Aviat NETWORKS

ECLIPSE™

INSTALLATION MANUAL

5.8 GHZ UNLICENSED BAND

Rev.003

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Eclipse IRU 600 Installation Manual

5.8 GHz Unlicensed Band

Manual Rev. 003
October 2012

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October 2012

This manual is specific to Eclipse with IRU 600 for all-indoor operation on the FCC and Industry Canada 5.8 GHz unlicensed band.

Warranty

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Further, Aviat Networks reserves the right to revise this publication and to make changes from time to time in the content hereof without obligation of Aviat Networks to notify any person of such revision or changes.

Safety Recommendations

The following safety recommendations must be considered to avoid injuries to persons and/or damage to the equipment:

1. *Installation and Service Personnel:* Installation and service must be carried out by authorized personnel who have the technical training and experience necessary to be aware of any hazardous operations during installation and service, and of measures to avoid any danger to themselves, to any other personnel, and to the equipment.

2. *Access to the Equipment:* Access to the equipment in use must be restricted to service personnel only.

3. *Safety Norms:* Recommended safety norms are detailed in the Health and Safety sections of this manual.

- Local safety regulations must be used if mandatory. Safety instructions in this document should be used in addition to the local safety regulations.
- In the case of conflict between safety instructions stated in this manual and those indicated in local regulations, mandatory local norms will prevail.
- Should local regulations not be mandatory, then the safety norms in Volume 1 will prevail.

4. *Service Personnel Skill:* Service personnel must have received adequate technical training on telecommunications and in particular on the equipment this manual refers to.

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CAUTION:Making adjustments and/or modifications to this equipment that are not in accordance with the provisions of this instruction manual or other supplementary documentation may result in personal injury or damage to the equipment, and may void the equipment warranty.

Aviat Networks Support

Service and Technical Support:

For customer service and technical support, contact one of the regional Technical Help Desks listed below.

Americas Technical Help Desk	EMEA Technical Help Desk	Asia Pacific Technical Help Desk
Aviat Networks 5200 Great America Parkway Santa Clara CA 95054 U.S.A.	Aviat Networks 4 Bell Drive Hamilton International Technology Park Blantyre, Glasgow, Scotland G72 0FB United Kingdom	Aviat Networks Bldg 10, Units A&B Philexcel Industrial Park M. Roxas Hi-way Clark Freeport Zone Philippines 2023
Toll Free (Canada/USA): 800 227 8332 **Phone:** 210 561 7400 **Fax:** 210 561 7399	**Phone:** Hamilton: +44 (0) 1698 717 230 Paris: +33 (0) 1 77 31 00 33 **Fax:** +44 (0) 1698 717 204	**Phone:** +63 45 599 5192 **Fax:** +63 45 599 5196
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Or you can contact your local Aviat Networks office. Contact information is available on our website at: http://www.aviatnetworks.com/services/customer-support/technical-assistance/

Sales and Sales Support:

For sales information, contact one of the Aviat Networks headquarters, or find your regional sales office at: http://www.aviatnetworks.com/contact-us/sales/

Corporate Headquarters California, USA	International Headquarters Singapore
Aviat Networks, Inc. 5200 Great America Parkway Santa Clara CA 95054 U.S.A. **Phone:** 408 567 7000 **Fax:** 408 567	Aviat Networks (S) Pte. Ltd. 17, Changi Business Park Central 1 Honeywell Building, #04-01 Singapore 486073 **Phone:** +65 6496 0900 **Fax:** + 65 6496 0999 **Sales Inquiries:** +1-321-674-4252

Eclipse Product Compliance Notes

Eclipse has been tested for and meets EMC Directive 2004/108/EC. The equipment was tested using screened cable; if any other type of cable is used, it may violate compliance.

Eclipse is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures. This equipment is intended to be used exclusively in telecommunications centers.

FCC Notices

1. IRU600, 5.8GHz, must be professionally installed and maintained.
2. This equipment has been tested and found to comply 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. Operation of this equipment in a residential environment is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
3. IRU600, 5.8GHz, is compliant with FCC CFR47, Part 15.247.
4. To ensure compliance with the FCC RF exposure requirements, a minimum distance of 18 meters must be maintained between the antenna and any persons whilst the unit is operational. This calculation is based on the maximum conducted power and maximum antenna gain.
5. IRU600, 5.8GHz, has been certified for use with a parabolic antenna with a maximum gain of 45.9dBi or a flat panel antenna with a maximum gain of 28dBi.
6. The filters and software provided with this product allow for transmission only in the frequency range 5725 – 5850MHz to ensure compliance with Part 15.247.
7. According to the conducted power limit in FCC CFR 47, Part 15.247, the power for this device has been limited to 1W (30dBm) at the antenna port.
8. FCC CFR47, Part 15.247 excludes the use of point-to-multipoint systems, omnidirectional applications and multiple co-located intentional radiators. This system is only for fixed, point-to-point operation.

Industry Canada Notices

1. IRU600, 5.8GHz, must be professionally installed and maintained.
2. IRU600, 5.8GHz, is compliant with Industry Canada RSS-210.

3. To ensure compliance with the Industry Canada RF exposure requirements in RSS-102, a minimum distance of 18 meters must be maintained between the antenna and any persons whilst the unit is operational. This calculation is based on the maximum conducted power and maximum antenna gain.
4. IRU600, 5.8GHz, has been certified for use with a parabolic antenna with a maximum gain of 45.9dBi or a flat panel antenna with a maximum gain of 28dBi.
5. The filters and software provided with this product allow for transmission only in the frequency range 5725 – 5850MHz to ensure compliance with the Canadian band edges.
6. According to the conducted power limit in RSS-210 Annex 8, the power for this device has been limited to 1W (30dBm) at the antenna port.

Avis d'Industrie Canada

1. L'IRU600, 5.8 GHz, doit être mis en oeuvre et maintenu par des professionnels.
2. L'IRU600, 5.8 GHz, est conforme à la spécification RSS-210 d'Industrie Canada.
3. Pour assurer la conformité aux exigences d'exposition de la spécification RSS-102 d'Industrie Canada, une distance minimum de 18 mètres entre l'antenne et toute personne doit être assurée quand l'équipement est en fonctionnement. Ce calcul est basé sur la puissance émise maximum et le gain maximum de l'antenne.
4. L'IRU600, 5.8 GHz, a été homologué avec utilisation d'une antenne parabolique de gain maximum 45.9dBi ou d'une antenne plane de gain maximum 28dBi.
5. Les filtres et le logiciel fournis avec ce produit permettent la transmission dans la bande de fréquences 5 725 – 5 850 MHz seulement, pour assurer la conformité avec les limites de bande canadiennes.
6. En conformité avec la limite de puissance émise de la spécification RSS-210 Annexe 8, la puissance de cet équipement a été limitée à 1 W (30 dBm) à l'accès de l'antenne.

International Use of 5.8 GHz

Eclipse IRU 600, 5.8 GHz, does not employ DFS, and as such the equipment cannot be deployed within Europe or any country where DFS is a regulatory requirement for protection of radars.

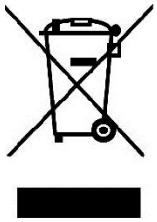
NEBS Compliance

The Eclipse terminal comprising the INU and associated IRU 600(s) complies with the relevant NEBS requirements under GR-1089-CORE and GR-63-CORE.

Such compliance requires installation of the Fan Air Filter option in the INUs, and adherence to the health and safety and equipment installation practices described herein.

WEEE Directive

In accordance with the WEEE Directive (2002/96/EC), Eclipse is marked with the following symbol:



This symbol indicates that this equipment should be collected separately for the purposes of recovery and/or recycling.

For information about collection and recycling of Aviat Networks equipment please contact your local Aviat Networks sales office. If you purchased your product via a distributor please contact the distributor for information regarding collection and recovery/recycling.

More information on the WEEE Directive is available at our website:

http://www.aviatnetworks.com/products/compliance/weee/.

(WEEE is the acronym for Waste Electrical and Electronic Equipment)

RoHS Directive

The RoHS (Restriction of Hazardous Substances) Directive (2002/95/EC) was implemented on 1 July, 2006. Eclipse meets the requirements of this directive, as at the implementation date.

Date of Manufacture

Eclipse date of manufacture information is controlled by serial number. Please contact the Aviat Networks helpdesk for information regarding serial number format and date of manufacture.

Contents

Volume I: Introduction and Safety

About the Documentation

This Installation documentation provides information on installing an Eclipse Microwave Radio system comprising the INU/INUe and IRU 600.

Intended Audience

This information is for use by trained technicians or engineers. It does not provide information or instruction on basic technical procedures. Aviat Networks recommends you read the relevant sections of this manual thoroughly before beginning any installation or operational procedures.

Organization

This manual is divided int othe following sections:

- Health and Safety Requirements
- System Overview
- Installation

Additional Resources

The resources identified below contain additional information.

- Eclipse User Manual.
- Aviat Networks Microwave Radio System Best Practices Guide. Use to assist in installing, commissioning, and troubleshooting Eclipse and other microwave radio products.

Contact Aviat Networks or your supplier for availability.

Documentation Conventions and Terminology

Caution, Warning and Note Cues

The following cues are used to characterize particular types of associated supporting information.

CAUTION: A caution item identifies important information pertaining to actions that may cause damage to equipment, loss of data, or corruption of files.

WARNING: A *warning* item identifies a serious physical danger or major possible problem.

A *note* item identifies additional information about a procedure or function.

Chapter 1. Health and Safety

This section includes the following health and safety information:

All personnel must comply with the relevant health and safety practices when working on or around Eclipse radio equipment.

The Eclipse system has been designed to meet relevant US and European health and safety standards as outlined in IEC Publication 60950-1.

Eclipse is a Class A product. It is intended to be used exclusively in telecommunications centers.

Local safety regulations must be used if mandatory. Safety instructions in this Volume should be used in addition to the local safety regulations. In the case of conflict between safety instructions stated herein and those indicated in local regulations, mandatory local norms will prevail. Should local regulations not be mandatory, then safety norms herein will prevail.

General Health and Safety

This table describes general health and safety information about the Eclipse radio.

Topic	Information
Flammability	The equipment is designed and constructed to minimize the risk of smoke and fumes during a fire.
Hazardous Materials	No hazardous materials are used in the construction of the equipment.
Hazardous Voltage	The Eclipse system meets global product safety requirements for safety extra-low voltage (SELV) rated equipment where the input voltage *must* be 48 V nominal, 60 V maximum.
Safety Signs	External warning signs or other indicators on the equipment are not required.
Surface Temperatures	The external equipment surfaces do become warm during operation due to heat dissipation. However, the temperatures reached are not considered hazardous.

Operator Health and Safety

The following table describes the precautions that relate to installing or working on the Eclipse radio.

Topic	Information
Equipment Protrusions	The equipment has been designed to be free of unnecessary protrusions or sharp surfaces that may catch or otherwise cause injury during handling. However, always take care when working on or around the equipment.
Laser and Fiber Optic Cable Hazards	Eclipse fiber optic transmitters are IEC60825-1 / 21CFR1040-1 Class I compliant and present no danger to personnel in normal use. However: Do not look into active unterminated optical ports or fibers. If visual inspection is required ensure the equipment is turned off or, if a fiber cable, disconnect the far end. Follow the manufacturer's instructions when using an optical test set. Incorrect calibration or control settings could result in hazardous levels of radiation. Protect/cover unconnected optical fiber connectors with dust caps. Place all optical fiber cuttings in a suitable container for safe disposal. Bare fibers and fiber scraps can easily penetrate the skin and eyes.
Lifting Equipment	Be careful when hoisting or lifting the antenna during installation or maintenance. Antennas with their mounting hardware can weigh in excess of 100 kg (220 lb) and require specialized lifting equipment and an operator trained and certified in its use.
Protection from RF Exposure: Eclipse	The Eclipse radio does not generate RF fields intense enough to cause RF burns. However, when installing, servicing or inspecting an antenna always comply with the Protection from RF Exposure guidelines under General Hazards on page 8.
Safety Warnings	When a practice or procedure poses implied or potential harm to the user or to the radio equipment, a warning is included in this manual.

General Hazards

The following table describes the general hazards that must be addressed when planning and installing an Eclipse system.

For more information on health and safety when using Aviat Networks products, refer to the *Best Practices Guide*.

Topic	Information
Airflow Requirements	Rack installations must be made so the airflow required for safe and correct operation of Eclipse is not compromised. For the fan-cooled Eclipse INUs and IDUs, unobstructed air passage must be maintained to each side of the chassis, which requires a minimum of 50 mm (2 inches) of side spacing to any rack panels, cable bundles or similar. Where a Fan Air Filter is installed in an INU it must not be allowed to become clogged with dust. Replace when necessary. Inspection must be at not more than 12 monthly intervals when installed in telecommunications equipment room controlled-air environments. Otherwise, inspection is required at more frequent intervals.
EMC	Eclipse has been tested for and meets EMC Directive 89/336/EEC. The equipment was tested using screened cable; if any other type of cable is used, it may violate compliance. Eclipse is a Class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures. This equipment is intended to be used exclusively in telecommunications centers.
ESD	ESD (electrostatic discharge) can damage electronic components. Even if components remain functional, ESD can cause latent damage that results in premature failure. Always wear proper ESD grounding straps when changing or handling the plug-in cards and avoid hand contact with the PCB back-plane and top-plane. Connect your ESD grounding strap to the combined ESD and ground connector on the INU rack ear. Spare plug-in cards or cards to be returned for service must be enclosed in an anti-static bag. When removing a card from the anti-static bag for installation in an INU, or placing a card in a bag, do so at the INU and only when connected to the INU via your ESD grounding strap.
Circuit Overloading	When connecting an Eclipse terminal determine the effect this will have on the power supply circuit protection devices, and supply wiring. Check Eclipse power consumption specifications and the supply capability of the power supply system. This check of capacity must extend to the dc power supply and not just to an intermediate connection point.

Topic	Information
Eclipse Indoor Unit and DC Supply Grounding	The ground for Eclipse indoor unit(s) must be connected directly to the dc supply system ground conductor, or to a bonding jumper from a grounding terminal bar, or bus to which the dc supply system grounding is connected.
Intrabuilding interfaces and cabling for NEBS compliance	Intrabuilding connections to/from Eclipse ports must only be connected via intrabuilding or unexposed wiring or cabling. Intrabuilding ports MUST NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring. Shielded and grounded cables must be used for intrabuilding cabling to/from Eclipse ports. Cables must be grounded at both ends.
Protection from RF Exposure	When installing, servicing or inspecting an antenna always comply with the following: - Do not stand in front of or look into an antenna without first ensuring the associated transmitter or transmitters are switched off. - At a multi-antenna site ask the site owner or operator for details of other radio services active at the site and for their requirements/recommendations for protection against potentially harmful exposure to RF radiation. - When it is not possible to switch transmitters off at a multi-antenna site and there is potential for exposure to harmful levels of RF radiation, wear a protective suit. - Do not look into the waveguide port of an RFU or into an unterminated waveguide when the radio is active. - See RF Exposure on page 11.
Fiber Optic Cables	Handle optical fibers with care. Keep them in a safe and secure location during installation. Do not attempt to bend them beyond their minimum bend radius. Protect/cover unconnected optical fiber connectors with dust caps.
Ground Connections	Reliable grounding of the Eclipse system must be maintained. Refer to instructions in the manual for equipment grounding. There must be no switching or disconnecting devices fitted in ground conductors.
Mains Power Supply Routing	Eclipse dc power, IF, tributary, auxiliary and NMS cables are not to be routed with any AC mains power lines. They are also to be kept away from any power lines which cross them.

Topic	Information
Maximum Ambient Temperature	The maximum ambient temperature (Tmra) for Eclipse indoor units is +55° C (131° F). Special conditions apply to the INUs - for more information see Power Consumption within Power Supply on page 61. To ensure correct operation and to maximize long term component reliability, ambient temperatures must not be exceeded. Operational specification compliance is not guaranteed for higher ambients.
Mechanical Loading	When installing an indoor unit in a rack, ensure the rack is securely anchored. Ensure that the additional loading of an Eclipse indoor unit or units will not cause any reduction in the mechanical stability of the rack.
Power Supply Connection	The Eclipse INUs and IDUs have the +ve pin on their dc power supply connector connected to chassis ground. It must be used with a -48 Vdc power supply which has a +ve ground; the power supply ground conductor is the +ve supply to the radio. For NEBS compliance the battery return connection is to be treated as a common DC return (DC-C), as defined in GR-1089-CORE. There must be no switching or disconnecting devices in this ground conductor between the dc power supply and the point of connection to an Eclipse system. On those high power IRU 600s that support an integral wide-mouth +/-21 to +/-60 Vdc input, both pins on its power supply connector are isolated from chassis ground. For NEBS compliance the battery return connection is to be treated as an isolated DC return (DC-I), as defined in GR-1089-CORE. The power supply for an Eclipse system must be located in the same premises as the Eclipse system.
Power Supply Disconnect	An appropriate power supply disconnect device should be provided as part of the building installation.
Rack Mount Temperature Considerations	If the Eclipse indoor unit is installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be greater than room ambient. The maximum ambient temperature applies to the immediate operating environment of the Eclipse indoor unit, which, if installed in a rack, is the ambient within the rack.
Restricted Access	The Eclipse system must be installed in restricted access sites. The indoor unit and associated power supply must be installed in restricted areas, such as dedicated equipment rooms, closets, cabinets, or the like. Access to a tower and antenna location must be restricted
	NOTE: For USA: In restricted access areas install the Eclipse system in accordance with articles 110-26 and 110-27 of the 2002 National Electrical Code ANSI/NFPA 70, or to any subsequent update to this code for the relevant articles.

RF Exposure

To ensure compliance with the FCC RF exposure requirements, a minimum distance of 20 meters must be maintained between the antenna and any persons whilst the unit is operational. This calculation is based on the maximum conducted power and maximum antenna gain.

- Eclipse with IRU600, 5.8 GHz, has been tested and certified for use with a parabolic antenna with a maximum gain of 45.9 dBi or a flat panel antenna with a maximum gain of 28 dBi. Higher gain antennas must not be used.
- The transmit output power on the IRU 600 has been limited to a maximum of 29 dBm at the antenna port to ensure compliance with the 1W power limit in FCC CFR 47, Part 15.247.

Routine Inspection and Maintenance

This section overviews required and recommended inspection and maintenance practices to ensure health and safety of installed equipment is maintained to highest levels. For more information, refer to the Aviat Networks publication: ***Best Practices***.

Routine Inspections

All sites must be inspected annually, or more frequently if subject to abnormal operating conditions such as particularly exposed sites, or sites subject to salt-spray or heavy snow/ice loading over winter months.

The inspection should cover the physical installation including the antenna, waveguide, waveguide pressurization installation, equipment grounding, tower and building grounds, weatherproofing, and general site integrity.

Where a Fan Air Filter is installed in an INU (for NEBS compliance) it must be inspected annually, or more frequently if the INU is installed in an environment that is not controlled for dust exclusion.

Selected ground wires should be resistance checked and then compared with previous checks to ensure there has been no significant change.

The operational performance of the radio and associated equipment should be checked against their as-built figures using the Portal or ProVision alarm and performance indicators.

Trend Analysis

Use available current and historical Eclipse alarm and performance data to determine any trend that may lead to a failure - if allowed to continue.

Check for the following trends:

- Reducing receive signal levels
- Gradually increasing bit errors or an increasing errored seconds count
- Changes in transmit power
- Increased frequency of rain fade or other fade conditions
- Increasing occurrence of other weather related changes in performance
- Increasing occurrence of a particular hardware failure

Time spent in conducting such analysis is time well spent. Catching a problem before it brings down the network is good network management.

