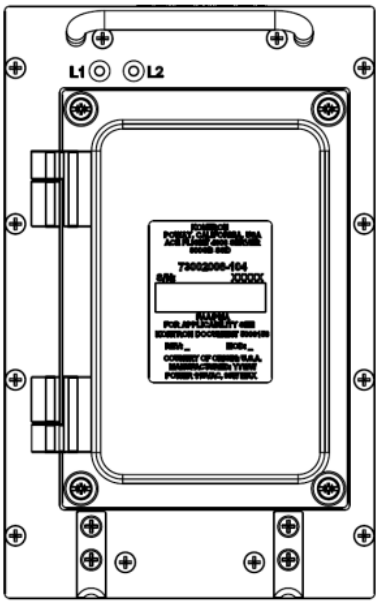
It is recommended that you keep the packaging materials in case it is required to move the system.

## 5.3 SYSTEM IDENTIFICATION

The product label is located on the front of the system.

Label Information:

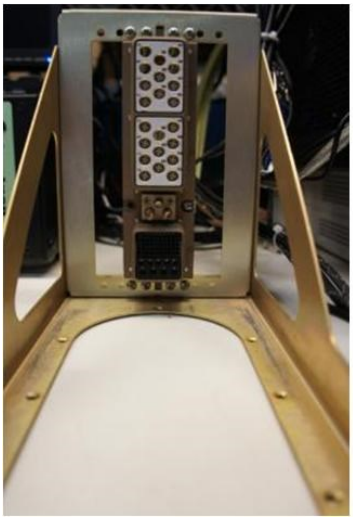
- Product Description
- Model Number: 73002008-xxx
- S/N
- FAA/PMA Number
- Rev and MOD
- Country of Origin
- Manufactured Date
- Power

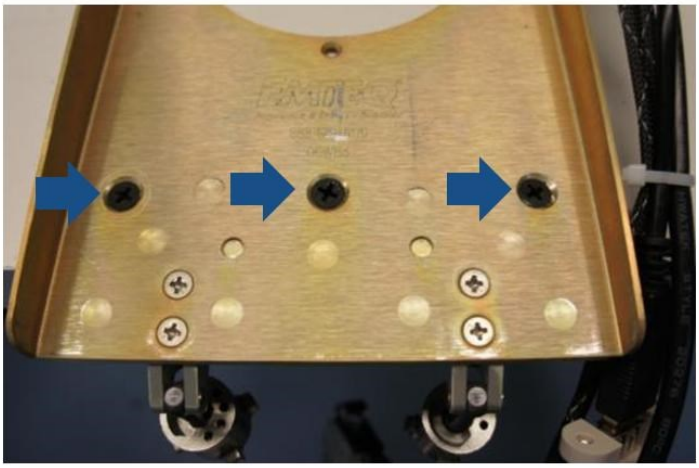


## 5.4 LAB EQUIPMENT

The following picture shows a typical lab setup using similar equipment.

When setting up the Server Air Tray on the bench, it is recommended to fix the Air Tray to the table as shown in the following picture. Screws are installed that hold the Air Tray firmly to the table and allow for ease of installation of the Sever into the Air Tray connector.