Fault Analysis

All faults, once cleared, should be the subject of a fault report. The data presented in these reports should be analyzed from time to time to check for any common threads, which may point to a particular weakness in the design, installation, or maintenance of the network or to a specific component.

The time taken to restore service and the parts used should also be analyzed to see if improvements are possible in the maintenance procedures, maintenance training and spares holdings.

Training

Properly trained and experienced planning and installation personnel are essential for establishing and maintaining high integrity in a new network. Similarly, properly trained network management and service personnel are essential for the continued good health of a network.

The training needs for personnel should be reviewed from time-to-time to ensure they maintain expertise in their area of work, and on the installed base.

Spares

Spares holdings should be reviewed on a regular basis to ensure the correct quantity and type are held, and held at the most appropriate locations.

Analysis of spares usage will show any trend for excessive use of spares, which may point to a weakness in the deployment or manufacture of the item.

Spares holdings should also be checked from time to time and if necessary brought up to the current hardware and/or software revision level.

Volume II: System Overview

Chapter 1. System Overview

This section overviews features and capabilities of the Eclipse node (INU/INUe) with companion IRU 600 RF unit for use on the 5.8 GHz unlicensed band.

5.8 GHz operation is compliant with FCC CFR47 Part 15.247, and Industry Canada RSS-210.

- It has been tested and certified for use with a parabolic antenna with a maximum gain of 45.9 dBi or a flat panel antenna with a maximum gain of 28 dBi.
- The filters used in the IRU 600 RF unit allow for transmission only in the frequency range 5725 - 5850MHz to ensure compliance with FCC CFR47 Part 15.247.

Operation is all-indoor, using rack-mounted indoor units, the INU or INUe, and one or more IRU 600 RF units.

- Eclipse supports multiple radio links from a common indoor unit with throughput capacities to 189 Mbit/s Ethernet, 100xDS1, 3xDS3, or 1xOC3.
- The IRU 600 RF unit is 1+1 optimized with two RFUs and an ACU. The RFUs can be operated as independent links, or as a protected link.
- Path, equipment, and data protection options support comprehensive link, network and data redundancy.
- Plug-in cards on the INU or INUe provide a wide choice of user interfaces and radio link operation.
- The node-based concept eliminates most ancillary equipment and external cabling, and offers smooth upgrade paths for next generation networks.

Figure 1. INUe with High Power 3RU IRU 600(v1)

MEF Certified. Eclipse meets MEF 9 and MEF 14 requirements for carrier-class Ethernet inter-operability and performance.

- MEF 9 specifies the User Network Interface (UNI)
- MEF 14 specifies Quality of Service (QoS)

Aviat Networks is ISO90001:2008 and TL9000 Certified. Full certification means all departments and business units within Aviat Networks have been strictly assessed for compliance to both standards. It testifies that Aviat Networks is a certified supplier of products, services and solutions to the highest ISO and Telecommunication standards available.

See:

- Eclipse Node on page 19
- Eclipse IRU 600 on page 31
- Protection Options on page 35
- Licensing on page 38
- Configuration and Management on page 41
- Antennas on page 42
- Power Supply on page 43

For more comprehensive information on Eclipse features, specifications, and operation refer to the Eclipse Product Description and Eclipse Datasheets.

Eclipse Node

Eclipse node is available as the 1RU INU, or 2RU INUe.

Mandatory plug-ins are the NCC (Node Control Card) and FAN (Fan card). Optional plug-ins include RAC (Radio Access Card), DAC (Digital Access Card), AUX (Auxiliary), NPC (Node Protection Card), and PCC (Power Converter Card).

It is designed to operate from a -48 Vdc power supply (+ve earth). For locations where the power supply is +24 Vdc, a plug-in PCC option provides a voltage conversion function.

INU

The INU requires one NCC and one FAN, and has provision for four option plug-ins. It supports a maximum of three RFUs for three non-protected links, or one protected/diversity link and one non-protected link.

Figure 1-1. INU

INUe

The INUe (INU extended) requires one NCC and one 2RU FAN, and has provision for ten option cards. It supports a maximum of six RFUs for six non-protected links, or up to three protected/diversity links.

Figure 1-2. INUe

See:

- Plug-in Cards on page 20
- Data Packet Plane on page 27
- Adaptive Coding and Modulation (ACM) on page 27
- Platforms on page 29

Plug-in Cards

Plug-in cards for the INU or INUe enable quick and easy customization on Eclipse configurations. All cards are hot-pluggable.

RACs support the radio modem function. In the transmit direction they take the digital traffic from the backplane or data packet plane and convert it to an IF signal for connection to an RFU (IRU 600). The reverse occurs in the receive direction.

- One RAC/IRU 600 combination is used for a 1+0 link.
- Two RACs with one 1+1 IRU 600 are used for 1+1 hot-standby or diversity links.
- RACs control TX switching and RX voting on protected / diversity links.
- XPIC (cross polarization interference cancellation) RACs support CCDP (co-channel dual polarization) operation.

DACs support the user interface.

- Different DACs support Ethernet, DS1, DS3, and OC3 connections.
- Multiplexer DACs support transport of OC3 or DS3 *with* NxDS1 rates.
- Ethernet DACs support a L2 switch function. DAC GE3 supports advanced options for Synchronous Ethernet, ring/mesh protection, QoS, buffer management, link aggregation, VLAN tagging, and OAM.
- Most DACs can be protected using a stacked (paired) configuration.
- DS1, DS3, and OC3 DACs support Ethernet-over-TDM options to enable Ethernet transport over legacy TDM radio or leased-line links.

AUX (Auxiliary card) supports async or sync service-channel connections, and alarm I/O options for connection to external devices.

NCC (Node Controller Card) provides Node management and DC-DC converter functions. NCC is a mandatory card.

- It manages Node operation and event collection and management.
- It incorporates a router function for local and remote network management interconnection.
- Node configuration and licensing data is held in flash-memory.
- Power supply: -48 Vdc (SELV -40.5 to -60 Vdc).

FAN (Fan card) provides forced-air cooling. FAN is a mandatory card.

NPC (Node Protection Card) provides 1+1 protection functions for the NCC power supply and backplane management.

PCC (Power Conversion Card) supports operation from a +24 Vdc power supply.

Plug-in Cards Overview

For detailed information on the plug-ins refer to the Eclipse Platform Product Description.

RAC 60E

RAC 60E supports DPP (Data Packet Plane) operation, ACM (Adaptive Coding and Modulation), and airlink recovered timing (ART) for high accuracy radio transport of a SyncE clock.

There are four dynamically switched modulation rates; QPSK, 16 QAM, 64 QAM, 256 QAM. Coding options additionally apply on each of these modulations, one for maximum throughput, one for maximum gain, to provide an effective total of eight modulation states.

- Maximum throughput delivers maximum data throughput - at the expense of some system gain.
- Maximum gain delivers best system gain - at the expense of some throughput.
- Up to four of the eight modulation states offered with ACM can be selected for use.
- Modulation switching (state change) is errorless for priority traffic.

A DPP port enables direct routing of Ethernet traffic to a DAC GE3.

Individual ACM modulations can be set as fixed rates. These are complemented by fixed-only rates for TDM capacities (DS1, DS3, OC3).

ANSI channel bandwidths range from 3.5 to 80 MHz.

Air-link capacities for Ethernet, or for Ethernet+TDM, extend to 366 Mbit/s.

TDM options extend to 127xDS1, 4xDS3, 2xOC3.

Payload encryption is a licensed option.

ART operation is designed to meet G.8262 synchronization mask requirements for SyncE clock transport.

A RAC 60E can link to a RAC 6XE in non-CCDP mode.

Figure 1-3. RAC 60E

RAC 6XE

RAC 6XE adds CCDP operation to 60E capabilities. RAC 6XE additionally supports ART.

Two RAC 6XE cards are operated as a CCDP pair, either in the same INU, or in separate co-located INUs to provide double the capacity over one channel, using both the horizontal and vertical polarizations. An XPIC function between the RACs ensures cross-polarization interference is eliminated.

Figure 1-4. RAC 6XE

DAC GE3

DAC GE3 capabilities include Synchronous Ethernet, link aggregation, policing, ring/mesh protection and Ethernet service OAM.

- Three RJ-45 10/100/1000Base-T ports
- Two multi-purpose SFP ports with plug-ins for:
  - Optical LC, 1000Base-LX, 1310 nm single-mode
  - Optical LC, 1000Base-SX, 850 nm multi-mode
  - Electrical RJ-45 10/100/1000Base-T
- Six transport channel (TC) ports
- Comprehensive QoS traffic prioritization and scheduling options:
  - 802.1p mapping
  - DiffServ mapping (IPv4, IPv6)
  - MPLS Exp bits mapping
  - Strict priority scheduling
  - Deficit Weighted-Round-Robin (DWRR) scheduling
  - Hybrid strict + DWRR scheduling
  - Eight transmission queues
- Traffic policing using TrTCM (two rate, three color metering) with remarking options
- L2 LAG (IEEE 802.1AX), static and LACP
- L1LA (Layer 1 link aggregation)

- Advanced options for VLAN tagging, including Q (802.1Q), QinQ (802.1ad), Filtering, Translation
- Synchronous Ethernet with Stratum 3 hold-over performance on timing subsystem
- RSTP (IEEE 802.1w)
- ERP (ITU-T 8032v2)
- Ethernet service OAM (IEEE 802.1ag/IYU-T Y.1731: ETH-CC, ETH-LB, ETH-LT)
- Data packet plane (DPP) and/or backplane traffic interconnection to RACs
- Advanced traffic shaping for fixed and adaptive modulation links
- Superior burst management with 1500 Kbytes shared memory across active ports
- Storm control
- Jumbo frames to 10 Kbytes bi-directional
- Flow control (IEEE 802.3x)
- 1+1 port and card protection
- Inter-frame gap (IFG) and preamble stripping and re-insertion
- RMON stats per port, channel, and queue
- Compatibility with legacy Eclipse Ethernet cards and IDUs

Figure 1-5. DAC GE3

For DPP traffic a DAC GE3 is operated with a RAC 60E or RAC 6XE.

DAC 16xV2

DAC 16xV2 supports 16xDS1 tributaries on compact HDR connectors.

Features additional to those provided by DAC 16x include:

- Tributary protection
- Ethernet over DS1 tribs
- Individual line code selection for AMI or B8ZS on DS1 tribs

Figure 1-6. DAC 16xV2

DAC 4X

DAC 4x supports 4xDS1 tributaries on individual RJ-45 connectors.

Figure 1-7. DAC 4X

DAC 3xDS3

DAC 3xDS3 supports 3xDS3 tributaries on paired mini-BNC connectors.

Figure 1-8. DAC 3xE3/DS3

DAC 3xDS3M

DAC 3xDS3M supports operational modes of:

- Normal DS3 tributary operation (as for DAC 3xDS3)
- M13 multiplexer mode. One or two DS3 interfaces are multiplexed to an NxDS1 backplane.
- DS3 Ethernet mode to enable up to 43 Mbit/s Ethernet over legacy TDM radio or leased-line links (links must support transparent DS3).

Tribs are supported on paired mini-BNC connectors.

Figure 1-9. DAC 3xE3/DS3M

DAC 2x155e

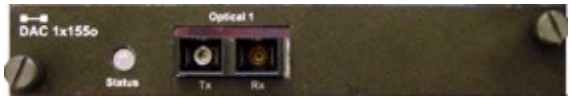
DAC 2x155e supports two OC3 electrical (STS3) tributaries on paired BNC connectors.

Figure 1-10. DAC 2x155e

DAC 1x155o

DAC 1x155o supports one OC3 single-mode optical tributary on SC connectors.

Figure 1-11. DAC 1x155o



DAC 2x155o

DAC 2x155o supports two OC3 single-mode optical tributaries on SC connectors.

Figure 1-12. DAC 2x155o

DAC 155oM

DAC 155oM multiplexes an OC3 optical tributary to an NxDS1 backplane. The user interface is provided on an SFP optical transceiver. Different SFPs support 1310nm single-mode, or 850nm multi-mode.

It functions as a terminal multiplexer; it terminates or originates the OC3 frame. It does not support interconnection of ADMs as there is no provision to transport OC3 overheads for ADM to ADM synchronization.

In virtual tributary mode it transports up to 130 Mbit/s Ethernet over an OC3 link.

Options are provided for external/recovered, or internal clock sourcing.

Figure 1-13. DAC 155oM

DAC 155eM

DAC 155eM multiplexes an OC3 electrical tributary to an NxDS1 backplane. The user interface is provided on an SFP electrical transceiver.

It functions as a terminal multiplexer; it terminates or originates the OC3 frame. It does not support interconnection of ADMs as there is no provision to transport OC3 overheads for ADM to ADM synchronization.

In virtual tributary mode it transports up to 130 Mbit/s Ethernet over an OC3 link.

Options are provided for external/recovered, or internal clock sourcing.

Figure 1-14. DAC 155oM

AUX

AUX provides synchronous and/or asynchronous auxiliary data channels, NMS porting, and alarm input and output functions. Data options are sync at 64 kbps or async to 19.2 kbps.

Figure 1-15.

NCC

The NCC is a mandatory plug-in for an INU/INUe. It performs key node management and control functions, and provides various dc rails from the -48 Vdc input. It also incorporates a plug-in flash card, which holds Node configuration and license data.

Power input limits are -40.5 to -60 Vdc. The power connector is a D-Sub M/F 2W2. The +ve dc return pin is connected to chassis ground.

Figure 1-16. NCC

FAN

The FAN is a mandatory plug-in. There are two variants, 2RU and 1RU. Each is fitted with two long-life axial fans plus monitoring and control circuits.

One 1RU FAN is fitted in an INU.

One 2RU FAN or two 1RU FANs are fitted in the INUe. The 2RU FAN is standard.

Figure 1-17. FAN (1RU)

NPC

NPC provides redundancy for the NCC backplane bus management and power supply functions.

Figure 1-18. NPC

PCC

The PCC provides a voltage conversion function for use at locations where the power supply is +24 Vdc. It converts +24 (19 to 36) Vdc to -56 Vdc for connection to the

INU -48Vdc input. -56 Vdc represents the typical float voltage for a battery-backed -48 Vdc supply.

Figure 1-19. PCC

Data Packet Plane

The high-performance data packet plane (DPP) operates independently of the back-plane.

The DPP is enabled via direct cable connection between the front panel packet data port on a RAC 60E, RAC 6XE, and a front-panel port on a DAC GE3. Customer traffic connected to the DACs is bridged to the RACs, and then to the RF transceiver; the IRU 600.

Where required, customer data can also be sourced via the circuit-switched back-plane, meaning both the DPP and backplane can be used to source/send traffic. This has special relevance where native mixed-mode IP + TDM traffic is to be sent over an Eclipse wireless link; GigE IP traffic via the DPP, and TDM traffic via the backplane.

Adaptive Coding and Modulation (ACM)

Advanced ACM options are provided using RAC 60E or RAC 6XE plug-ins.

- Adaptive modulation maximizes use of available channel bandwidth.
- Coding provides options for maximum throughput or maximum system gain on each modulation rate.

Adaptive Modulation (AM)

AM uses one of four automatically and dynamically switched modulations - QPSK, 16 QAM, 64 QAM, or 256 QAM. For a given RF channel bandwidth a two-fold improvement in data throughput is provided for a change from QPSK to 16 QAM, a three-fold improvement to 64 QAM, and a four-fold improvement to 256 QAM.

In many instances the link parameters that supported the original system gain can be retained. For example, the antenna sizes and Tx power used for an original QPSK link on a 7 MHz channel are unchanged when operated on 256 QAM using adaptive modulation. The adaptive modulation engine ensures that the highest throughput is always provided based on link quality.

Modulation switching is hitless/errorless. During a change to a lower modulation, remaining higher priority traffic is not affected. Similarly, existing traffic is unaffected during a change to a higher modulation.

Note that while adaptive modulation can also be used on PDH links and combined PDH and Ethernet links, unlike Ethernet there is no QoS synergy on PDH connections.

Ethernet connections enjoy real synergy through the QoS awareness on the DAC GE3 GigE switch, and the service provisioning provided by any MPLS or PBB-TE network overlay. All high priority traffic, such as voice and video, continues to get through when path conditions are poor. Outside these conditions 'best effort' lower priority traffic, such as email and file transfers enjoy data bandwidths that can be up to four times the guaranteed bandwidth.

DS1 connections by comparison are dropped in user-specified order when link capacity is reduced, and restored when capacity is increased.

Coding

Modulation code options provide two sets of modulation states, one for maximum throughput, the other for maximum gain. These apply on each of the modulation rates (QPSK, 16 QAM, 64 QAM, 256 QAM) to provide a total of eight modulation states.

Maximum throughput delivers maximum data throughput - at the expense of some system gain.

Maximum gain delivers best system gain - at the expense of some throughput.

Up to four of the eight modulation states offered with ACM can be selected for use. For example:

- With four modulation rates, each can be set for maximum throughput or maximum gain.
- With three modulation rates, such as 16 QAM, 64 QAM, 256 QAM, *one* rate (any) can be set for maximum gain and additionally for maximum throughput, to provide four step AM operation.
- With two modulation rates, such as 16 QAM (or 64 QAM) with 256 QAM, each can be set for maximum gain and additionally for maximum throughput, to provide four step AM operation.

This feature provides a practical trade-off between capacity and system gain to fine-tune link performance. It provides best balance on AM operation.

The four modulation rates support near-linear 2x, 3x, 4x capacity steps.

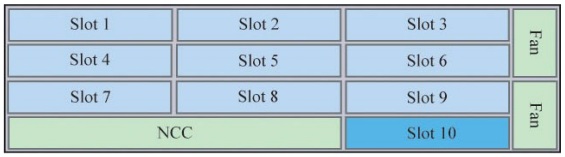
The coding options allow capacity/gain variations on these rates to always support up to four steps, even when just two of the possible four modulation rates are in use, or are permitted.

Even where just one modulation rate is required/permitted, the coding option supports two-step AM operation, one for maximum throughput, one for maximum gain.

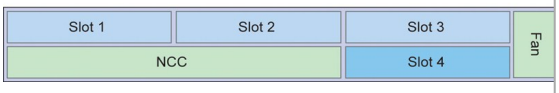
Platforms

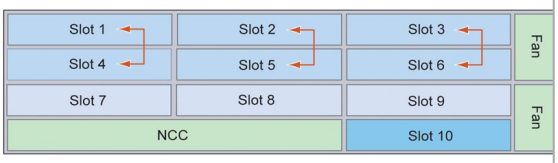
Eclipse supports flexible customization of traffic type, traffic capacity, and traffic protection for up to three links using the INU, and to six links using the INUe.

Platform Layout

	Platform
INU 	Supports 3 non-protected links or 1 protected/diversity and 1 non-protected link. 1RU.
INUe 	Supports up to 6 non-protected links for: 1 protected/diversity and 4 non-protected links, or 2 protected/diversity and 2 non-protected links, or 3 protected/diversity links. 2RU.
IRU 600 	IRU 600: - QPSK to 256 QAM, 5.8 GHz ISM band (USA and Canada). - Requires RAC 60E/6XE. Fixed or adaptive modulation rates. - 1+1 optimized. - High power and standard power RFU options. - 2RU for IRU 600v3; 3RU for IRU 600v1 and v2.

Slot Assignments

	Slots
INU 	- Slots 1, 2, 3, 4 are universal: any RAC, DAC, or AUX plug-in - Slot 4 is NPC or universal: NPC or any RAC, DAC, AUX - NCC and FAN slots are dedicated - For protected operation the RAC/RAC, RAC/DAC 155oM, or DAC/DAC pairings can be installed in any of the universal slots

	Slots
INUe 	- Slots 1, 2, 3, 4, 5, 6 are universal: any RAC, DAC, or AUX plug-in - Slots 7, 8, 9 are restricted: any DAC, or AUX, except DAC 155oM/eM and AUX *where NMS access is required*[1] - Slot 10 is restricted: NPC option only - NCC and FAN slots are dedicated - the INUe is supplied standard with a single 2RU FAN, though accepts two 1RU FANs - RAC/RAC, or RAC/DAC 155oM/eM protected pairings must be installed in the positions indicated by the arrows - For protected DACs, the protection partners can be installed in slots 1 to 9, except for the DAC 155oM/eM where NMS access is needed, in which case install only in slots 1 to 6

Data is transported natively over an Eclipse wireless link, whether Ethernet or TDM.

[1]Internal (backplane bus) NMS access is only provided on slots 1 to 6. Do not install DAC 155oM, DAC 155eM, or AUX in slots 7 to 9 if an NMS connection is required in their configuration.

Eclipse IRU 600

The IRU 600 is a rack-mounted transceiver unit for co-location with an INU/INUe as an all-indoor installation.

- IRU 600 is 1+1 optimized. It comprises one or two RFUs (radio frequency units), and a filter-based ACU (antenna coupler unit).
  - The ACU design supports paired and unpaired Tx/Rx frequency splits and incorporates an optional expansion port to allow other radio links onto its waveguide feed for co-path operation.
  - Protected/diversity options include:
    - 1+1 hot-standby, single antenna.
    - 1+0 hot-standby-ready.
    - Space diversity (dual antennas) with common or split Tx.
    - Frequency diversity (single antenna) or frequency diversity with space diversity (dual antennas).
  - 1+0 repeater (back-to-back) single chassis operation is supported.
- IRU 600 is supported from a RAC 60E/6XE.
- NEBS compliant EMI filtering is standard (currently IRU 600(v1) and IRU 600v2). NEBS compliance for IRU 600v3 is planned.
- Labels on the ACU show filter and circulator losses and the total loss (filters, circulators, switch and cables combined).
- When multiple IRU 600 links are combined onto a single waveguide feed for ACCP operation, required minimum Tx to Tx and Rx to Rx spacings, and minimum Tx to Rx separations must be strictly maintained. For information on ACCP operation and limitations contact Aviat Networks or your supplier.

IRU 600 Variants

There are three variants, IRU 600 [IRU 600(v1)], IRU 600v2, and IRU 600v3. IRU 600v2 and IRU 600v3 incorporate a transmit coaxial RF switch in place of the Tx coupler used with IRU 600(v1) for 1+1 hot standby and space diversity applications. IRU 600v2 and IRU 600v3 also add a transmit monitoring port.

Tx Coaxial Switch: IRU 600v2 and IRU 600v3

Primary benefits of the Tx coaxial switch are reduced power loss and faster Tx protection switch times.

- It avoids the losses associated with a Tx coupler/combiner.
  - With the Tx coaxial switch (relay) there is no A-side versus B-side consideration required as the loss is not more than 0.5 dB on both.

- Average recovery times of 50 ms compared to times approaching 200 ms for the Tx-mute/unmute operation of the coupler-based IRU 600(v1) solution.
  - Times apply to full MHSB operation (standby Tx on), and muted standby Tx mode (standby Tx on Tx mute). The standby Tx is terminated into a dummy load via the Tx switch.

MHSB mode increases power consumption as both transmitters are fully active - both online and offline Tx status is captured in real time. Where lower power consumption is the priority, an option is provided to mute the offline Tx. For power consumption data See Power Supply on page 61.

- With MHSB operation both A-side and B-side transmit are fully monitored.
- With a Tx mute configured on the offline Tx, its Tx status cannot be monitored. A solution to guard against this leading to a possible unreported standby Tx failure situation is provided through periodic activation of the standby Tx for health monitoring purposes - it is turned on, checked, and turned off again. The period between turn-on instances is user-selectable.

RFU Variants

IRU 600v2 and IRU 600v3 RFUs (RFUv2 and RFUv3) incorporate a Tx switch control port (DIN5 connector) for cable connection to the Tx coaxial switch.

- Switch-port cables (two) are included with the Tx switch on MHSB and MHSB/SD ACUs.
- On the RFUv2 and RFUv3, RSSI access is provided on the front panel as meter test-probe points. On RFUv1 RSSI access is provided on the ACU-side of the

IRU 600 Compatibility

IRU 600(v1) and IRU 600v2 share a common 3RU chassis. Dimensions and mounting points for V1 and V2 RFUs and ACUs are identical.

IRU 600v3 is housed in a compact 2RU chassis. While the ACU is unique to the V3, the V3 RFUs can be used in V1 and V2 chassis.

The following use guidelines apply:

- V1 and V2 RFUs are compatible sparing partners EXCEPT for HSB configurations where the ACU incorporates a coaxial relay Tx switch (IRU 600v2/v3 ACUs). RFU V1 cannot control the Tx coaxial switch. This means that:
  - V1, V2 RFUs are interchangeable in non-protected systems using V1, V2 ACUs. Applies to single-ended 1+0, and to 1+0 repeater systems.
  - In protected HSB or HSB-ready systems with a V1 ACU, a V2 RFU can spare for a V1.
  - In protected HSB or HSB-ready systems with a V2 ACU, the V1 RFU cannot spare for a V2 RFU.
- V3 RFUs can be installed in IRU 600(v1) or IRU 600v2 chassis using a conversion kit, which increases RFU unit height to match the mounting points provided for V1 and V2 RFUs.

  - The V3 RFU (with conversion kit installed) can be used in non-protected and HSB V1 and V2 chassis.
  - V1 or V2 RFUs cannot be installed in a V3 chassis.
- V1 and V2 ACUs are interchangeable. The V3 ACU is not.
  - A V1 ACU can be installed in a V2 chassis, and vice-versa.
  - V1 and V2 ACUs cannot be installed in a V3 chassis. Similarly a V3 ACU cannot be installed in a V1 or V2 chassis.
- All IRUs are fully over-air compatible with like-for-like configurations. For example, a 1+0 IRU 600(v1) may be linked to a 1+0 IRU 600v2 or IRU 600v3. Similarly, 1+1 HSB IRU 600(v1) may be linked to a 1+1 HSB IRU 600v2 or IRU 600v3.

Tx Monitoring Port

IRU 600v2 and IRU 600v3 Tx filters incorporate a Tx monitoring port (SMA connector) to provide a 30 dB attenuated (nominal) sample for test and measurement purposes. A label on the ACU shows the measured ex-factory insertion loss of the port.

5.8 GHz Unlicensed Band

Eclipse INUs with IRU 600 are compliant with FCC CFR47, Part 15.247, and Industry Canada RSS-210 Annex 8, on ISM frequency band 5725 to 5850 MHz. International use is not supported; the system does not employ DFS and as such cannot be deployed within Europe or any country where DFS is a regulatory requirement for protection of radars.

Features and Capabilities:

- ACU filters are tuned 30 MHz wide.
  - Filters are spot tuned (pre-tuned) on 5740.5/5805.5 MHz or 5769.5/5834.5 MHz.
  - With 30 MHz filters just two Tx/Rx pairs can be used to provide full coverage of the band.
- Bandwidths 5, 10, 20, or 30 MHz.
- Tx and Rx can be paired on different sub-bands (Tx on one 30 MHz sub-band, RX on the other).
- Adaptive or fixed modulation options.
- Supports Ethernet and/or NxDS1 payloads, with air-link capacities to 189 Mbit/s (30 MHz Ch BW).
- Extensive protection and diversity options.
- Output power is limited to 29 dBm at the waveguide port to ensure compliance with the FCC 1 Watt rule.
- For Tx power and system gain figures, see the Eclipse Node Datasheet.

Operational Limitations and Restrictions

Unlicensed band operation means sharing the air-space with other operators of unlicensed band links. Interference is possible.

- IRU 600 5.8 GHz operation is 'narrow-band'; it competes/shares spectrum with other narrow-band links and with spread-spectrum links.
- Performance could deteriorate over time with the introduction of other links in the same geographical area.
- Antennas must be approved (FCC or Industry Canada) for 5.8 GHz unlicensed band.
  - Eclipse 5.8 GHz is certified for use with a parabolic antenna with a maximum gain of 45.9 dBi or a flat panel antenna with a maximum gain of 28 dBi.

Common RFU for 5.8 GHz Unlicensed and L6 Licensed

The RFU for 5.8 GHz unlicensed is common with L6 licensed for easy transition and sparing (from unlicensed to licensed and vice-versa). Links can be rapidly deployed using 5.8 GHz unlicensed, and subsequently transitioned to L6 on license approval.

- The 5.8 GHz unlicensed band is designed to support easy and fast deployment. With a suitable antenna, installation can be 'immediate'.
- The common 5.8 GHz / L6 RFU design means subsequent conversion to L6 licensed operation only requires replacement of the ACU.

5.8 GHz operation supports fast turn-up for new link requirements. On receipt of a license, operation can be converted to L6 licensed band by replacing the ACU.

Protection Options

Eclipse supports link, interface, network, and platform protection options:

Link/Path Protection

Hot-standby, space diversity, frequency diversity, or dual protection options are available. RACs and their companion IRU 600 are protectable.

Rx voting is hitless/errorless; Tx switching is not hitless. The maximum restoration time for a Tx switch is 200 ms.

A remote Tx switch is forced in the event of a silent Tx failure.

Interface Protection

DS1, DS3 and OC3 interfaces can be hot-standby protected using paired (stacked) DACs.

The protectable DACs are DAC 16x V2, DAC 3xDS3, DAC 3xDS3M, DAC 2x155o, DAC 2x155e, DAC 155oM.

When a switch occurs, all Tx and/or Rx tributaries are switched to the protection partner.

Two protection configurations are supported, tributary protection, and always-on:

Tributary Protection

- Y cables connect the paired DACs to customer equipment.
- In the Rx direction (from the customer) both DACs receive data, but only the online

Rx DAC sends this data to the TDM bus.

- In the Tx direction, the online Tx DAC sends data to customer equipment, the other mutes its Tx line interface.

Tributary Always-On

- Separate cables connect each DAC to customer equipment.
- In the Rx direction (from the customer) both DACs receive data, but only the online Rx DAC sends this data to the TDM bus.
- In the transmit direction both DACs send data to customer equipment, and the customer equipment switches between these two always-on tributaries.

Protection switching is not hitless. The maximum restoration time for a Tx or Rx trib switch is 200 ms. Typical restoration times are between 80 ms and 120 ms.

Network/Data Protection

- Ethernet ring network protection is supported on DAC GE3 using ERP (ITU-T 8032v2 Ethernet Ring Protection) or RSTP (IEEE 802.1w).
- Ethernet data redundancy is supported on L1 and L2 link-aggregated links (DAC GE3).
- PDH ring protection is supported by an DS1 loopswitch capability, or a ring-wrap Super PDH (SPDH) option.

Ethernet Ring and Mesh Networks

ERP uses standard Ethernet bridging and OAM protocols and OAM automatic protection switching (APS) messaging to provide a fast-acting protection mechanism for ring networks.

RSTP uses a development of the spanning tree protocol (STP) to prevent network loops and provide path redundancy.

Ethernet Link Aggregation (N+0 Protection)

Traffic redundancy is supported on co-path Ethernet links using L1 or L2 link aggregation. If one link fails its traffic is recovered on the remaining link or links. While the reduced bandwidth may result in some traffic loss for low-priority traffic, appropriate QoS settings should ensure security for all higher priority traffic.

PDH Ring Protection

Eclipse supports two DS1 ring protection mechanisms, loop-switch and SPDH.

- The loop-switch function configures a bi-directional redundant ring with a *hitless* switching capability. Rings can be configured using RACs, and PDH/SDH mux DACs.
- SPDH uses a ring-wrap mechanism formed on east/west facing RAC/RAC or RAC/DAC 1550M combinations. Switching is not hitless.

Platform Protection

Platform management functions provided by the NCC are protected using the NPC option to protect essential Backplane Bus and power supply functions.

Bus Protection

- Protects all circuit/tributary traffic. Alarm I/O is not protected.
- Switching is not hitless for an NCC bus clock failure; restoration is within 200 ms, during which time all traffic on the NTU is affected.
- When the bus clock has switched to NPC control, it will not automatically revert to NCC control on restoration of the NCC. Return to NCC control requires either withdrawal/failure of the NPC, or use of diagnostic commands.

Power Supply Protection

- Protection is hitless for an NCC power supply failure. If the NCC converter or one of its supply rails fails, the NPC will take over without interruption. And vice versa.
- With an NPC installed, the NCC can be withdrawn and replaced without further impacting traffic.
- For 24 Vdc operation two PCCs are required for platform protection, one each for the NCC and NPC.

Licensing

Eclipse is subject to capacity and feature licensing.

Capacity Licensing

Capacity licensing is INU and INUe based (node-based). A single license applies across all installed RACs installed in an INU/INUe.

- Licensed capacity ranges from 50 Mbps with license EZE-08001, to 2 Gbps with license EZE-08010
- Capacity license is auto-allocated or user-allocated between installed RACs.
- Upgrade licenses are available to increase existing capacity supported on a node.

Node Feature Licensing

Feature licenses provide access to extended Eclipse functionality.

- A feature license is a node-based license - it applies across all relevant cards installed in the node.
- When a feature is required on a new node it is ordered together with the capacity license for the node.
- Feature licenses can be separately ordered as upgrades on existing nodes.

Node Feature Overview

Feature Licenses:

EZF-01: Layer 1 Link Aggregation (DAC GE3)

L1 link aggregation (L1LA) splits traffic between links on a byte-segment basis.

It supports higher burst capacities compared to L2 link aggregation - throughput can burst to the aggregated total capacity, unlike L2 link aggregation.

L1LA (like L2 link aggregation) supports redundancy - data from a failed link is directed onto the remaining link, or links.

L1LA on DAC GE3 is modulation-aware; load re-balancing occurs on modulation change under adaptive modulation.

EZF-02: Adaptive Modulation (RAC 60E/6XE)

Modulation is automatically and dynamically switched between modulation selections.

EZF-03: Secure Management (NMS)

Secure Management applies to Eclipse NMS access over the network, and to local access via the Portal craft tool.

- Provides secure management access to Eclipse over an unsecured network.
- Protects Eclipse configurations from accidental or intentional modification by unauthorized personnel.
- Keeps track of all events for accountability.
- Based on FIPS 140-2 validated algorithms.

EZF-04: Payload Encryption (RAC 60E/6XE)

Payload Encryption encrypts payload and management data on the wireless link to prevent eavesdropping.

- Checks integrity of each data frame in the wireless link to ensure that received data has been sent by the intended transmitter.
- Provides the same level of security as Wi-Fi and WiMAX.
- FIPS-197 compliant.
- Can be enabled/disabled independently for each wireless link.
- Meets US federal and commercial requirements.

EZF-05: Ethernet over TDM (DS3, DS1)

Enables mapping of Ethernet data to DS3, DS1 PDH interfaces using the DAC 3xDS3M or DAC 16xV2. Applies where a customer wishes to transport Ethernet data over existing DS3 or NxDS1 radio or leased-line circuits.

- Ethernet data from the Eclipse backplane is mapped into a DS3 frame as DS1 (1.544 Mbps) multiples to a maximum 28xDS1, to support a maximum data rate (available bandwidth for Ethernet) of 43 (43.232) Mbps per DS3. The DS3 connection must support unframed/transparent DS3.
- Ethernet data is mapped into NxDS1 frames at 1.544 Mbps per DS1 to a maximum 16xDS1 on the DAC 16xV2, to support a maximum data rate (available bandwidth for Ethernet) of 24 (24.7) Mbps.

EZF-06: RADIUS Client

Enables connection validation to a RADIUS server for centralized account management.

EZF-09: Synchronous Ethernet

Enables Synchronous Ethernet operation on DAC GE3 cards.

EZF-10: Ethernet OAM/ERP

Enables access to DAC GE3 Ethernet OAM and ERP capabilities.

EZF-61 to EZF-66: IRU 600v3 High Tx Power

Unlocks an additional 3dB of transmit power over standard power. Applies on all modulations. It also increases the manual and ATPC transmit power control range by 3dB.

- EZF-61 EZG-61 IRU 600 High power option 1 x RFU
- EZF-62 EZG-62 IRU 600 Nodal High power option 2 x RFU
- EZF-63 EZG-63 IRU 600 Nodal High power option 3 x RFU
- EZF-64 EZG-64 IRU 600 Nodal High power option 4 x RFU
- EZF-65 EZG-65 IRU 600 Nodal High power option 5 x RFU
- EZF-66 EZG-66 IRU 600 Nodal High power option 6 x RFU

Configuration and Management

Eclipse is a software-driven product; there are no manual controls. Configuration and management is achieved via Portal and ProVision.

Portal is a PC based configuration and diagnostics tool for Eclipse.

ProVision is the Eclipse network element manager. ProVision also supports other Aviat Networks products, including legacy products.

Portal is supported in the Eclipse system software, such that once installed on a PC, it automatically downloads support from the radio as needed to ensure Portal always matches the version of system software supplied, or subsequently downloaded in any radio upgrade.

Portal has the look and feel of a Windows environment with screen-based views and prompts for all configuration and diagnostic attributes.

A Portal PC connects to an INU/INUe using Ethernet or V.24 options.

For more information refer to the Eclipse Configuration Guide.

ProVision is the network element manager for all Aviat Networks radios (current and legacy). ProVision also supports partner products, including multiplexors, switches, routers, and power systems.

ProVision is installed on a Windows or Solaris server, typically at a network operating center, and communicates with network elements using standard LAN/WAN IP addressing and routing; each radio has its own unique IP address.

For more information, refer to the Aviat Networks ProVision User Guide.

Secure Access from Portal and ProVision is enabled through the Secure Management and RADIUS Client strong security options.

Antennas

Antennas for the 5.8 GHz unlicensed band must be FCC approved.

- Parabolic antennas must have a maximum gain not exceeding 45.9 dBi.
- Flat panel antennas must have a maximum gain not exceeding 28 dBi.

For information on antenna types and availability, contact Aviat Networks or your supplier.

Antenna mounts are designed for use on industry-standard 115 mm OD (4.5 inch) pipe-mounts.

For information on installing and aligning antennas, refer to the data supplied with the antennas.

Power Supply

Eclipse is designed to operate from a -48 Vdc power supply (+ve earth) but will operate to specification over a voltage range of -40.5 to -60 Vdc.

A plug-in PCC option provides a voltage conversion function for locations where the power supply is +24 Vdc. It converts +24 (19 to 36) Vdc to -56 Vdc for connection to the INU -48Vdc input. -56 Vdc represents the typical float voltage for a battery-backed -48 Vdc supply.

One PCC supports a maximum three IRU 600 RFUs, plus any combination of RACs and DACs.

The dc power supply must be UL or IEC compliant for SELV (Safety Extra Low Voltage) output (60 Vdc maximum limited).

Volume III: Installation

Chapter 1. Introduction to Eclipse Installation

This section provides a list of recommended installation tools and materials, and a procedure for unpacking and checking the equipment.

Eclipse has been tested for and meets EMC Directive 89/336/EEC. The equipment was tested using screened cable; if any other type of cable is used, it may violate compliance.

CAUTION: Eclipse is a Class A product. In a domestic environment it may cause radio interference: be prepared to resolve this. Eclipse equipment is intended to be used exclusively in telecommunications centers.