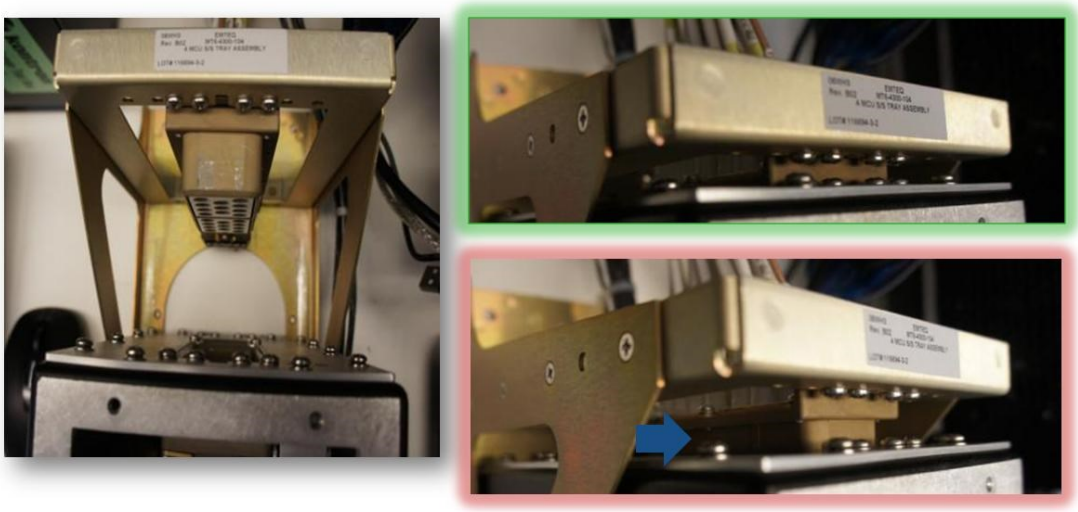


Ensure that the power source is turned off and that all front panel switches on the Server Test Box are in the DOWN position (off).

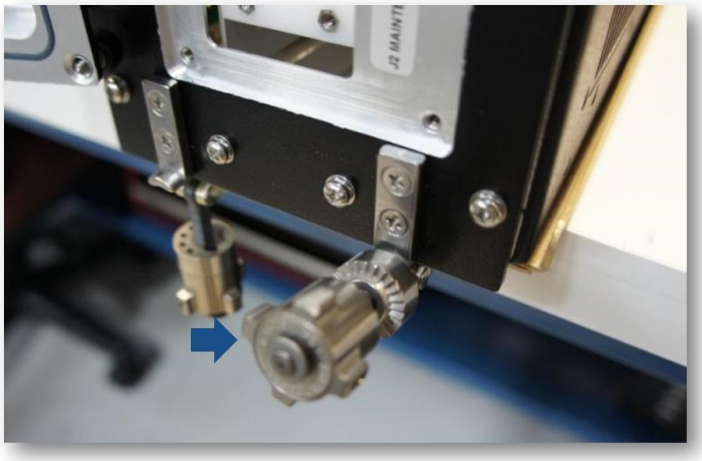
Install the Server into the Air Tray Assembly and make sure the Server is fully engaged into the ARINC mating connector on the tray.

The following picture shows the server fully engaged into the air tray in the top right section (green highlight). The bottom right picture (red highlight) shows the Server NOT fully engaged into the Air Tray. If the Server is only partially installed, the power input may be connected and power the Server, but the signal pins may not be connected. The power pins are longer and engage first on the Air Tray.

If the Server Pwr LED (green) is on, but the Server Sys En LED (blue) is not on, ensure that the Server is fully seated into the Air Tray. Note, Sys En must also be turned on for Sys EN LED to be on



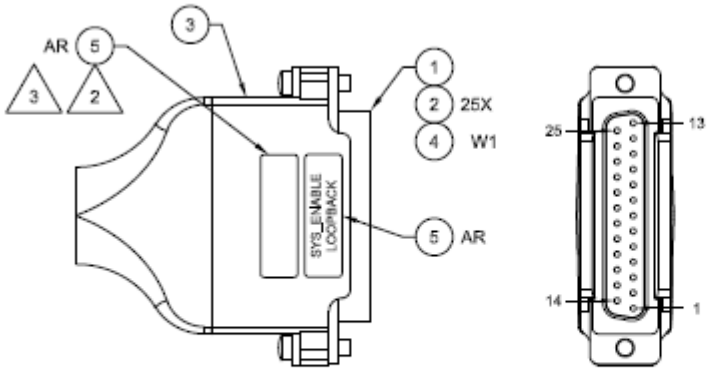
Once the Server is fully installed into the Air Tray, the front wing nuts can be hand tightened to completely secure the Server to the Air Tray.



Now the front maintenance cable assembly can be installed to the Server Front Panel Maintenance Port. The Server is a headless system (no graphics out). For DVI/VGA out, install the USB-to-DVI/VGA converter included with the system. This can be installed directly to the USB 3.0 port, USB 2.0 port (from maintenance port) or USB hub.

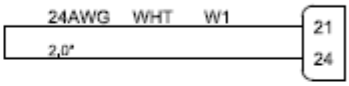
### 5.4.1 Sys-Enable Loopback Connector

For lab environment, the Sys-Enable needs to be engaged by either the Test Box or by installing the Sys-Enable Loopback Connector (shown below) onto the P9 DB-25 cable coming from the air tray break-out cables. Once installed, and power is turned on to the unit, the system will power up.




1060-9147
CABLE ASSEMBLY



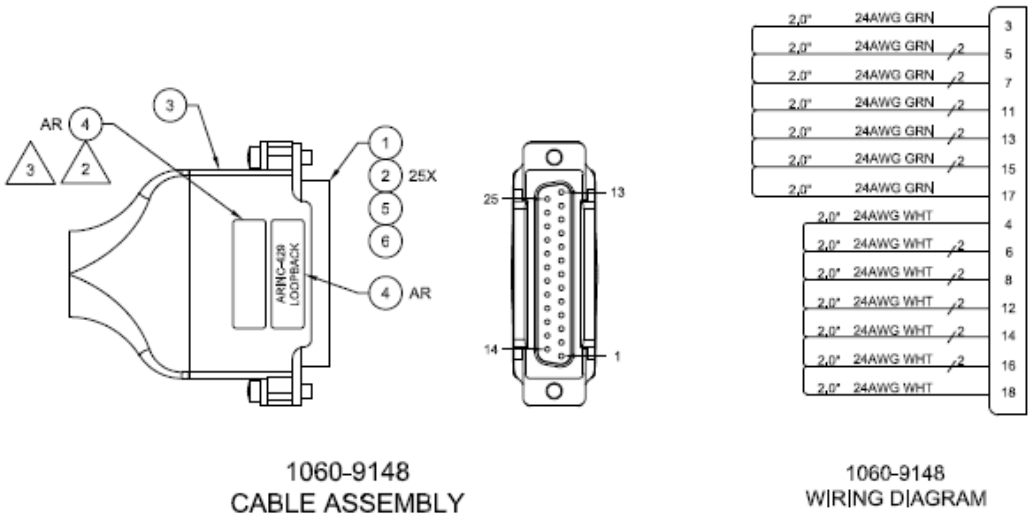




1060-9147
WIRING DIAGRAM

### 5.4.2 ARINC Loopback Connector

For lab environment, it is desirable to test the ARINC signals. The Cable Kit comes with the ARINC Loopback Connector (shown below). Install this onto the P10 DB-25 cable coming

from the air tray break-out cables. The following signals are tied together for this test.

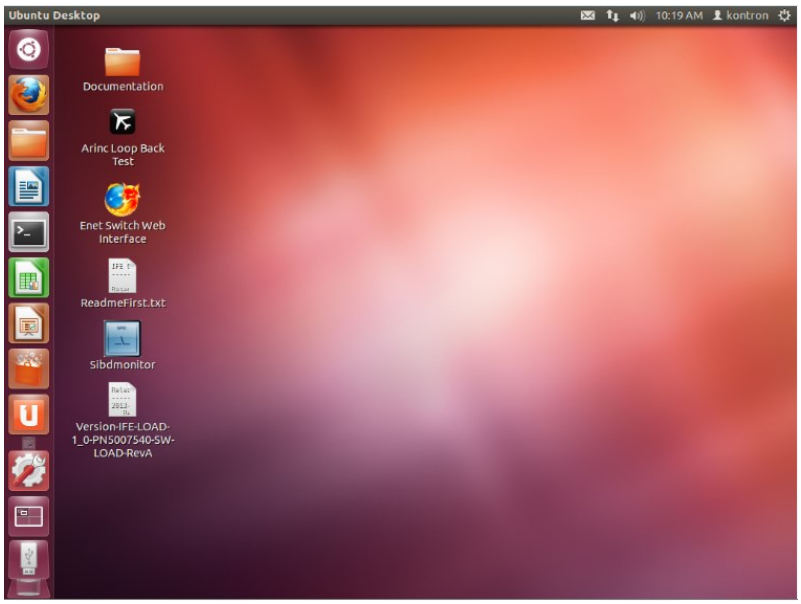



1060-9148
CABLE ASSEMBLY

1060-9148
WIRING DIAGRAM

### 5.4.3 Ubuntu Start-Up Screen

Once the system boots up, a start-up screen will appear.