WARNING: You *must* comply with the relevant health and safety practices when working on or around Eclipse radio equipment. Refer to **Health and Safety on page 5**

Installation Overview

The following list provides a basic guide, in order, of an Eclipse hardware installation process.

Hardware installation typically proceeds as follows:

1. **Pre-Installation**

- Unpack equipment - see Unpacking on page 48
- Verify system configuration
- Check basic components
- Check kits and accessories

2. **Installation**

- Antenna - refer to the antenna manufacturer's installation instructions
- Waveguide and waveguide pressurization equipment - refer to manufacturer's installation instructions
- IRU 600 - see IRU 600 Installation on page 49
- INU chassis - see INU and INUe Installation on page 59
- INU plug-in cards - see Plug-in Installation on page 74
- Traffic and NMS cables - as required

For more information on installation practice refer to the Aviat Networks' publication 'Best Practices Guide'.

Installation Tools and Materials

Ensure you have the following tools and material before going to site. These are items to be sourced/supplied by the installer.

The items are indicative for standard installations. For non-standard installations additional materials and tools may be required.

Table 1-1. Required Tools and Material

Equipment	Tool/Material	Description
Antenna	As required by the manufacturer/supplier	Refer to the manufacturer's data supplied with each antenna for required and recommended installation tools and equipment. (Aviat Networks offers antennas from several suppliers).
Waveguide and Pressurization Eqpt	As required by the manufacturer/supplier	Refer to the manufacturer's data supplied for required and recommended installation tools and equipment. (Aviat Networks offers products from several suppliers).
Eclipse Radios	Basic electrician's toolkit	The kit must include a crimp lugs, a crimp tool for attaching the lugs to stranded copper cable, a multimeter.
	Torque wrench	Capable of 66 N-m or 50 ft-lb, with a selection of sockets for antenna mount fastening
	Hot-air gun	For use on the heat-shrink tubing.
	Protective grease and zinc-rich paint	For weather-protecting grounding attachment points on towers and grounding bars.
	4mm^2 (#12) green PVC insulated strand copper wire and grounding lugs	For grounding the indoor unit to the rack/frame
	16 mm^2 (#6) green PVC insulated strand copper wire and grounding lugs	For grounding the rack to the station ground. 16mm is also required for chassis grounding for NEBS compliance.

Unpacking

To unpack Eclipse equipment:

- Open the shipping boxes, carefully remove the equipment and place it on a clean, flat working surface.
- Ensure all the basic components and accessories for your system have been included in the shipment by comparing the packaging, component part numbers and product descriptions against the packing list, and cross-checking against the installation datapack for the system to be installed.
- If there has been shipping damage or there are discrepancies between the equipment expected and the equipment received, contact an Aviat Networks Help Desk or your supplier.

Chapter 2. IRU 600 Installation

Before commissioning an IRU 600 and companion INU, its antenna, waveguide, and waveguide pressurization equipment must be installed according to manufacturer's instructions.

For an overview of IRU 600 features and function, see Eclipse IRU 600 on page 31.

For information on installing an INU, see INU and INUe Installation on page 59.

For guidance on installing antennas, waveguide and pressurization equipment, see the **Best Practices Guide** from Aviat Networks.

IRU 600 (v1), IRU 600v2 and IRU 600v3 RFU Sparing Compatibility

For information on sparing compatibility see IRU 600 Compatibility on page 32.

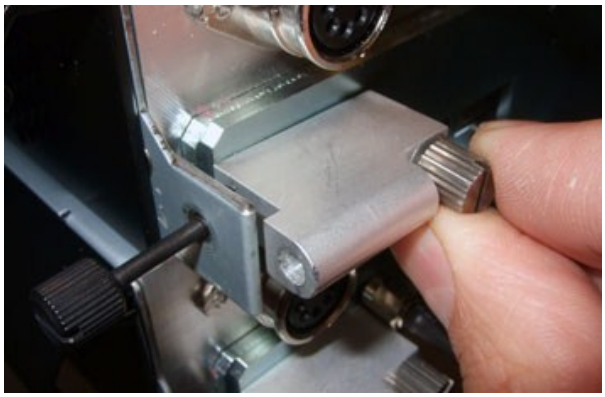
IRU 600 Installation Procedure

This procedure applies to IRU 600(v1), IRU 600v2, and IRU 600v3. Unless otherwise stated, reference to IRU 600 refers to all IRU 600 variants.

1. Fit the rack mounting brackets onto the chassis.
    - Brackets can be mounted in either a forward mount or a flush mount position.
    - Brackets can be mounted such that the grounding stud is to the left or right side.
2. Install the chassis. If installing multiple chassis:
    - For IRU 600(v1) and IRU 600v2 install with a 3RU space between the chassis to permit installation of an expansion or extension kit. This space can be used to install an INU/INUE.
    - For IRU 600v3 no chassis spacing is required, but a 1RU space should be retained above the top and below the bottom of the chassis stack to ease hand access to RFU - ACU cable installation.
3. Locate and secure RFU(s) and ACU in the IRU 600 chassis.
    - For IRU 600v3 the chassis-mounted post fitted to secure the right side of the RFU / left side of the ACU front cover is removable.
    - This is to assist connection/dis-connection of the RFU SMA connectors, and the DIN5 connector on 1+1 configurations.

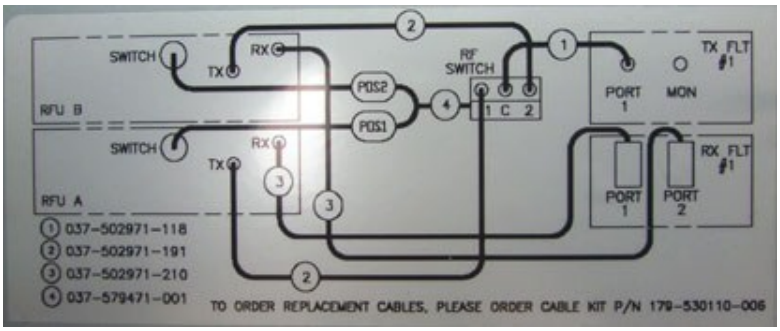
CAUTION:When re-fitting the IRU 600v3 removable post do not over-tighten. Thumb-tighten only to avoid thread-striping.

Figure 2-1. IRU 600v3 Removable Post



4. Connect the RFU(s) to the ACU using the supplied RF cables. Refer to the cabling diagram on the rear side of the ACU front panel. The lower RFU is A-side, the top B-side. A-side is the default online RFU in a 1+1 protected pairing.

Figure 2-2. Example Cabling Diagram on Rear of ACU Front Panel



5. For the IRU 600v2 and IRU 600v3 with Tx coaxial switch, fit the RFU-to-switch cable assembly.
   - The fixing post in front of the RFU connectors can be removed to aid connector access. See step 3 above.
   - Ensure cables connect to the correct RFU. Refer to the cabling diagram on the rear side of the ACU front cover.
   - Ensure DIN5 RFU cable connectors are correctly inserted and locked using the connector locking ring - turn the ring clockwise until clicked into its locked position.
   - Ensure the switch connector is held secure using its screw fasteners.
   - The Tx switch cable must remain securely connected at all times. Incorrect communication between the RFU and Tx switch may result in mismatched A-side and B-side operation and loss of standby.
6. Connect the RFU(s) to the INU/INUe RAC 60E or RAC 6XE card(s) using the supplied IF cable(s). The minimum bend radius of the IF cable is 25mm.

Figure 2-3. IRU 600 and INU

Figure 2-4. IRU 600v2 Tx Switch and RFUv2 Connections

Figure 2-5. IRU 600v3 Tx Switch and RFUv3 Connections

CAUTION:Ambient temperatures must not exceed 55^{0}C (131^{0}F). If installed in a rack cabinet, it is the ambient within the cabinet.

Grounding

The chassis grounding stud accommodates ground cables up to 16 mm² (AWG 6). The stud also provides jack plug connection for a wrist strap.

1. Ground the IRU 600 from the grounding stud to the rack/frame ground bar using 4 mm² (AWG 12) green PVC insulated stranded copper wire with a suitably sized crimp lug at the ground bar end (supplied by the installer). For NEBS grounding compliance, see below.
2. If the equipment rack/frame requires grounding, use 16 mm² (AWG 6) wire from its ground bar to the station ground.

Safety Requirements for Equipment Grounding

- Do not assume that an existing rack or mounting frame is correctly grounded. Always check the integrity of the ground connections, which must include a check through to the master ground for the station, which should be located at the point of cable entry to the equipment building. Ground wires must provide a direct, low impedance path to the master ground bar.
- Do not connect other equipment to the same grounding cable as the INU. Each item of equipment in a rack must be separately grounded to the rack ground bar.
- The INU / IRU 600 must be located in the same immediate area (adjacent racks/cabinets) as all other equipment with a (ground) connection to a common DC supply source.
- All intra-building signal cabling must be shielded and both ends of each shield must be grounded.
- There must be no switching or disconnecting devices in the grounded circuit conductor between the DC source and the point of connection of the grounding electrode conductor.

Waveguide Grounding

Grounding the waveguide is an essential part of the overall lightning protection scheme at the site. The number of waveguide grounds required is dependant on the antenna height at its centerline. At a height of 45m, the minimum number of waveguide grounds required is three:

- One located at the top of the vertical waveguide run, about 1 meter below the bend before the waveguide goes horizontal toward the antenna,
- One located at the bottom of the vertical cable run, about a meter above the bend before the waveguide goes horizontal toward the equipment room entry point,
- One located at the equipment room entry way point.

The top and bottom ground is typically connected to a tower ground bar, or to the tower steel using a ground clamp. The entryway ground should be attached to the ground bus bar, generally located directly below the waveguide entryway point.

If the height of the antenna centerline is greater than 45m, then additional grounds are required every 25m, or part of, above the 45m level. The topmost one should be located about 1 meter below the bend before the waveguide goes horizontal toward the antenna.

NEBS Compliance

- Use a 16 mm2 (AWG 6) green PVC insulated stranded copper ground wire (not 4 mm^2) together with a star washer under the grounding screw at the

ground-bar end. Torque the grounding post screw to 1.2-1.5 Nm (10-13 in-lbs).

- All bare conductors must be coated with an appropriate antioxidant compound before crimp connectors are fitted.
- All unplated connectors, braided strap, and bus bars must be brought to a bright finish and then coated with an antioxidant before they are connected. This does not apply to tinned, solder-plated, or silver-plated connectors and other plated connection surfaces – but all must be clean and free of contaminants.
- All raceway fittings must be tightened to provide a permanent low-impedance path.

Waveguide Connection

Connect ACU antenna port(s) to waveguide(s) using flexible waveguide.

For information on required waveguide flange, and recommended waveguide type, refer to the following table.

Remove and discard any protective flange/port covers before installation.

Table 2-1. IRU 600 ACU Flange Data

Freq, GHz	Flange Type	Holes	Screw Length	Wave-guide
5.8/6	CPR 137 G	8 x #10-32 tapped holes	1/2"	WR 137

The screw length assumes a flex twist mating flange thickness of 1/4".

Power Supply

CAUTION:The DC power connector (D-Sub M/F 2W2) on high power V1 and V2 RFUs can be shorted inadvertently if applied at an angle. Always insert with correct alignment.

The DC power supply must be SELV compliant (maximum limited 60 Vdc).

For IRU 600 power consumption figures refer to Power Consumption and INU Load Maximums on page 61.

For +24 Vdc operation one PCC supports a maximum three V1 or V2 RFUs, or a maximum two V3 RFUs.

IRU 600(v1) and IRU 600v2

For 5.8 GHz operation the high-power RFU is required. High power RFUs are powered over the IF cable from its INU/INUe, and additionally via a separate DC input on the RFU front panel.

- The power connector (D-Sub M/F 2W2) and cable is identical to that used for the INU.

- The high power RFU provides a wide-mouth connection for +/- 21 to 60 Vdc. Both +ve and -ve pins are isolated from ground.
- The integral DC/DC converter provides polarity protection, under/over voltage shutdown, over-current limit, and thermal shutdown.
- For operation from +24 Vdc supplies, the associated INU/INUe must be fitted with a PCC to convert +24 Vdc to -48 Vdc.

Run the supplied power cable through to the power pick up point, which should be protected by a circuit breaker or fuse in the rack. The circuit breaker or fuse should have maximum capacity of 8 A.

- For a -48 Vdc supply, connect the blue wire to -48 Vdc (live), and the black wire to ground/+ve.
- For a +24 Vdc supply, connect the blue wire to +24 Vdc (live), and the black wire to ground/-ve.
- For NEBS compliance the battery return connection is to be treated as an isolated DC return (DC-I), as defined in GR-1089-CORE.

NEBS compliant EMI filtering is included.

There are no serviceable fuses.

IRU 600v3

The v3 RFU supports both standard and high Tx power operation, with DC power supplied over the IF cable from its INU/INUe.

- The RFU is SW configured for standard or high power. High power operation requires a feature license.
- For 5.8 GHz operation standard power is used. Standard power supports the 29 dBm maximum-limited output power at the antenna port.
- The INU/INUe requires a -48Vdc power input.
- For +24 Vdc operation a PCC (Power Converter Card) converts +24 Vdc to -48 Vdc for connection to the NCC. Two PCCs are required if an NPC is also installed.

Insertion Loss Labels

Labels on the ACU provide factory-measured insertion loss data. These list the loss for each filter and circulator, and the total loss through the ACU (filters, circulators, cables, plus any protection components, such as Tx switch and couplers). Total (combined) loss figures are used by the craft tool (Portal) to enable computation of Tx power and RSL figures at the ACU antenna waveguide port(s) based on the RFU measured values of Tx power and RSL.

For IRU 600v2 and IRU 600v3 an additional label shows the insertion loss of the Tx monitoring port. The value must be taken into account when measuring output power with a power meter.

Expansion Port Use

The expansion port allows system expansion through the addition of co-located IRU 600 radios, or external radio equipment.

When multiple carriers are deployed on a common branching network (same antenna), the selection and installation of branching network components must be such that threshold degradation caused by intermodulation products is avoided.

While the IRU 600 ACUs are specified to avoid placing undue constraints on frequency planning for multiple carrier systems, the following conditional requirements are intended to provide a guidelines for such systems, which may require extra diligence in the selection and installation of branching components.

- The intermodulation frequency products that result from combining two or more transmitter frequencies on a common antenna feeder should be 48MHz or more above or below each of the receiver frequencies present on the same antenna feeder.
- Systems employing carrier frequencies with potential intermodulation products within 48MHz of any of the receiver frequencies present on the same antenna branching network (feeder) must be designed and installed to mitigate the effects of the potential intermodulation products.

FAN Module

The fan units in an RFU are removable for service/replacement. Fan module replacement is non traffic affecting.

- For IRU 600(v1) and IRU 600v2 a fan cover is removed to expose the two fans. Removal and replacement is per-fan.
- For the IRU 600v3 the four fans are located on a removable/replaceable front-cover fan tray.
  - To remove, unscrew the fan tray fasteners, ease outwards and carefully disconnect the rear cable connector. Fan replacement is per-tray.
- Fan operation is monitored. Each fan has a matching alarm.
- For IRU 600(v1) and IRU 600v2 both fans are operated at a fixed speed.
- For IRU 600v3 the fans are currently operated at a fixed speed. Temperature-dependent speed will be introduced in a subsequent SW release.

If one fan needs to be replaced, replace all fans.

Figure 2-6. IRU 600v3 Fan Removal

Next Step

- INU/INUe installation. Refer to INU and INUe Installation on page 59.

Chapter 3. INU and INUe Installation

The INU and the INUe are the indoor units for the Eclipse Node.

This chapter includes:

CAUTION:Do not turn power off within 10 minutes of initial INU/INUe turn-on, or initial turn-on after a new compact flash card is installed.

CAUTION:There must be a minimum of 50 mm (2") of side spacing from the INU/INUe to any rack panels, cable bundles or similar, and 50 mm (2") of space to the front and back of the RF section to ensure proper ventilation.

INU/INUe Overview

The INU/INUe is a rack-mounted unit that pairs with one or more RFUs. An INU/INUe comprises a chassis and plug-ins.

Dedicated slots are provided for the NCC and FAN plug-ins, and either four slots (INU) or ten slots (INUe) for optional RAC, DAC, AUX and NPC plug-ins.

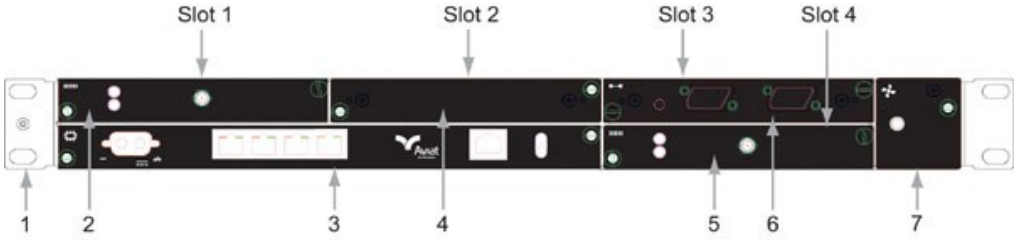
Refer to:

- Front Panel Layout on page 60
- Power Supply on page 61
- FAN Air Filter Option on page 66
- Power Line Filter Option on page 68

Front Panel Layout

An INU front panel is shown. For information on the plug-in cards see Plug-in Cards on page 20 .

Figure 3-1. Typical INU Front Panel Layout



No	Item/Label	Description
1	Rack Ear and grounding stud	Rack attachment bracket for the IDC. One ear has a combined ESD and IDC grounding stud. The ears can be fitted either side, which provide flush-with-rack-front mounting.
2	RAC	RAC fitted in slot 1
3	NCC	Mandatory Node Control Card (dedicated slot)
4	Blank Panel	Blanking panel fitted to slot 2
5	RAC	RAC fitted in slot 4
6	DAC 16x	16xDS1 DAC fitted in slot 3
7	FAN	Mandatory fan plug-in (dedicated slot)

Power Supply

The dc power supply must be UL or IEC compliant for SELV (Safety Extra Low Voltage) output (60 Vdc maximum limited).

INUs require a -48 Vdc power supply (+ve earth), but will operate to specification over a voltage range of -40.5 to -60 Vdc.

The return (+ve) pin on the NCC and NPC power supply connectors is clamped to chassis ground via polarity-protecting power FETs.

- NCC and NPC power inputs are reverse polarity protected (the input fuse will not blow if polarity is reversed).

For NEBS compliance the battery return connection is to be treated as a common DC return (DC-C), as defined in GR-1089-CORE.

Where operation from a +24 Vdc PSU is required, the plug-in PCC option provides voltage conversion from + 24 (19 to 36) Vdc to -56 Vdc for connection to the NCC -48Vdc input. -56 Vdc represents the typical float voltage for a battery-backed -48 Vdc supply.

Power Consumption and INU Load Maximums

Total power consumed is dependent on the number and type of plug-in cards, and the number and type of IRU 600s supported.

Unless otherwise stated reference to IRU 600 refers to all IRU 600 variants; IRU 600(v1), IRU 600v2, and IRU 600v3.

INU loading maximums, the number and type of RACs and DACs that can be installed in an INU, are determined by the load capacity and temperature limits of the DC converter in the NCC, which supplies various DC rails to the plug-in cards.

- IRU 600s and FANs are not powered via the NCC converter, meaning the IRU 600 type does not impact INU link loading. Their DC supply is taken from the -48 Vdc power supply input connector.

However, if a PCC is installed for +24 Vdc operation, the INU cards *and* associated IRU 600s are supplied from the PCC, meaning PCC power limits are determined by the INU cards *and* by the number and type of IRU 600s supported.