Open the Readmefirst.txt for detailed information regarding system setup and use of the supplier desktop icons. A documentation folder is supplied which contains additional support information.

The following shortcuts are provided for easy access to the system features and test:

- ARINC Loop Back Test

- Enet Switch Web Interface
- SIBMonitor

### 5.4.4 Power-Up and Boot-up

The following setup and power up sequence describes the proper steps for powering up the system and is valid for a Linux operating system with the ACE Flight 4608 BSP installed.

A live image is available on the Kontron website under the ACE Flight 4608 product site download section or can be requested via Kontron technical support.

NOTICE

**WARNING!**

The specified voltage input range is from 97 to 134 VAC, 47 - 800 Hz, single-phase power.

**DO NOT connect to 220 VAC**

The power source must supply a minimum of 100 W.
Ambient temperature must be above -20°C for the system to turn on.

The following setup and power up sequence describes the proper steps for powering up the system:

1. Turn AC Power ON (via Power Switch on 400Hz PSU) to Air Tray Assembly
2. Confirm the Server's front panel PWR LED is ON (green color) as AC Power is connected to the Server Tray Assembly (which routes AC Power to the Server).
3. Confirm that the Sys En (blue color) LED is OFF (since the DC Power is not internally applied until the Test Box Sys-Enable switch enabled during next steps).
4. On Server Test Box, activate Sys-Enable by flipping switch to UP (ON) position.

NOTICE

**If not using the Server Test Box, a Sys-Enable Loopback is required to activate Sys-Enable or the Server will not turn on. See Sys-Enable Loopback Connector description for more details.**

5. After about 3 seconds, confirm that Sys En (blue color) LED is now ON (Note: This turn-ON delay is per expected per design.)
6. To deactivate the system and turn AC power off, follow the steps above in reverse order.

**Under-temperature protection:**
There is an internal temperature sensor that prevents damage to the system's components by preventing the unit from turning on below -20°C (+/-2°C).

**Over-temperature protection:**
The DC outputs of the system internal power supply will be disabled if an internal temperature of +100°C (+/-7°C) is detected. The system will return to normal operation once the temperature condition drops within the acceptable range.

# 6.Technical Data

## 6.1 DO-160G QUALIFICATION

The system has been qualified to the following DO-160G tests. For further details, see Qualification Test Plan (QTP) and Qualification Test Report (QTR).

Table 14: DO-160G Testing

| Requirement | DO-160G Sec | Cat |
|---|---|---|
| Ground Survival Low Temp (-55°C, non-operating) & Short-Term Operating Low Temp (-40°C, 30min) | 4.5.1 | A1 |
| Operating Low Temp (-15°C) | 4.5.2 | A1 |
| Ground Survival High Temp (+85°C, non-operating) & Short-Term Operating High Temp (+70°C, 30min) | 4.5.3 | A1 |
| Operating High Temp (+55°C) | 4.5.4 | A1 |
| Inflight Loss of Cooling | 4.5.5. | A1 (V) |
| Altitude Test | 4.6.1 | A1 |
| Decompression | 4.6.2 | A1 |
| Overpressure Test (-15,000ft, non-operating) | 4.6.3 | A1 |
| Temperature Variation | 5.3.1 | C |
| Humidity, Non-Operation | 6.3.1 | A |
| Operational Shock | 7.2.1 | B |
| Crash Safety (Impulse) | 7.3.1 | |
| Crash Safety (Sustained) | 7.3.3 | |
| Vibration (Random) | 8.5.2 | S (Curve B) |
| Magnetic Effect | 15.0 | A |
| Power Input | 16.0 | A (WF) H |
| Voltage Spike | 17.0 | B |
| Audio Frequency Conducted Susceptibility | 18.0 | CAT K |
| RF Radiated and Conducted Susceptibility | 20.0 | T |
| Emission of Radio Frequency Energy (Radiated and Conducted) | 21.0 | M |
| Electrostatic Discharge (ESD) | 25.5 | A |
| Fire/Flammability | 26.0 | B |
| | 14 CFR Part 25.853 (a) AMD 25-116 Appendix F, Part I (a)(1)(ii)<br>14 CFR Part 25.869 (a) (4) AMD 25-113 Appendix F, Part I (a)(3) | |

## 6.2 DESIGN AND CONSTRUCTION

The system is designed and constructed in accordance with the general requirements of RTCA/DO-254 to the extent that it does not conflict with the requirements specified herein.

## 6.3 INTERCHANGEABILITY

The components of the system are physically and functionally interchangeable in accordance with RTCA/DO-254. Parts or components of the same part number procured as defined in this document are physically and functionally interchangeable without calibration, selection, or adjustment to fit. Only those tools generally available for preventative and corrective maintenance at the specified level are required for the removal and replacement of interchangeable items.

## 6.4 MATERIALS

All materials used in the construction of the system are inherently non-nutrient to fungus and do not support combustion. The materials are of the best commercial quality, and will not blister, corrode, crack, soften, or show other immediate latten defects that affect the storage, operation, or environmental capabilities of the unit after any or all of the test specified.

Materials used in the system have been selected in accordance with the appropriate flammability requirements of Code of Federal Regulations FAR-25.853a.

## 6.5 GROUNDING AND BONDING

Electrical grounding and bonding of the unit follows standard avionics industry design practices, ensuring proper grounding for electrical safety and for Electromagnetic Interference (EMI) control and compliance and is in compliance with D6-36440D 7.3.2.4.

## 6.6 WORKMANSHIP

Workmanship, including ANSI/IPC-A-620 soldering, is designed to meet ANSI/J-STD-002 and RTCA/DO-254.

## 6.7 SAFETY

The system is designed to meet the safety requirements of RTCA/DO-254

## 6.8 PROTECTIVE DEVICES

A fuse is utilized on the power line to conform to the recommendations of RTCA/DO-254. Two temperature sensors are located on the power supply assembly to protect the internal electronics from an over-temperature or under-temperature condition. Additionally, a separate temperature sensor is in place to enable/disable the unit based on low ambient temperatures (below -20°C).

## 6.9 HUMAN ENGINEERING

Human Engineering design criteria and principles were applied in the design of the system in order to achieve safe, reliable and effect performance by the operator, maintenance and control personnel. RTCA/DO-254 was utilized as guidelines in applying human engineering design criteria.

# 7.Reliability and Maintainability

## 7.1 RELIABILITY

The Mean Time Between Failure (MTBF) for the unit is greater than 50,000 operating hours, MIL-HDBK-217Plus, Airborne Inhabit Cargo @ 30°C.

## 7.2 MAINTAINABILITY

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

## 7.3 MEAN TIME TO REPAIR (MTTR)

Repair time will not exceed 30 minutes, which entails replacement of the LRU. The time to gain access to the LRU is not included.

## 7.4 PRODUCTION TESTING

Production units are subjected to a production Factory Acceptance Test (FAT) prior to shipment. This test ensures that all elements of the product are functional and capable of performing as stated and that the unit is free from any manufacturing defects.

## 7.5 SPECIAL TEST AND EXAMINATIONS

Testing and analysis has been performed to verify that the system meets the requirements stated in this document. Kontron retains a Qualification Test Report (QTR) for the system.

Operational compatibility is verified during Factory Acceptance Testing (FAT).

## 7.6 SPECIAL TOOLS

Special tools are not required for the installation, replacement, tuning, or adjustment of electronic parts. Special tools are defined as those not listed in the federal supply catalog.

# 8.Use Case: Wireless-On-Aircraft

The following provides as information only, additional details and use cases for Wireless-on-Aircraft.

Operation of WiFi network during various phases of aircraft operation is at the discretion of the airline customer, although may be subject to overview/approval of local aviation authority (FAA, EASA, CAAC, etc) and local regulatory agencies (FCC & international equivalents).

Operation of the Server Terrestrial Modem radio (cellular) is generally prohibited while the aircraft is in flight.