- A PCC should always be installed to receive maximum FAN cooling. This means it should be installed in the immediate FAN-side slots in an INU/INUe.

Power Consumption

The table below lists nominal power consumption figures for Eclipse cards. Use these together with the IRU600 consumption figures in the following tables to determine total nodal power consumption.

Power consumption figures are for a -48 Vdc supply voltage at normal room ambients.

Table 3-1. Typical Plug-in Power Consumptions

Item	Consumption
RAC 60E	12W
RAC 6XE	17W
DAC 16xV2, 4x, 3xE3/DS3, 3xE3/DS3M	2.5W
DAC 155o, 2x155o, 2x155e, 155oM, 155eM	4W
DAC GE3	13W
NCC	11W
NPC	8W
AUX	1W
FAN 1RU	2W
FAN 2RU	2W

The tables below list nominal figures for an IRU 600.

IRU 600(v1) and IRU 600v2

- For a standard power IRU 600(v1) and IRU 600v2 RFUs, power is provided via its RAC - RFU cable.
- For a high power RFU, power is supplied via its RAC cable *and* additionally by a front-mounted DC connector.

Table 3-2. Typical IRU 600 and IRU 600v2 Power Consumption

Configuration	Power Sourced from INU	Power Sourced from External DC Connector	Total DC Power
1+0 Standard Power (1xRFU), IRU 600, IRU 600v2	52W	N/A	52W
1+0 High Power (1xRFU), IRU 600, IRU 600v2	52W	38W	90W
1+1 HSB or SD, Standard Power (2xRFU), IRU 600	82W	N/A	82W
1+1 HSB or SD, High Power (2xRFU), IRU 600	82W	42W	124W
2+0 or 1+1 FD, Standard Power (2xRFU), IRU 600, IRU 600v2	104W	N/A	104W
2+0 or 1+1 FD, High Power (2xRFU), IRU 600v2	104W	76W	180W
1+1 MHSB or SD, Std Power (2xRFU), IRU 600v2	104W	N/A	104W
1+1 MHSB or SD, High Power (2xRFU), IRU 600v2	104W	76W	180W
1+1 MHSB or SD, Power save Mode (Offline Tx Mute), Std Power (2xRFU), IRU 600v2	82W	N/A	82W
1+1 MHSB or SD, Power Save Mode (Offline Tx Mute), High Power (2xRFU), IRU 600v2	82W	42W	124W

IRU 600v3

Typical and maximum power consumption figures are listed for standard and high power operation on the 5.8/L6 GHz bands for QSPK operation at maximum Tx power settings.

- A common RFU is used for standard and high power modes. High power is enabled through feature license. See Licensing on page 38.

- For both standard power and high power operation DC power to the RFU(s) is provided from its INU/INUe via the RAC - RFU cable.

Table 3-3. Nominal IRU 600v3 Power Consumption for QPSK at Max Tx Power

Configuration	5.8/L6 GHz Typical	5.8/L6 GHz Maximum
1+0 Standard Power (1xRFU)	58W	63W
1+0 High Power (1xRFU)	63W	68W
2+0 or 1+1 FD, Standard Power (2xRFU)	116W	126W
2+0 or 1+1 FD, High Power (2xRFU)	126W	136W
1+1 MHSB or SD, Std Power (2xRFU)	116W	128W
1+1 MHSB or SD, High Power (2xRFU)	126W	138W
1+1 MHSB or SD, Power save Mode (Offline Tx Mute), Std Power (2xRFU)	106W	115W
1+1 MHSB or SD, Power save Mode (Offline Tx Mute), High Power (2xRFU)	111W	118W

NOTE:

- Power consumption is reduced (slightly) on higher modulations (higher modulations have reduced Tx power output maximums).
- Power consumption is reduced as Tx power is reduced (either when enabling ATPC or when manually configuring Tx power to a value below the maximum capability).
  - High power and standard power operation realizes power consumption savings of approximately 5W when operated 3dB below maximum power, and approximately 15 W when operated 10dB below.

Node Card Maximums

From SW release 5.04 improvements in the cooling fan operating logic allow higher card loadings coupled with maximum ambients to 55°C (131°F), or 45°C (113°F).

- From software release 5.04 fan logic improvements allow higher INUe loading when an NPC is installed.
- An NPC must be fitted in an INUe where specified below. The NPC provides power supply load sharing with the NCC, allowing the overall loading to be increased. Should the NPC fail, airflow from the 2RU FAN is increased to compensate.
- Extended FAN failure/impairment detection is included. For example, an alarm will be raised on a reduction in fan speed (RPM), such as can occur as a result of bearing wear/friction.

When planning the number and type of cards to be installed in an INUe or INU, the following rules must be observed. Individual card consumptions are detailed under Power Consumption.

CAUTION:The loading rules below must be observed by the installer - there is no built-in mechanism to report or limit an incorrect dimensioning of power supply consumption.

INUe Loading Rules for Operation up to 55ºC (131ºF)

The following loading rules must be followed when dimensioning the total power consumption of an INUe that is required to operate in ambient temperatures up to 55ºC (131ºF):

- If the total power consumption of all cards installed exceeds 85 watts, an NPC must be fitted, a 2RU FAN card must be fitted, and 5.04 or later SW loaded.
- With this configuration confirmed (NPC + 2RU FAN + 5.04 SW or later) the maximum INUe loading enabled is 125 watts. The one exception/condition is that the combined installed total of DAC GE3 cards must not exceed four.
- If an earlier version of SW is loaded, the maximum INUe loading allowed is 85 watts. This rule applies even if an NPC and 2RU FAN is fitted.

CAUTION:55ºC (131ºF) operation does not apply to the PCC. Operational ambient temperatures with a PCC installed must not exceed 45ºC (113ºF).

INUe Loading Rules for Operation at 45ºC (113ºF)

The following loading rules must be followed when dimensioning the total power consumption of an INUe that is operating in ambient temperatures that do not exceed 45ºC (113ºF):

- If the total power consumption of all cards installed exceeds 85 watts, an NPC must be fitted, a 2RU FAN card must be fitted, and 5.04 or later SW loaded.
- With this configuration confirmed (NPC + 2RU FAN + 5.04 SW or later) the maximum INUe loading enabled is 150 watts. The exceptions/conditions to this rule are:
  - INUe loading is limited to 140 watts if the installed total of DAC GE3 cards exceeds two.
  - The combined installed total of DAC GE3 cards must not exceed four.
- If an earlier version of SW is loaded, the maximum INUe loading allowed is 105 watts. This rule applies even if an NPC and 2RU FAN is fitted.

Table 3-4. Example Compliant INUe Configurations (5.04 SW or later)

Configuration	Total Card Consumption	Ambient Max Temp	Max Power Consumption
NCC, NPC, 6xRAC 60E, 2xDAC GE3, AUX	120W	+55 ºC	125W
NCC, NPC, 6xRAC 6XE, 2xDAC GE3, AUX	150W	+45 ºC	150W
NCC, NPC, 6xRAC 60E, 2xDAC GE3, DAC 155oM	124W	+55 ºC	125W
NCC, NPC, 4xRAC 6XE, 2xDAC GE3, 2xDAC 16x, AUX	121W	+55 ºC	125W

INU (1RU) Loading Rules

The INU (1RU) chassis should not be loaded above the follow limits:

- 65 watts total for operation up to 45ºC
- 50 watts total for operation up to 55ºC

No improvements are introduced for the INU with 5.04 SW due to its use of smaller, lower volume cooling fans.

Elevated ambient temperatures should be avoided. The ambient temperature is the air temperature in the immediate operating environment of the chassis, which if installed in a rack, is the ambient applying to its location within the rack.

CAUTION:The ambient temperature maximums must not be exceeded. Over-temperature operation is a primary factor affecting long term component reliability.

PCC +24 Vdc Operation

The PCC is for use with standard +24 Vdc (-ve grounded) battery-backed power supply systems.

- One PCC supports a maximum three IRU 600v1 or v2 RFUs, plus any combination of RACs and DACs.
- One PCC supports a maximum two IRU 600v3 RFUs, plus any combination of RACs and DACs.
- The PCC +ve and -ve input terminals are isolated from chassis (ground). The -ve input is grounded by the -ve grounded power supply connection.
- The PCC 20A fuse is fitted in the +ve input. It is a PCB mount type and is not field replaceable.
- Reverse polarity protection is provided. The PCC will automatically recover from a reverse polarity connection - the fuse will not blow. Over temperature thermal protection is included.
- The PCC load maximum is 200 Watts. Use the power consumption data in the preceding section to determine the maximum number of cards and RFUs that an be supported.
- Ambient temperatures must not exceed 45^{0}C (113F). The PCC should always be installed next to the FAN card to get best air flow cooling.
- The PCC conversion efficiency is nominally 10%. To determine the power consumed by the PCC, use a figure of 10% of the power consumed by the INU/INUe cards and RFUs.
- When installed in an INUe the INUe must be fitted with the 2RU FAN module as it provides almost double the air flow of the 1RU FAN modules.
- The PCC must be connected to the NCC before applying power to the PCC to avoid a current-inrush trip (overload) on the PCC.
- The PCC can be plugged into any INU/INUe option slot. It is not connected to the backplane and its function is not monitored within Portal.
- Where an NPC is fitted, two PCCs are required for +24 Vdc operation, one for the NCC, the other for the NPC. This means an INUe must be used for NCC + NPC operation.
- If the PCC front-panel LED is not lit, it indicates the existence of abnormal conditions such as output under-voltage, output over-voltage, loss of input power, output over-current, or open input fuse.

Power Cables

The INU power cable is supplied in the IDC Installation Kit. It is supplied with a D-sub M/F 2W2 connector fitted at one end and wire at the other. The cable is nominally 5 m (16 ft), and the wires are 4 mm2 (AWG 12).

The cable is used for -48 Vdc connections to an NCC or NPC, or for +24 Vdc connections to a PCC.

The blue wire must be connected to live (-48 Vdc or +24 Vdc); the black wire to ground (+48 Vdc or -24 Vdc).

Figure 3-2. Power Cable and Connector

CAUTION:DC power connector can be shorted inadvertently if applied at an angle. Always insert with correct alignment.

The PCC is supplied with a power cable to connect to an NCC or NPC.

Similarly, the optional NEBS power line filter unit is supplied with a power cable to connect to an NCC, NPC, or PCC.

This cable is fitted with a D-sub M/F 2W2 connector at each end. Note that a standard power cable is not included for the reason the cable supplied with an NCC (or NPC) is not used when powered from a PCC, or via a power line filter, so the cable is re-used as the power input cable for the PCC or filter unit.

Fuses

The NCC and NPC are fitted with a fast-acting 25A fuse fitted on the PCB behind the power cable connector.

The PCC is fitted with a fast-acting PCB-mounted 20A fuse.

NCC, NPC and PCC fuses are not field-replaceable.

FAN Air Filter Option

A fan air filter option is available for installation with the FAN module in an INU, and with the 2RU FAN module in an INUe. Where Eclipse is required to be NEBS

(Network Equipment-Building System) compliant, the fan air filter *must* be installed.

The fan air filter must be inspected regularly and replaced when dust laden. In normal telecommunications equipment-room environments inspection must be at not more than 12 monthly intervals. In other environments where air quality is not controlled, more frequent inspection is required.

CAUTION:A heavily dust-laden filter will severely restrict fan air flow and may lead to over-heating.

Excessive heat is the number one cause of premature equipment aging and failure.

To maximize long term component reliability, the fan air filter must not be allowed to become clogged, and ambient temperature limits must not be exceeded.

Fan Air Filter Installation

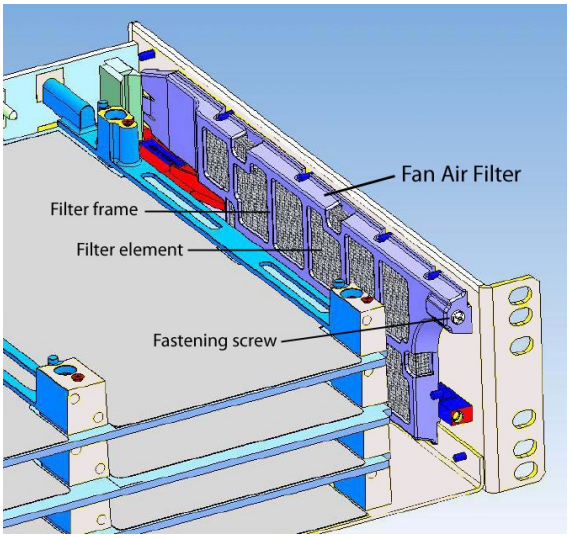
For the INUe a fan air filter kit is supplied, comprising a filter frame, filter element, and fastening screw. For the INU the filter it is a single-piece element.

The filter is installed in the INU/INUe to the right side of the FAN module, as illustrated below for an INUe.

Remove the FAN module and slide the air filter into the chassis so that it locates to the right side of the FAN module backplane connector, and up against the chassis side. FAN module removal and replacement does not affect traffic.

Installation instructions are included with the fan filter kit.

Figure 3-3. Location of Fan Air Filter in INUe



Power Line Filter Option

An external DC power line filter option is available and must be installed with an INU/INUe for NEBS compliance. It ensures Eclipse meets EMI requirements specified within Telcordia GR-1089-CORE, Issue 4, June 2006.

It is IRU tall and 140mm wide (5.5”), and is supplied as a kitset comprising the filter unit, bracket for left or right side rack mounting, and a short 2W2 to 2W2 cable for connecting the filter unit to the NCC or NPC -48 Vdc inputs.

Where an NPC is fitted, two filter units are required, one for the NCC, the other for the NPC.

The standard power cable supplied with an INU or NPC is re-used as the power input cable for the filter unit.

Figure 3-4. Power Line Filter with Bracket

Installation Requirements

This table lists typical INU Installation requirements.

Function/Requirement	Details
Restricted access	The INU/INUe and its associated dc power supply must be installed in a restricted access area such as a secure equipment room, closet, or cabinet. For **NEBS compliance**, this equates to installation of the INU/INUe in a secure, restricted access central office (CO) or customer premises (CP) location.
Required Rack Space	The INU requires 44.5 mm (1RU) of vertical rack space and 300 mm rack depth. The INUe requires 89mm (2RU) vertical rack space.
Ventilation	The INU/INUe requires unobstructed air passage to *each side* for ventilation purposes. There must be a minimum of 50 mm (2") of side spacing to any rack panels, cable bundles or similar. No space above or below is required for ventilation purposes.
Fan Air Filter	The fan air filter must be installed where the INU/INUe is required to be NEBS compliant. The filter must be inspected regularly and replaced when dust laden. Inspection must be at not more than 12 monthly intervals in controlled air environments, or more frequently otherwise.
Power Line Filter	The power line filter must be installed where the INU/INUe is required to be NEBS compliant.
Maximum Ambient Temperature	The INU/INUe is specified for a maximum ambient temperature (Tmra) of +55° Celsius (131° Fahrenheit). Conditions apply - see Power Supply on page 61. The maximum ambient temperature (Tmra) applies to the *immediate operating environment* of the INU, which if installed in a rack, is the ambient applying to its location within the rack.
Physical stability	Ensure that adding an INU/INUe to a rack does not adversely impact the physical stability of the rack.
Power supply -48 Vdc	The INU (NCC and NPC) has the +ve pin on its dc power supply connector connected to the chassis. It must be used with a -48 Vdc power supply which has a +ve ground; the power supply ground conductor is the +ve supply to the INU. There must be no switching or disconnecting devices in the ground conductor between the dc power supply and the point of connection to an INU/INUe. For NEBS compliance the battery return connection is to be treated as a common DC return (DC-C), as defined in GR-1089-CORE.

Function/Requirement	Details
Power Supply +24 Vdc	A PCC is required to provide a +24 Vdc to -48 VDC conversion. The dc power supply supplying the PCC must be -ve grounded. There must be no switching or disconnecting devices in the ground conductor between the dc power supply and the point of connection to a PCC.
Power Supply Location	The INU/INUe must be installed in the same premises as its dc power supply and be located in the same immediate area (such as adjacent racks or cabinets) as any other equipment that is connected to the same dc power supply.
Power Supply Compliance and Loading	The dc power supply must be UL or IEC compliant for a SELV output (60 Vdc maximum). Check to ensure that connection of an Eclipse system to an existing dc supply does not overload the supply, circuit protection devices and wiring. Where a new dc power supply is to be installed for an Eclipse Node, the power supply should be rated to supply: - 12.5 A for the INU - 25 A for the INUe - 15A for the PCC
Cable routing	Eclipse tributary, auxiliary and NMS cables are not to be routed with any AC mains power lines. They are also to be kept away from any power lines which cross them.
Grounding	The INU must be grounded to the station or master ground, which must be the same ground as used for the dc power supply. Normally this is achieved by grounding the INU to the ground bar in its equipment rack or frame. This bar is most often located to one side of the rack or at rack top or bottom. In turn, the ground bar is grounded to the station ground.
Intrabuilding interfaces and cabling **(NEBS Compliance)**	Intrabuilding connections to/from Eclipse ports must only be connected via intrabuilding or unexposed wiring or cabling. Intrabuilding ports MUST NOT be metallically connected to interfaces that connect to the OSP or its wiring. These interfaces are designed for use as intrabuilding interfaces only (Type 2 or Type 4 ports as described in GR-1089-CORE, Issue 4) and require isolation from the exposed OSP cabling. The addition of Primary Protectors is not sufficient protection in order to connect these interfaces metallically to OSP wiring. Shielded and grounded cables must be used for intrabuilding cabling to/from Eclipse ports. Cables must be grounded at both ends.

Installation Procedure

1. Fit the rack mounting brackets to the chassis with the grounding stud to left or right side for the most direct ground wire path to the rack ground bar.
2. Locate the INU/INUe in the equipment rack and secure it using four No.12 Phillips dome-head screws from the IDC installation kit.
3. Ground the INU/INUe from the grounding stud to the rack/frame ground bar using a length of 4 mm2 (AWG 12) green PVC insulated stranded copper wire with a suitably sized ground lug at the ground bar end (supplied by the installer). The grounding stud accommodates ground cables up to 16 mm^2 (AWG 6). The stud also provides jack plug connection for a wrist strap.
4. If the equipment rack/frame requires grounding, use 16 mm2 (AWG 6) wire from its ground bar to the station ground.

Grounding Safety:

- Do not assume that an existing rack or mounting frame is correctly grounded. Always check the integrity of the ground connections, which must include a check through to the master ground for the station, which should be located at the point of cable entry to the equipment building. Ground wires must provide a direct, low impedance path to the master ground bar.
- Do not connect other equipment to the same grounding cable as the INU. Each item of equipment in a rack must be separately grounded to the rack ground bar.
- The INU must be located in the same immediate area (adjacent racks/cabinets) as all other equipment with a (ground) connection to a common DC supply source.

For NEBS compliance:

- Install the fan air filter option. Options are available for the 1RU INU and 2RU INUe. See FAN Air Filter Option on page 66.
- Install the NEBS power line filter unit. Install immediately below or above the INU. Separate filter units are required for the NCC and, where fitted, the NPC. Use the supplied 2w2 to 2w2 cable to connect the output of the filter unit to the input of the NCC or NPC.
- To ground the INU use 16 mm2 (AWG 6) green PVC insulated stranded copper wire together with a star washer under the grounding screw at the ground-bar end. Torque the INU grounding post screw to 1.2-1.5 Nm (10-13 in-lbs).
- All bare conductors must be coated with an appropriate antioxidant compound before crimp connectors are fitted.
- All unplated connectors, braided strap, and bus bars must be brought to a bright finish and then coated with an antioxidant before they are

connected. This does not apply to tinned, solder-plated, or silver-plated connectors and other plated connection surfaces – but all must be clean and free of contaminants.

- All raceway fittings must be tightened to provide a permanent low-impedance path.

5. Install the plug-ins in their assigned slot positions, and check that their front panels are flush-fitted (not protruding) and held secure by their fasteners. Ensure unused slots are covered by blanking panels.
   - If a FAN air filter is required, fit it prior to inserting the FAN.
   - Install the CompactFlash (CF) card in the NCC; insert in the socket on the right side of the PCB.
   - The CF card holds configuration, software load, and license data.
   - Each CF card is identified by a unique serial number; which is the license number for the Eclipse terminal.
6. For an IRU 600 installation fit the supplied jumper cable between the RAC and its companion IRU 600 RFU.
7. Fit NMS cables, DAC tributary cables, and where required, AUX cables. For data on the cable sets, refer to INU/INUe Cable Assemblies on page 77.

The following steps describe the procedure for installing the power cable, and preparing for power-on. *Do not connect* the power until *all* steps have been completed.

8. Run the supplied power cable through to the power pick up point, which will normally be at a circuit breaker panel in the rack. A circuit breaker (or fuse) should have a capacity of 12 A for the INU and a 25 A for the INUe, however these ratings can be adjusted in line with the number of cards installed, and hence power consumption. For power consumption data, see Power Supply on page 61.
9. For a -48 Vdc supply, connect the blue wire to -48 Vdc (live), and the black wire to ground/+ve. (Power input on the NCC and NPC is polarity protected).
10. For a +24 Vdc supply, connect the blue wire to +24 Vdc (live), and the black wire to ground/-ve. (Power input on the PCC is polarity protected).
11. Measure the voltage on the dc power connector.
    - For -48 Vdc operation the voltage should be -48 Vdc, +/-2 Vdc for a non battery floated supply, and nominally -56 Vdc for a battery floated supply. (Limits are -40.5 to - 60 Vdc).
    - For +24 Vdc operation the voltage should be 24 +/- 2 Vdc for a non battery floated supply, and nominally 30 Vdc for a battery floated supply. (Operating limits are 20 to 36 Vdc).

CAUTION: This product meets the global product safety requirements for SELV (safety extra low voltage) rated equipment and the input voltage must be guaranteed to remain within the SELV limits (60 V maximum) in the event of a single internal fault.
Always check the integrity of the dc power supply to an INU/INUe right to its source. Never assume that the supply provided to the pick-up point in a rack is correct.
Eclipse dc power, IF, tributary, auxiliary and NMS cables are not to be routed with any AC mains power lines. They are also to be kept away from any AC power lines which cross them.

12. Carry out a complete check of the installation. If all is correct, and the IRU 600 installation has likewise been completed and checked, the INU and IRU 600 are ready for power-on.
    - If a PCC is installed, ensure the PCC to NCC/NPC cable is correctly fitted before power-on.

CAUTION: Once powered up the RFU(s) will be transmitting with the pre-configured or ex-factory frequency and power settings unless the start-up transmit mute option has been invoked. (All RFUs shipped ex-factory have the transmit-mute set as the default unless otherwise specified). If frequency and power settings are not correct, interference can be caused to other links in the same geographical area.

13. Turn power on. For -48 Vdc connect the power cable to the NCC, and to the NPC where fitted. For +24 Vdc operation, connect to the PCC input.
    - Where a power line filter is installed (for -48 Vdc), connect to the filter input.

CAUTION: Do not turn off an INU/INUe within 10 minutes of initial turn-on, or initial turn-on after a new compact flash card is installed.

CAUTION: 2W2 DC power connectors can be shorted inadvertently if applied at an angle. Always insert with correct alignment.

CAUTION: Ambient temperatures must not exceed 55^0C (131^0F). If installed in a rack cabinet, it is the ambient within the cabinet.

Next Step: The Eclipse INU with IRU 600 is ready for configuration and antenna alignment.

Plug-in Installation

Installing or changing out a plug-in is a straightforward process.

- The table below lists plug-in requirements at installation or subsequent upgrade.
- Unless specified by the customer, plug-ins will not be installed in an INU/INUe at shipment. Instead, each is individually packed within the shipping box.

For a description of the plug-ins, see Plug-in Cards on page 20.

For information on user-interface connector and cable data, refer to INU/INUe Cable Assemblies on page 77.

Table 3-5. Plug-in Requirements

Function/Requirement	Priority	Details
Slot Assignment		
All slots filled	 CAUTION	All slots must be filled with either a plug-in or a blanking panel. Failure to do so will compromise EMC integrity and distribution of FAN cooling air.
Universal slots 1-4 on an INU 1-6 on an INUe		RAC, DAC, and AUX plug-ins can be fitted in any universal slot.
Restricted slots 7-9 on an INUe		DAC, and AUX plug-ins can be fitted in any restricted slot. The exceptions are the DAC 155oM, DAC 155eM, and AUX, which must only be installed in slots 1 to 6 *when they are to be configured to carry/access Eclipse NMS*, otherwise they can be installed in slots 7 to 9.
Dedicated slots		The NCC, FAN, and NPC plug-ins have dedicated slots.
Protected RACs INUe		Protected RACs (or ring-protected RAC with DAC 155oM) must only be installed in 'above and below' slots as indicated by the red arrows.
AUX		Multiple AUX plug-ins can be installed per INU/INUe.
NPC		Only one NPC is required to provide the NCC protection option. An NPC must be installed in slot 4 of an INU, or slot 10 of an INUe. If an NPC is not installed in an INU, slot 4 is available as a universal slot.
Installing / Changing Plug-ins		
ESD grounding strap	 CAUTION	Always connect yourself to the INU/INUe with an ESD grounding strap before changing or removing a plug-in. Failure to do so can cause ESD damage to the plug-ins. Avoid hand contact with the PCB top and bottom.

Function/Requirement	Priority	Details
Finger-grip fasteners		Plug-ins must be withdrawn and inserted using their finger-grip fasteners/pulls. Never withdraw or insert using attached cables, as damage to the plug-in connector and its PCB attachment can occur. If not complied with, the Aviat Networks warranty may be voided.
Hot-swappable		Plug-ins are hot-swappable. - Removal of an in-service payload plug-in will interrupt its traffic. - Removal of the NCC will affect all traffic - unless protected by an NPC. - Removal / replacement of the FAN does not affect traffic.
Engaging backplane connector		When installing a plug-in, ensure its backplane connector is correctly engaged before applying sufficient pressure to bring the plug-in panel flush with the front panel.
Revision time lag		When swapping or installing plug-ins, up to 60 seconds can be required for the INU/INUe to show its revised status via the front panel LEDs, or via Portal.
EMC integrity		Plug-ins and blanking panels are held in place by captive finger-screws. Ensure the finger-screws are fastened as failure to do so may compromise EMC integrity and fan cooling.
RACs		
Connecting and disconnecting the RFUcable at the RAC		Never disconnect or reconnect an RFU cable to a RAC without first turning the power off to the INU or withdrawing the RAC from the backplane. **NOTE:** The RFU cable provides the power feed to the RFU. Arcing during connection and disconnection at the RAC on a live RAC can cause damage to connector contact surfaces. Power spikes caused by live connection and disconnection may also cause errors on other traffic passing through the INU/INUe. The only exception to live disconnection and connection should be for checks of protected operation at link commissioning.
Removing RAC from a powered INU		When removing a RAC from a powered INU, always the disengage the RAC from the backplane before disconnecting its RFU cable. Similarly before inserting an RAC, always reconnect the RFU cable before engaging the backplane.
RAC combinations for INUe		An INUe can be fitted with a maximum of six RACs for one of the following combinations: - Six non-protected links - One protected/diversity link plus four non-protected links - Two protected/diversity links plus four non-protected links - Three protected/diversity links *Before installing more than four RACs refer to the Power Consumption and INU Load Maximums* in Power Supply on page 61.)

Function/Requirement	Priority	Details
DACs		
DAC combinations		DACs can be fitted singly or in combination to provide a mix of interface types and capacities provided they have a common backplane configuration. The backplane can be set for: - 1.5 Mbit/s / DS1 - 3 Mbit/s / DS3 - 155 Mbit/s / OC3 Mux version DACs allow a mix of interfaces from a common DS1 backplane configuration.
Increasing node capacity		To achieve a greater node capacity, two or more INUs can be interconnected via a DAC option.
Interface Protection (electrical DACs)		Line (interface) protection is supported for paired DS1, DS3 and OC3 electrical DACs.
Interface Protection (optical DACs)		Line (interface) / card protection is supported for paired OC3 optical DACs.
Interface Protection, Ethernet DAC GE3		Interface / card protection is supported for paired DAC GE3 cards.
General		
Antistatic bags		Enclose spare plug-ins, or plug-ins to be returned for service, in an antistatic bag. When handling a plug-in to or from an antistatic bag, do so at the INU/INUe and only when you are connected to the INU/INUe via an ESD ground strap.
Spare blank panels		Keep any removed blanking panels for future use.

INU/INUe Cable Assemblies

CAUTION:Eclipse tributary, auxiliary and NMS cables are not to be routed with any AC mains power lines. They are also to be kept away from any power lines which cross them.

For safety reasons tributary, auxiliary and NMS cables should not be connected to outside plant.

Use approved surge suppression equipment when connecting to un-protected external inputs and outputs.

Refer to:

- DAC Trib Connectors and Cables on page 77
- NMS Connectors and Cables on page 88
- Auxiliary and Alarm Connectors and Cables on page 89

DAC Trib Connectors and Cables

This section provides cable and connection data for:

- DAC 16xV2 Cable and Connector Data on page 77
- DAC 4x Cable and Connector Data on page 83
- DAC GE3 Ethernet RJ-45 Cables on page 85
- DAC Optical Cable and Connector Data on page 86
- DAC 155eM Cables on page 88

DAC 16xV2 Cable and Connector Data

Refer to:

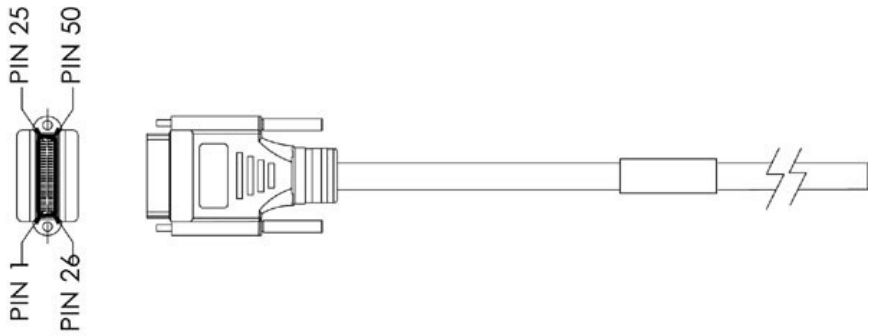
- DAC 16xV2 HDR-E50 To 24 AWG Free End Cable Assembly on page 77
- DAC 16xV2 HDR-E50 To BNC Cable Assembly on page 78
- DAC 16xV2 HDR-E50 To RJ-45 Cable Assembly on page 79
- DAC 16xV2 HDR-E50 To Free End Y-Cable Assembly on page 80
- DAC 16xV2 HDR-E50 To BNC Y-Cable Assembly on page 81

DAC 16xV2 HDR-E50 To 24 AWG Free End Cable Assembly

The assemblies provide balanced 120 ohm connections on cable lengths of 3 m, 10 m, 15m or 32 m. The wire is intended for use with wire-wrap or insulation displacement termination blocks.

Each cable supports up to 8 tribs. Two cables are required per DAC if more than 8xE1/DS1 tribs are to be connected.

Figure 3-5. DAC 16xV2 Free End Trib Cable



PIN	DATA	COLOR		PIN	DATA	COLOR
1	RX1T	WHITE/ORANGE STRIPE		26	TX1T	WHITE/BLUE STRIPE
2	RX1R	ORANGE/WHITE STRIPE		27	TX1R	BLUE/WHITE STRIPE
3	NC	-----		28	NC	-----
4	NC	-----		29	NC	-----
5	RX2T	WHITE/BROWN STRIPE		30	TX2T	WHITE/GREEN STRIPE
6	RX2R	BROWN/WHITE STRIPE		31	TX2R	GREEN/WHITE STRIPE
7	NC	-----		32	NC	-----
8	RX3T	RED/BLUE STRIPE		33	TX3T	WHITE/GREY STRIPE
9	RX3R	BLUE/RED STRIPE		34	TX3R	GREY/WHITE STRIPE
10	NC	-----		35	NC	-----
11	RX4T	RED/GREEN STRIPE		36	TX4T	RED/ORANGE STRIPE
12	RX4R	GREEN/RED STRIPE		37	TX4R	ORANGE/RED STRIPE
13	NC	-----		38	NC	-----
14	RX5T	RED/GREY STRIPE		39	TX5T	RED/BROWN STRIPE
15	RX5R	GREY/RED STRIPE		40	TX5R	BROWN/RED STRIPE
16	NC	-----		41	NC	-----
17	RX6T	BLACK/ORANGE STRIPE		42	TX6T	BLACK/BLUE STRIPE
18	RX6R	ORANGE/BLACK STRIPE		43	TX6R	BLUE/BLACK STRIPE
19	NC	-----		44	NC	-----
20	RX7T	BLACK/BROWN STRIPE		45	TX7T	BLACK/GREEN STRIPE
21	RX7R	BROWN/BLACK STRIPE		46	TX7R	GREEN/BLACK STRIPE
22	NC	-----		47	NC	-----
23	NC	-----		48	NC	-----
24	RX8T	YELLOW/BLUE STRIPE		49	TX8T	BLACK/GREY STRIPE
25	RX8R	BLUE/YELLOW STRIPE		50	TX8R	GREY/BLACK STRIPE

RX indicates data into the DAC 16xV2 (DAC Rx).

TX indicates data out from the DAC 16xV2 (DAC Tx).

DAC 16xV2 HDR-E50 To BNC Cable Assembly

The HDR to BNC 75 ohm cable is available in lengths of 2.3 m or 5.3 m.

Each cable supports up to 8 tribs. Two cables are required per DAC if more than 8xE1/DS1 tribs are to be connected.

Figure 3-6. DAC 16xV2 BNC Trib Cable Assembly

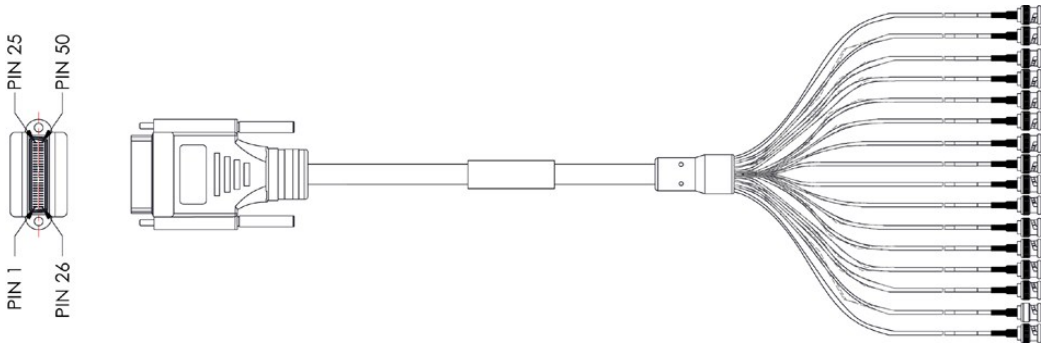
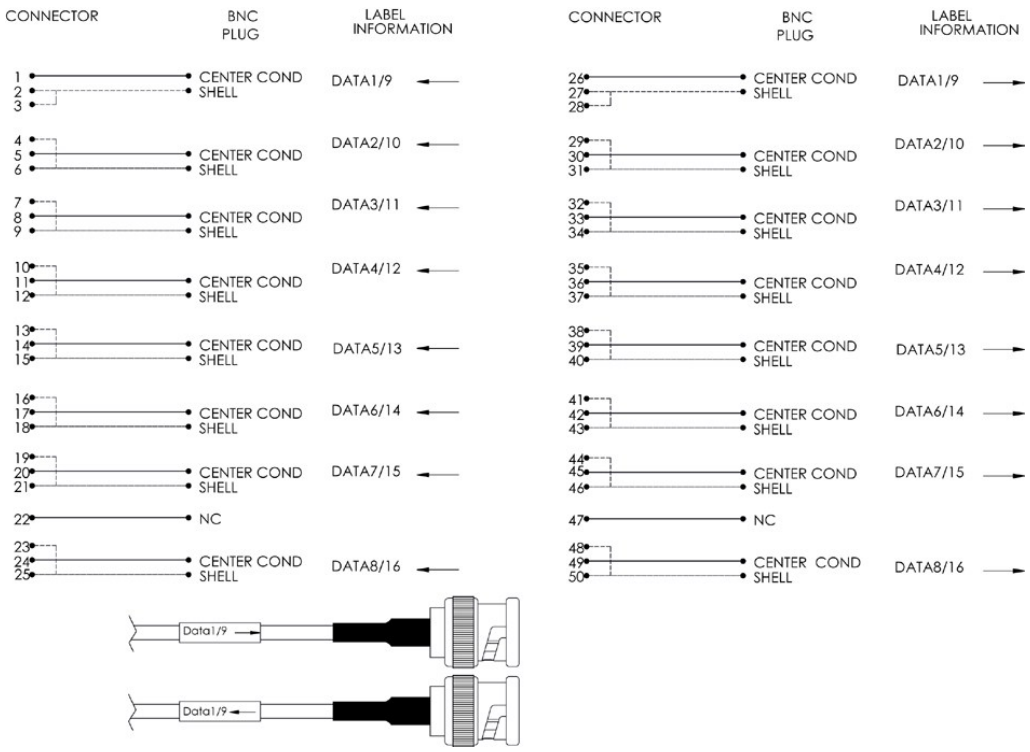


Figure 3-7. DAC 16xV2 BNC Trib Cable Connections



Arrow towards BNC indicates data out (DAC Tx).
Arrow away from BNC indicates data in (DAC Rx).
The 1/9 in the label indicates that it is for trib 1 if the cable assembly is used with the trib 1-8 connector, or trib 9 if used with the trib 9-16 connector. This also applies for 2/10, 3/11, etc. up to 8/16.

DAC 16xV2 HDR-E50 To RJ-45 Cable Assembly

The HDR to RJ-45 cable is available in lengths of 2 m or 5 m. Impedance is nominally 120 ohms.

This cable (straight cable) is intended for connection to RJ-45 patch panels, which have a built-in crossover function.

Each cable supports up to 8 tribs. Two cables are required per DAC if more than 8xE1/DS1 tribs are to be connected.