As an example, consider a commercial airline flight divided into 4 phases. The Wireless IFE or Connectivity system usually implements different modes of operation for each of these phases, especially with regards to operation of the WiFi (CWAP) and Terrestrial Modem (Server) radios.

- On ground, at gate
- On ground, not at gate
- In flight, below 10,000 feet
- In flight, above 10,000 feet

These phases are typically detected by the Airborne Server to support enable/disable of radios:

- WOW (Weight on Wheels) – Discrete input signal that is monitored by the Airborne Server. Asserted for Phases A & B.
- Door Open – Discrete input signal that is monitored by the Airborne Server. Asserted for Phase A.
- Altitude – ARINC429 data label that is monitored by the Airborne Server. Provides aircraft altitude value that can be checked against 10,000 foot or other threshold.
-

## 8.1 SCENARIO FOR WIFI AND CELLULAR MODEM OPERATION

Operation of the WiFi network is installation dependent. In some cases, systems allow the CWAP radios to operate continuously, but in many cases the WiFi is disabled while the aircraft is inflight up to 10,000 feet altitude.

The Terrestrial Modem (T-Modem) in the Server is generally allowed to operate only on the ground. The enable/disable of the T-Modem is accomplished by monitoring the Discrete Input signals to the Server – usually WOW and Door Open.

The table below gives an example of an operational scenario during various phases of flight. Note that this information is provided as an example only and that local or installation dependent requirements may apply.

| Phase of Flight | WOW | Door Open | Altitude | WiFi (CWAP) | T-Modem (Server) |
|---|---|---|---|---|---|
| **On ground, at gate** | TRUE | TRUE | 0 feet | ON or OFF | ON |
| **On ground, not at gate** | TRUE | FALSE | 0 feet | ON or OFF | OFF |
| **In flight, below 10K ft** | FALSE | FALSE | <10k feet | OFF | OFF |
| **In flight, above 10K ft** | FALSE | FALSE | >10k feet | ON | OFF |

# 9.Support and Service

## 9.1 TECHNICAL SUPPORT

Technicians and engineers from Kontron Embedded Modules GmbH and/or its subsidiaries are available for technical support. We are committed to making our product easy to use and will help you use our products in your systems.

Please consult our Web site at http://www.kontron.com/support for the latest product documentation, utilities, drivers.

## 9.2 RETURNING DEFECTIVE MERCHANDISE

Please use the website to obtain latest information on returning merchandise.

http://us.kontron.com/support/rma-information

All equipment returned to Kontron must have a Return Material Authorization (RMA) number assigned exclusively by Kontron. Kontron cannot be held responsible for any loss or damage caused to the equipment received without an RMA number. The Buyer accepts responsibility for all freight charges for the return of goods to Kontron's designated facility. Kontron will pay return freight charges back to the Buyer's location in the event that the equipment is repaired or replaced within the warranty period stipulated herewith.

To request a Return Material Authorization (RMA) number

- Be prepared to supply the unit serial number, reason for return and original ship date
- Place call to 800-480-0044 to receive RMA number (toll free in the US and Canada) "OR"
- E-mail the information to support@us.kontron.com to receive RMA number
- RMA Request Form (found on website)
- Return defective material (unless instructed otherwise with issuance of RMA) to:

  Kontron America

  9477 Waples Drive

  San Diego, CA 92121

  USA

  Attn: (RMA number)

About Kontron

Kontron, a global leader in embedded computing technology and trusted advisor in IoT, works closely with its customers, allowing them to focus on their core competencies by offering a complete and integrated portfolio of hardware, software and services designed to help them make the most of their applications.

With a significant percentage of employees in research and development, Kontron creates many of the standards that drive the world's embedded computing platforms; bringing to life numerous technologies and applications that touch millions of lives. The result is an accelerated time-to-market, reduced total-cost-of-ownership, product longevity and the best possible overall application with leading-edge, highest reliability embedded technology

Kontron is a listed company. Its shares are traded in the Prime Standard segment of the Frankfurt Stock Exchange and on other exchanges under the symbol "KBC". For more

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