Figure 3-8. DAC 16xV2 RJ-45 Trib Cable

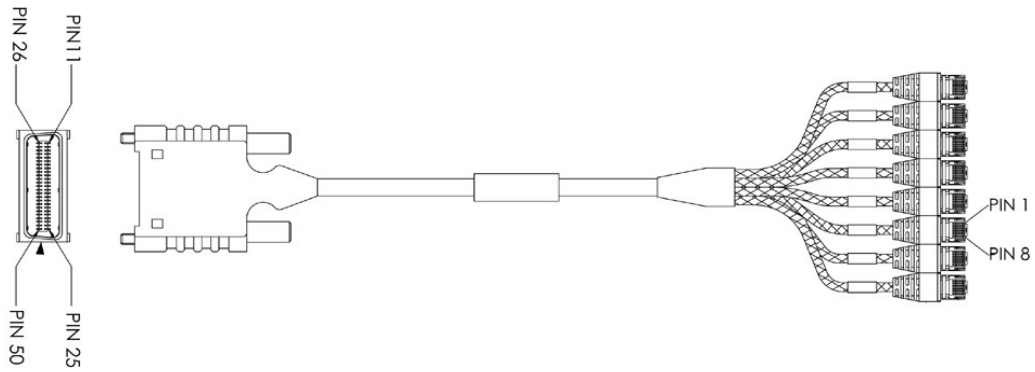
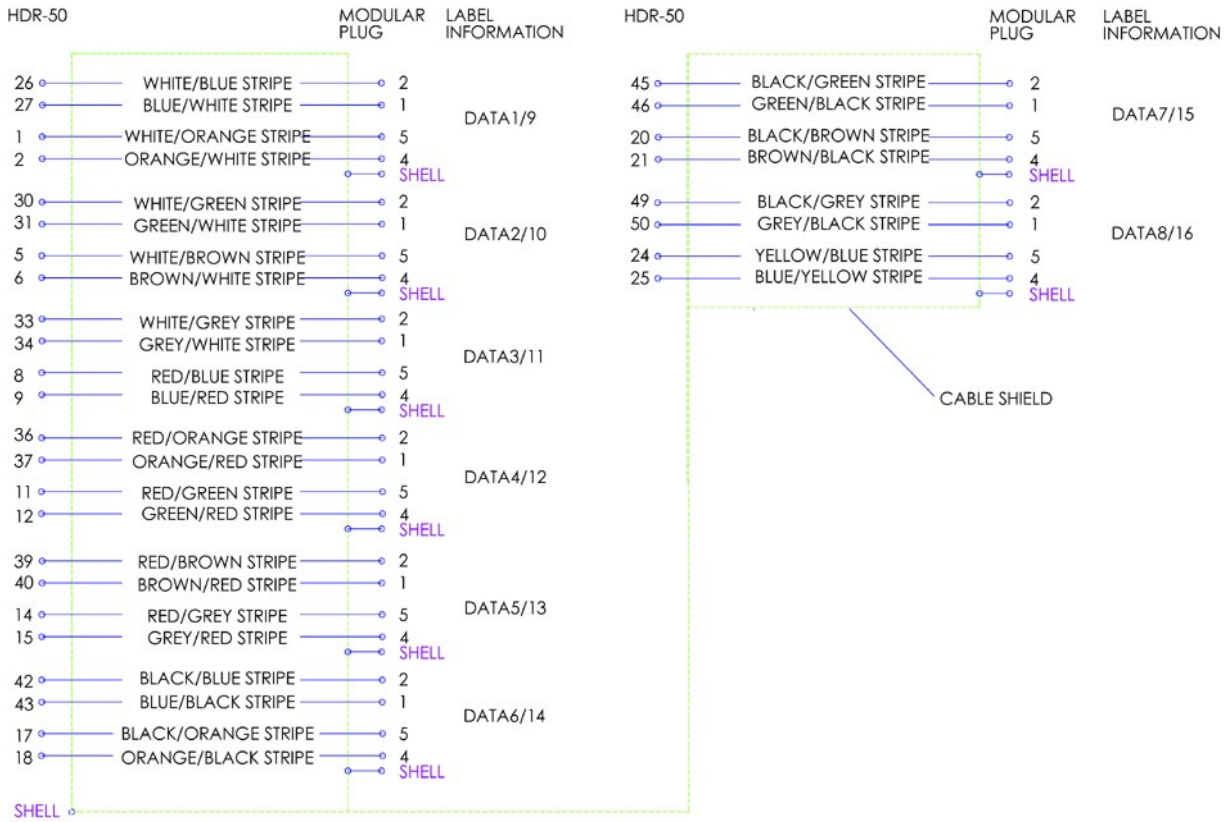


Figure 3-9. DAC 16xV2 RJ-45 Trib Cable Connections



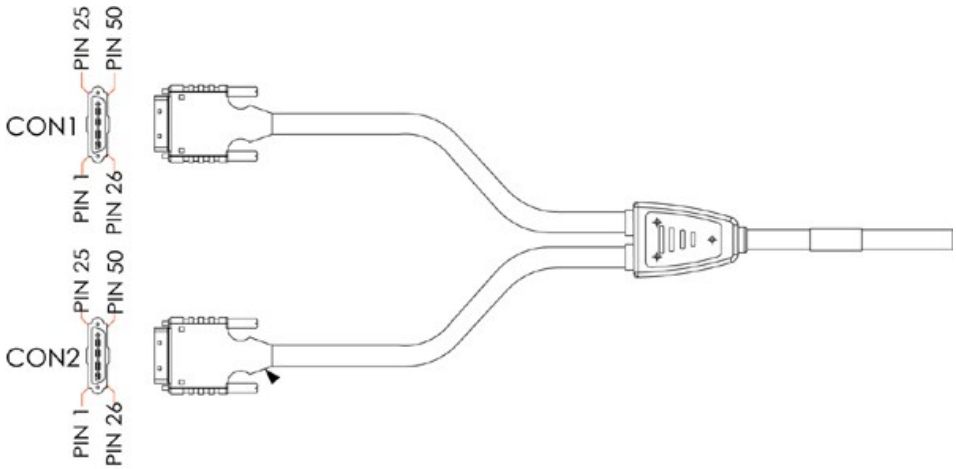
DAC 16xV2 HDR-E50 To Free End Y-Cable Assembly

This cable is for use with DAC 16xV2 1+1 protected operation. It is available in lengths of 3.5 m, 15.5m or 5 m. Impedance is nominally 120 ohms.

The 24 AWG wire is intended for use with wire-wrap or insulation displacement termination blocks.

Each cable supports up to 8 tribs. Two cables are required per DAC if more than 8xE1/DS1 tribs are to be connected.

Figure 3-10. DAC 16xV2 Free End Y-Cable



PIN	DATA	COLOR		PIN	DATA	COLOR
1	RX1T	WHITE/ORANGE STRIPE		26	TX1T	WHITE/BLUE STRIPE
2	RX1R	ORANGE/WHITE STRIPE		27	TX1R	BLUE/WHITE STRIPE
3	NC	-----		28	NC	-----
4	NC	-----		29	NC	-----
5	RX2T	WHITE/BROWN STRIPE		30	TX2T	WHITE/GREEN STRIPE
6	RX2R	BROWN/WHITE STRIPE		31	TX2R	GREEN/WHITE STRIPE
7	NC	-----		32	NC	-----
8	RX3T	RED/BLUE STRIPE		33	TX3T	WHITE/GREY STRIPE
9	RX3R	BLUE/RED STRIPE		34	TX3R	GREY/WHITE STRIPE
10	NC	-----		35	NC	-----
11	RX4T	RED/GREEN STRIPE		36	TX4T	RED/ORANGE STRIPE
12	RX4R	GREEN/RED STRIPE		37	TX4R	ORANGE/RED STRIPE
13	NC	-----		38	NC	-----
14	RX5T	RED/GREY STRIPE		39	TX5T	RED/BROWN STRIPE
15	RX5R	GREY/RED STRIPE		40	TX5R	BROWN/RED STRIPE
16	NC	-----		41	NC	-----
17	RX6T	BLACK/ORANGE STRIPE		42	TX6T	BLACK/BLUE STRIPE
18	RX6R	ORANGE/BLACK STRIPE		43	TX6R	BLUE/BLACK STRIPE
19	NC	-----		44	NC	-----
20	RX7T	BLACK/BROWN STRIPE		45	TX7T	BLACK/GREEN STRIPE
21	RX7R	BROWN/BLACK STRIPE		46	TX7R	GREEN/BLACK STRIPE
22	NC	-----		47	NC	-----
23	NC	-----		48	NC	-----
24	RX8T	YELLOW/BLUE STRIPE		49	TX8T	BLACK/GREY STRIPE
25	RX8R	BLUE/YELLOW STRIPE		50	TX8R	GREY/BLACK STRIPE

RX indicates data into the DAC 16xV2 (DAC Rx).

TX indicates data out from the DAC 16xV2 (DAC Tx).

DAC 16xV2 HDR-E50 To BNC Y-Cable Assembly

This cable is for use with DAC 16xV2 1+1 protected operation. It is available in lengths of 3.5 m, 15.5m or 5 m. Impedance is nominally 75 ohms. Each cable supports up to 8 tribs. Two cables are required per DAC if more than 8xE1/DS1 tribs are to be connected.

Figure 3-11. DAC 16xV2 Trib BNC Y-Cable

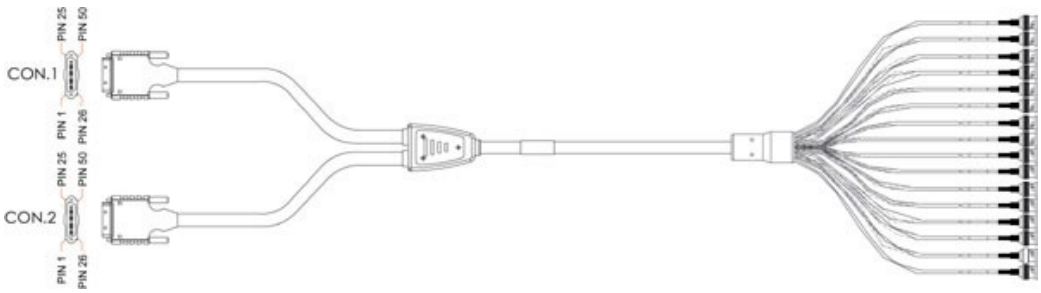
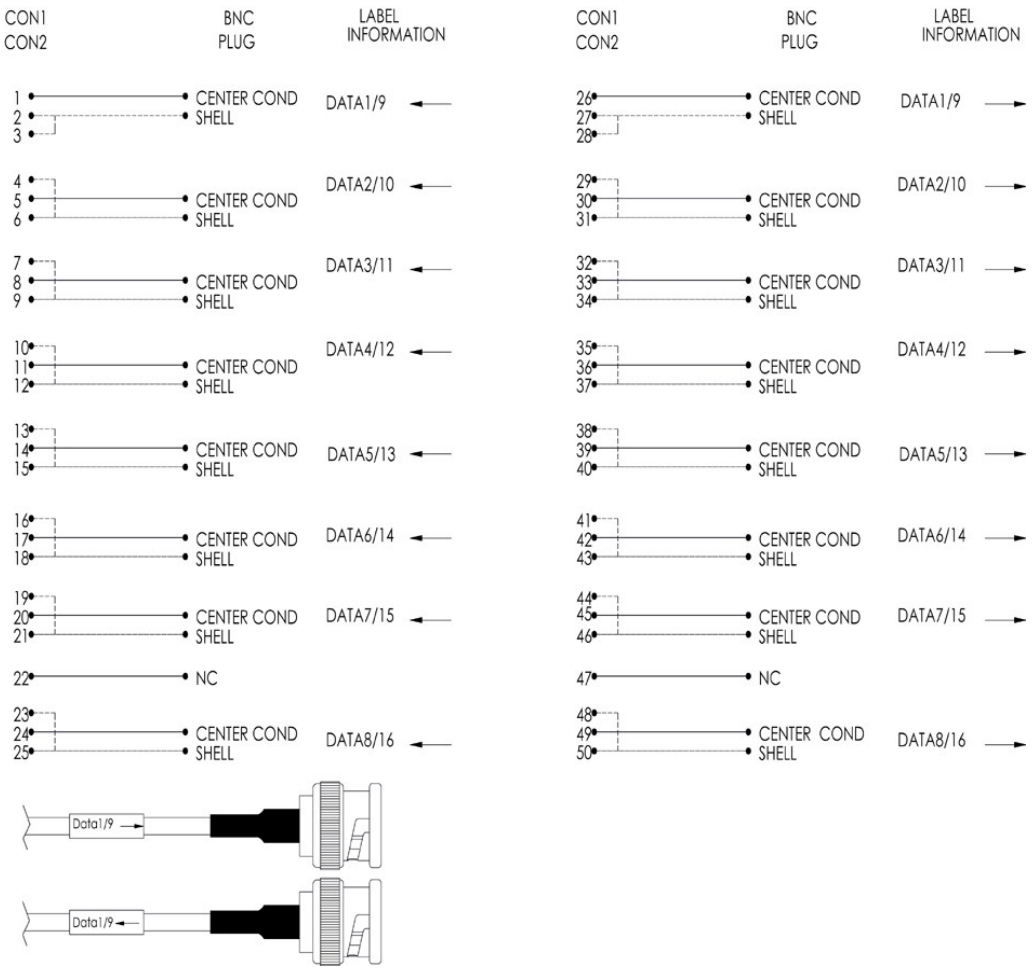


Figure 3-12. DAC 16xV2 Trib BNC Y-Cable Connections



Arrow towards BNC indicates data out (DAC Tx).

Arrow away from BNC indicates data in (DAC Rx).

The 1/9 in the label indicates that it is for trib 1 if the cable assembly is used with the trib 1-8 connector, or trib 9 if used with the trib 9-16 connector. This also applies for 2/10, 3/11, etc. up to 8/16.

DAC 4x Cable and Connector Data

Refer to:

- DAC 4x BNC Cable Assembly on page 83
- DAC 4x RJ-45 to RJ-45 Straight Cable on page 83
- DAC 4x RJ-45 to RJ-45 Crossover Cable on page 84
- DAC 4x RJ-45 to Wire Wrap Cable Assembly on page 84
- DAC 4x RJ-45 Connector Pin Assignments on page 85

DAC 4x BNC Cable Assembly

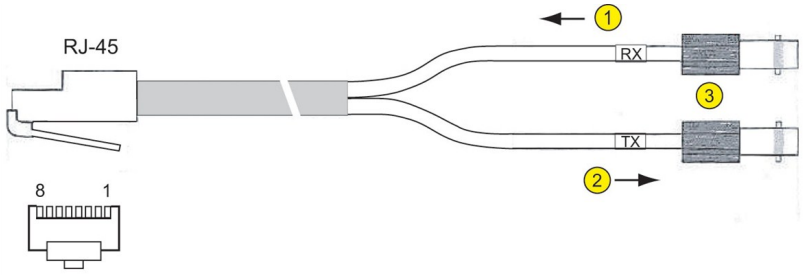
The assembly is provided as a kit of three cables. Each kit provides:

- One RJ-45 to 2 x BNC female, 0.5m long.
- Two BNC to BNC male extension cables, 2m or 5m long.
- One kit is labeled as a 2.5m cable kit, the other as 5.5m.

Each supports one trib. Four are required if all four ports of the DAC 4x are to be connected.

At the RJ-45 plug RX connects to pins 1 and 2, and TX connects to pins 4 & 5. The pin-numbered RJ-45 plug is pictured with its cable exiting to the rear.

Figure 3-13. DAC 4x RJ-45 to BNC Cable



Item	Description
1	RX indicates Data In to the DAC.
2	TX indicates Data Out from the DAC.
3	75 ohm BNC female connectors.

DAC 4x RJ-45 to RJ-45 Straight Cable

Connectors at both ends of the cable are wired pin-for-pin as shown in the figure below. It provides a balanced 120 ohm connection.

Each cable supports one trib. Four cables are required if all four ports of the DAC 4x are to be connected.

Straight cable assemblies are used when connecting to RJ-45 patch panels, which have a built-in crossover function.

For Connection Function, receive specifies data in to the DAC; transmit is data out from the DAC.

Table 3-6. DAC 4x RJ-45 to RJ-45 Straight Cable Connections

RJ-45 Pin-to-Pin Connections		Connection Function
1	**1**	Receive Ring
2	**2**	Receive Tip
3	**3**	Optional Ground
4	**4**	Transmit Ring
5	**5**	Transmit Tip
6	**6**	Optional Ground
7	**7**	Ground
8	**8**	Ground

DAC 4x RJ-45 to RJ-45 Crossover Cable

Connectors are wired such that Receive Ring and Tip at one end connect to Transmit Ring and Tip respectively, at the other. Pins 3, 6, 7, 8 remain the same. It provides a balanced 120 ohm connection.

Each cable supports one trib. Four cables are required if all four ports of the DAC 4x are to be connected.

Crossover cable assemblies are used to interconnect one DAC RJ-45 port to another.

For Connection Function, receive specifies data in to the DAC; transmit is data out from the DAC.

Table 3-7. DAC 4x RJ-45 to RJ-45 Crossover Cable Assembly

Connection Function	Pin-to-pin Connections		Connection Function
Receive Ring	**1**	**4**	Transmit Ring
Receive Tip	**2**	**5**	Transmit Tip
Optional Ground	**3**	**3**	Optional Ground
Transmit Ring	**4**	**1**	Receive Ring
Transmit Tip	**5**	**2**	Receive Tip
Optional Ground	**6**	**6**	Optional Ground
Ground	**7**	**7**	Ground
Ground	**8**	**8**	Ground

DAC 4x RJ-45 to Wire Wrap Cable Assembly

The assemblies are available with cable lengths of 2 m, 5 m or 7.5 m. It provides a balanced 120 ohm connection.

The wire is designed for use with wire wrap or insulation displacement termination blocks.

Each cable supports one trib. Four cables are required if all four ports of the DAC 4x are to be connected.

Receive specifies data in to the DAC; Transmit is data out from the DAC.

Table 3-8. DAC 4x Wire Wrap Cable Data

Pin	Function	Wire Color
1	Receive Ring	White / Orange
2	Receive Tip	Orange / White
3	Optional Ground	White / Green
4	Transmit Ring	Blue / White
5	Transmit Tip	White / Blue
6	Optional ground	Green / White
7	Ground	White / Brown
9	Ground	Brown / White

DAC 4x RJ-45 Connector Pin Assignments

This table shows the pin assignments for each front panel RJ-45 trib connector. Refer to the figure below for connector pin numbering.

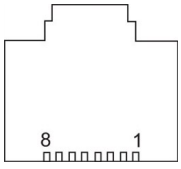
Receive refers to an input and specifies from the user.

Transmit refers to an output and specifies towards the user.

Table 3-9. DAC 4x RJ-45 Trib Connector Pin Assignments

Pin	Function
1	Receive Ring
2	Receive Tip
3	* Optional Ground
4	Transmit Ring
5	Transmit Tip
6	* Optional Ground
7	Ground
8	Ground

Figure 3-14. RJ-45 Front Panel Connector (face view)



DAC GE3 Ethernet RJ-45 Cables

The table below list the RJ-45 Ethernet cable options for DAC GE3. One cable required per port.

Table 3-10. RJ-45 Ethernet Cable Options

Description	Part Number
Ethernet Cable, RJ45 to RJ45, 2 m	037-579124-001
Ethernet Cable, RJ45 to RJ45, 5 m	037-579125-001
Ethernet Cable, RJ45 to RJ45, 15 m	037-579126-001

The cables are industry-standard straight (Mdi) Ethernet RJ-45 to RJ-45.

DAC Optical Cable and Connector Data

The following table lists the cable and attenuator options for DAC 1550M, DAC 1x/2x1550, and for the optical SFPs available for DAC GE3.

Table 3-11. Optical Cables and Attenuators

Description	Con-nectors	Mode	Application	Part number
SIMPLEX 0.5 M SM LC TO LC	LC	Single 1310 nM	DAC GE3, DAC 155oM	037-579272-001
SIMPLEX 3M SM LC TO LC	LC	Single 1310 nM	DAC GE3, DAC 155oM	037-579131-001
SIMPLEX 5M SM LC TO LC	LC	Single 1310 nM	DAC GE3, DAC 155oM	037-579132-001
SIMPLEX 10M SM LC TO LC	LC	Single 1310 nM	DAC GE3, DAC 155oM	037-579133-001
SIMPLEX 3M SM LC TO FC	LC, FC	Single 1310 nM	DAC GE3, DAC 155oM	037-579134-001
SIMPLEX 5M SM LC TO SC	LC, SC	Single 1310 nM	DAC GE3, DAC 155oM	037-579138-001
SPLITTER 2M LC-LC TO SC	LC, SC	Single 1310 nM	DAC GE3, DAC 155oM	037-579142-001
SPLITTER 2M LC-LC TO LC	LC	Single 1310 nM	DAC GE3, DAC 155oM	037-579143-001
ATTENUATOR 3M, LC, 10DB	LC	Single 1310 nM	DAC GE3, DAC 155oM	037-579155-001
ATTENUATOR 5M, LC, 10DB	LC	Single 1310 nM	DAC GE3, DAC 155oM	037-579156-001
SIMPLEX 2M SM LC TO SC	LC, SC	Single 1310 nM	DAC GE3, DAC 155oM	037-579179-001
SIMPLEX 5M, SM SC-FC	SC, FC	Single 1310 nM	DAC 1/2x155o	037-579191-001
SIMPLEX 3M, SM SC-SC	SC	Single 1310 nM	DAC 1/2x155o	037-579194-001
SIMPLEX 5M, SM SC-SC	SC	Single 1310 nM	DAC 1/2x155o	037-579194-005
SPLITTER 2M SC-SC TO SC	SC	Single 1310 nM	DAC 1/2x155o	037-579198-001
SPLITTER 4M SC-SC TO LC	SC, LC	Single 1310 nM	DAC 1/2x155o	037-579200-001
SPLITTER 4M SC-SC TO ST	SC, ST	Single 1310 nM	DAC 1/2x155o	037-579201-001

ATTENUATOR 3M, SC, 10DB	SC	Single 1310 nM	DAC 1/2x155o	037-579209-001
ATTENUATOR 5M, SC, 10DB	SC	Single 1310 nM	DAC 1/2x155o	037-579210-001
SIMPLEX 3M MM LC TO LC	LC	Multi 850 nM	DAC 155oM	037-579431-001
SIMPLEX 10M MM LC TO LC	LC	Multi 850 nM	DAC 155oM	037-579432-001
SIMPLEX 5M MM LC TO SC	LC, SC	Multi 850 nM	DAC 155oM	037-579434-001
SIMPLEX 3M MM LC TO FC	LC, FC	Multi 850 nM	DAC 155oM	037-579440-001
SPLITTER 2M MM SC TO LC/LC	LC, SC	Multi 850 nM	DAC 155oM	037-579390-001

Single-mode (1310 nm) cables are available for LC to LC connections.

Single-mode and multi-mode (850 nm) cables are available for LC to SC connections.

Y-cable assemblies for protected DAC 1550M operation are available for single-mode LC to LC, and for single-mode or multi-mode LC to SC connections.

LC to LC Connections - non-protected operation

Two cables required per connection.

Single-mode, part no. 037-579131-001: Simplex, single-mode, LC TO LC 3M (9 ft)

Single-mode, part no. 037-579132-001: Simplex, single-mode, LC TO LC 5M (16 ft)

LC to LC Connections - protected operation

- Two Y-cable assemblies required per connection.
- Single-mode, part no. 037-579143-001: Y-cable, single-mode, LC to LC, 2m (6 ft) splitter/combiner
- Single-mode, part no. 037-579147-001: Y-cable, single-mode, LC to LC, 4m (13ft) splitter/combiner

LC to SC Connections - non-protected operation

- Two cables required per connection.
- Single-mode cable part no. 037-579137-001: Simplex, single-mode, LC to SC 3m (9 ft)
- Multi-mode cable part no. 037-579180-001: Simplex, multi-mode, LC to SC 2m (6 ft)

LC to SC Connections - protected operation

- Two Y-cable assemblies required per connection.
- Single-mode, part no. 037-579142-001: Y-cable, single-mode, LC to SC, 2m (6 ft) splitter/combiner

- Multi-mode, part no. 037-579390-001: Y-cable, multi-mode, LC to SC, 2m (6 ft) splitter/combiner

Other cable options are available for LC connection to FC or ST. Contact Aviat Networks or your supplier for details.

DAC 155eM Cables

The following cables are for use with the DAC 155eM (electrical SFP):

Part number	Description
037-579462-003	CABLE, M1.0/2.3 TO M1.6/5.6, 75 OHM STRANDED 3m
037-579462-005	CABLE, M1.0/2.3 TO M1.6/5.6, 75 OHM STRANDED 5m
037-579462-010	CABLE, M1.0/2.3 TO M1.6/5.6, 75 OHM STRANDED 10m
037-579472-002	CABLE, M1.0/2.3 TO M1.0/2.3, 75 OHM STRANDED, 2M
037-579466-001	CABLE, M1.0/2.3 TO M1.0/2.3, 75 OHM STRANDED, 150mm

NMS Connectors and Cables

Data is included for:

- NMS 10/100Base-T Connector on page 88
- Maintenance V.24 Connector on page 89

NMS 10/100Base-T Connector

The NMS connector provides Ethernet access for Portal or ProVision. Pin assignments represent industry-standard LAN cable assembly for a 10/100Base-T, RJ-45 connector. Different length ‘straight’ Ethernet cables are included as optional accessories.

The Eclipse INU/INUe has a four-port 10/100Base-T NMS assembly. The Ethernet port auto-resolves for straight and crossover cables (Mdi or MdiX). Either cable type can be used.

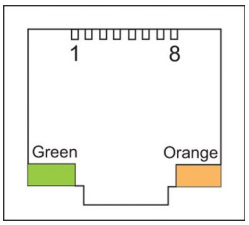
The port connectivity and activity LED indications are not consistent across all Eclipse products. The orange LED indicates connectivity (on for a valid connection) and the green LED flashes to indicate traffic activity.

Table 3-12. RJ-45 Ethernet NMS Connector Pin Assignments

Pin	Function
1	Ethernet transmit data +
2	Ethernet transmit data -
3	Ethernet receive data +
4	Not used

Pin	Function
5	Not used
6	Ethernet receive data -
7	Not used
8	Not used

Figure 3-15. RJ-45 Ethernet NMS Connector(s)



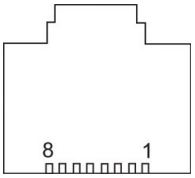
Maintenance V.24 Connector

The V.24 connector provides serial data access for Portal. One industry-standard RJ-45 to DB-9 V.24 Maintenance Cable is included with every INU.

Table 3-13. RJ-45 V.24 Connector Pin Assignment

Pin	Signal Name	Direction	Function
1	DSR/RI	In	Data Set Ready/Ring Indicator
2	CD	In	Carrier Detect
3	DTR	Out	Data Terminal Ready
4	GND		System Ground
5	RXD	In	Receive Data
6	TXD	Out	Transmit Data
7	CTS	In	Clear to Send
8	RTS	Out	Request to Send

Figure 3-16. RJ-45 V.24 Portal Connector (face view)



Auxiliary and Alarm Connectors and Cables

Data is included for AUX Plug-in auxiliary interfaces and cable-sets.

Alarm and Auxiliary cables should not terminate to equipment outside the shelter or building. Use approved surge suppression equipment when connecting to un-protected external inputs and outputs.

Refer to:

- AUX Data Cable: Async, HD26 to Wirewrap, 2 m on page 90
- AUX Data Cable: Sync, HD26 to Wirewrap, 2 m on page 91
- AUX Data Cable: Async, HD26 to 3 X DB9, 1 m on page 92
- AUX Data Cable: Sync, HD26 to 3 X DB9, 1 m on page 93
- AUX Data Cable: Async, AUX HD26 to AUX HD26, 1 m on page 94
- AUX Data Cable: Sync, AUX HD26 to AUX HD26, 1 m on page 95
- AUX Alarm I/O Cable: HD15 to Wirewrap, 2 m or 5 m on page 96

In this section, all connector front views are cable-connector views.

AUX Data Cable: Async, HD26 to Wirewrap, 2 m

Part No: 037-579114-00

Figure 3-17. AUX HD26, 2M, Async, Front View

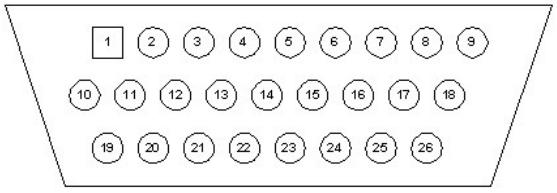


Table 3-14. Pin Descriptions and Color Code for Part # 037-579114-00

Pin No.	Function		Wire Color Code
	TIA/E1A-562	DCE Direction	
1		Output	Green/Black
2		Output	Black/Green
3	Aux RXD1	Output	Black/Orange
4		Output	Brown/Black
5	Aux TXD1	Input	Orange/Black
6		Input	Black/Brown
7		I/O	Brown/White
8		I/O	White/Brown
9	GND		Black/Blue
10		Output	White/Gray
11		Output	Gray/White
12	Aux RXD2	Output	Red/Gray

Pin No.	Function		Wire Color Code
13		Output	Black/Gray
14	Aux TXD2	Input	Gray/Red
15		Input	Gray/Black
16		I/O	Green/White
17		I/O	White/Green
18	GND (Shared)		Drain
19		Output	Brown/Red
20		Output	Red/Brown
21	Aux RD	Output	Blue/Yellow
22		Output	Yellow/Blue
23	Aux TXD3	Input	Red/Blue
24		Input	Blue/Red
25		I/O	Blue/White
26		I/O	White/Blue
Wire Colors Not Used:	Blue/Black, Green/Red, Red/Green, Red/Orange, Orange/Red, White/Orange, Orange/White		

AUX Data Cable: Sync, HD26 to Wirewrap, 2 m

Part No: 037-579115-00

Figure 3-18. AUX HD26, 2M, Sync, Wirewrap, Front View

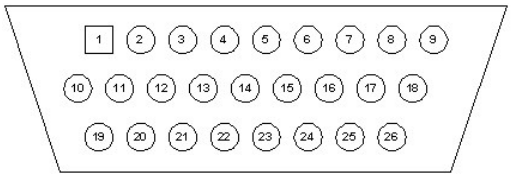


Table 3-15. Pin Descriptions and Color Code for Part # 037-579115-00

Pin No.	Function		Wire Color Code
	TIA/E1A-422	DCE Direction	
1	1AuxRXC+	Output	Green/Black
2	1AuxRXC-	Output	Black/Green
3	1RXD-	Output	Black/Orange
4	1RXD+	Output	Orange/Black
5	1TXD+	Input	Brown/Black
6	1TXD-	Input	Black/Brown
7	1AuxTXC+	I/O	Brown/White
8	1AuxTXC-	I/O	White/Brown

Pin No.	Function		Wire Color Code
9	GND		Black/Blue
10	2AuxRXC+	Output	White/Gray
11	2AuxRXC-	Output	Gray/White
12	2RXD-	Output	Red/Gray
13	2RXD+	Output	Gray/Red
14	2TXD+	Input	Black/Gray
15	2TXD-	Input	Gray/Black
16	2AuxTXC+	I/O	Green/White
17	2AuxTXC-	I/O	White/Green
18	GND (Shared)		Drain
19	3AuxRXC+	Output	Brown/Red
20	3AuxRXC-	Output	Red/Brown
21	3RXD-	Output	Blue/Yellow
22	3RXD+	Output	Yellow/Blue
23	3TXD+	Input	Red/Blue
24	3TXD-	Input	Blue/Red
25	3AuxTXC+	I/O	Blue/White
26	3AuxTXC-	I/O	White/Blue
Wire Colors Not Used:	Blue/Black, Red/Green, Green/Red, Red/Orange, Orange/Red, White/Orange, Orange/White		

AUX Data Cable: Async, HD26 to 3 X DB9, 1 m

Part No: 037-579116-00

Figure 3-19. AUX HD26 and 3 X DB9, 1M, Async: Front Views

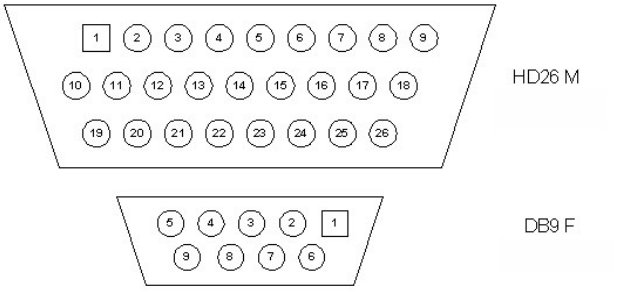


Table 3-16. Pin Descriptions and Color Code for Part # 037-579116-00

AUX	Function		AUX 1	AUX 2	AUX 3
Pin No.	TIA/E1A-562	DCE Direction	Pin No.	Pin No.	Pin No.
3	AuxRXD1	Output	2		
5	AuxTXD1	Input	3		
9	GND		5		
12	AuxRXD2	Output			2
14	AuxTXD2	Input			3
18	GND (Shared)			5	5
21	AuxRXD3	Output		2	
23	AuxTXD3	Input		3	

AUX Data Cable: Sync, HD26 to 3 X DB9, 1 m

Part No: 037-579117-001

Figure 3-20. AUX HD26 to 3 X DB9, 1m, Sync, Front Views

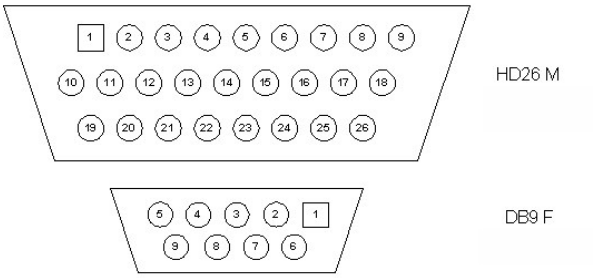


Table 3-17. Pin Descriptions for 037-579117-001

AUX	Function		AUX 1	AUX 2	AUX 3
Pin No.	TIA/E1A-422	DCE Direction	Pin No.	Pin No.	Pin No.
1	1AuxRXC+	Output	1		
2	1AuxRXC-	Output	6		
3	1RXD-	Output	2		
4	1RXD+	Output	7		
5	1TXD+	Input	3		
6	1TXD-	Input	8		
7	1AuxTXC+	I/O	4		
8	1AUXTXC-	I/O	9		
9	GND		5		
10	2AuxRXC+	Output		1	

AUX	Function		AUX 1	AUX 2	AUX 3
11	2AuxRXC-	Output		6	
12	2RXD-	Output		2	
13	2RXD+	Output		7	
14	2TXD+	Input		3	
15	2TXD-	Input		8	
16	2AuxTXC+	I/O		4	
17	2AUXTXC-	I/O		9	
18	GND (Shared)			5	5
19	3AuxRXC+	Output			1
20	3AuxRXC-	Output			6
21	3RXD-	Output			2
22	3RXD+	Output			7
23	3TXD+	Input			3
24	3TXD-	Input			8
25	3AuxTXC+	I/O			4
26	3AUXTXC-	I/O			9

AUX Data Cable: Async, AUX HD26 to AUX HD26, 1 m

Part No: 037-579120-001

Figure 3-21. AUX TO AUX, HD26, 1M, ASYNC, Front View

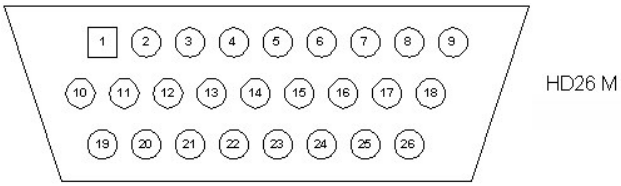


Table 3-18. Pin Descriptions for 037-579120-001

AUX	Function		AUX
3	AuxRXD1	AuxTXD1	5
5	AuxTXD1	AuxRXD1	3
9	Ground	Ground	9
12	AuxRXD2	AuxTXD2	14
14	AuxTXD2	AuxRXD2	12
18	Ground	Ground	18
21	AuxRXD3	AuxTXD3	23
23	AuxTXD3	AuxRXD3	21

AUX Data Cable: Sync, AUX HD26 to AUX HD26, 1 m

Part No: 037-579121-001

Figure 3-22. AUX TO AUX, HD26, 1m, Sync, Front View

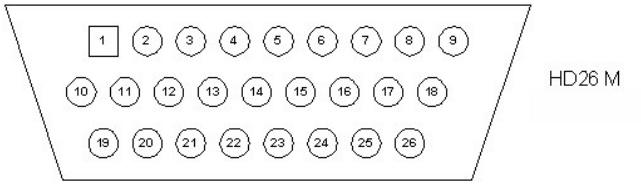


Table 3-19. Pin Descriptions for 037-579121-001

AUX	Function		AUX 1
1	1AuxRXC+	1AuxTXC+	7
2	1AuxRXC-	1AuxTXC-	8
3	1RXD-	1TXD-	6
4	1RXD+	1TXD+	5
5	1TXD+	1RXD+	4
6	1TXD-	1RXD-	3
7	1AuxTXC+	1AuxRXC+	1
8	1AUXTXC-	1AUXRXC-	2
9	GND	GND	9
10	2AuxRXC+	2AuxTXC+	16
11	2AuxRXC-	2AuxTXC-	17
12	2RXD-	2TXD-	15
13	2RXD+	2TXD+	14
14	2TXD+	2RXD+	13
15	2TXD-	2RXD-	12
16	2AuxTXC+	2AuxRXC+	10
17	2AUXTXC-	2AUXRXC-	11
18	GND	GND	18
19	3AuxRXC+	3AuxTXC+	25
20	3AuxRXC-	3AuxRTXC-	26
21	3RXD-	3TXD-	24
22	3RXD+	3TXD+	23
23	3TXD+	3RXD+	22
24	3TXD-	3RXD-	21
25	3AuxTXC+	3AuxRXC+	19
26	3AuxTXC-	3AuxRXC-	20

AUX Alarm I/O Cable: HD15 to Wirewrap, 2 m or 5 m

Part No: 037-579112-001, 2 m

Part No: 037-579113-001, 5 m

Figure 3-23. ALARM I/O, HD15, 2M, WIREWRAP, Front View

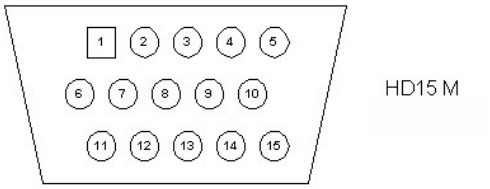


Table 3-20. Pin Descriptions for 037-579112-001 and 037-579113-001

Pin No.	Function		Wire Color Code
1	TTL Input 1	I	Brown/White
2	Relay 1 NC	I/O	White/Brown
3	Relay 1 NO	I/O	White/gray
4	Relay 2 Pole/TTL Input 5	I/O	gray/White
5	Relay 3 NC	I/O	Red/Blue
6	Relay 3 NO	I/O	Blue/Red
7	Relay 4 Pole/TTL Input 3	I/O	Orange/Red
8	Ground		Drain
9	TTL Input 2	I	Red/Orange
10	Relay 1 Pole/TTL Input 6	I/O	Red/Green
11	Relay 2 NC	I/O	Green/Red
12	Relay 2 NO	I/O	Orange/White
13	Relay 3 Pole/TTL Input 4	I/O	White/Orange
14	Relay 4 NC	I/O	White/Green
15	Relay 4 NO	I/O	Green/White
Wire Colors Not Used:	White/Blue, Blue/White		

The output relay is a 4 pole, double throw; it has four independent switch contact sets, where the pole (common) connection on each set switches between NO (normally open) and NC (normally closed) contacts. Note that the relays may be configured to be energized or de-energized on receipt of an alarm event.

- Active Condition De-energized requires an alarm event to release the relay.
- Active Condition Energized requires an alarm event to energize the relay.

260-668066-001

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