LGC WIRELESS®

InterReach™ Unison

Installation, Operation, and Reference Manual

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SECTION 1

General Information

This section contains the following subsections:

1.1 Purpose and Scope

This document describes the InterReach™ Unison system components and the AdminManager software. Included is information for the installation, operation, and maintenance of the system. Also included is information about how to use the AdminManager software to install and configure the Unison system, as well as to perform other tasks such as change gain settings and check system status.

1.2 Conventions in this Manual

The following table lists the type style conventions used in this manual.

Convention	Description
bold	Used for emphasis
BOLD CAPS	Used to indicate labels on equipment
SMALL CAPS	Used to highlight software window buttons

Measurements are listed first in metric units, followed by U.S. Customary System of units in parentheses. For example:

0° to 45°C (32° to 113°F)

The following symbols are used to highlight certain information as described.

NOTE: This format is used to emphasize text with special significance or importance, and to provide supplemental information.

CAUTION: This format is used when a given action or omitted action can cause or contribute to a hazardous condition. Damage to the equipment can occur.

WARNING: This format is used when a given action or omitted action can result in catastrophic damage to the equipment or cause injury to the user.

Procedure

This format is used to highlight a procedure.

1.3 Acronyms in this Manual

Acronym	Definition
AGC	automatic gain control
ALC	automatic level control
AMPS	Advanced Mobile Phone Service
BTS	base transceiver station
Cat-5/6	Category 5 or Category 6 (twisted pair cable)
CDMA	code division multiple access
CDPD	cellular digital packet data
dB	decibel
dBm	decibels relative to 1 milliwatt
DC	direct current
DCS	Digital Communications System
DL	downlink
EDGE	Enhanced Data Rates for Global Evolution
EGSM	Extended Global Standard for Mobile Communications
EH	Expansion Hub
GHz	gigahertz
GPRS	General Packet Radio Service
GSM	Groupe Speciale Mobile (now translated in English as Global Standard for Mobile Communications)
Hz	hertz
IF	intermediate frequency
iDEN	Integrated Digital Enhanced Network (Motorola variant of TDMA wireless)
LAN	local area network
LO	local oscillator
mA	milliamps
MBS	microcellular base station
MH	Main Hub
MHz	megahertz
MMF	multi-mode fiber
MTBF	mean time between failures
NF	noise figure
nm	nanometer
OA&M	operation, administration, and maintenance

Acronym	Definition
PCS	Personal Communication Services
PLL	phase-locked loop
PLS	path loss slope
RAU	Remote Access Unit
RF	radio frequency
RSSI	received signal strength indicator
SC/APC	fiber optic connector complying with NTT SC standard, angle-polished
SMA	sub-miniature A connector (coaxial cable connector type)
SMF	single-mode fiber
ST	straight tip (fiber optic cable connector type)
ScTP	screened twisted pair
TDMA	time division multiple access
UL	uplink; Underwriters Laboratories
uW	microwatts
UMTS	Universal Mobile Telecommunications System
UPS	uninterruptable power supply
W	watt
WCDMA	wideband code division multiple access

1.4 Standards Conformance

- Utilizes the TIA/EIA 568-A Ethernet cabling standards for ease of installation.
- See Appendix C for compliance information.

1.5 Related Publications

- *MetroReach Focus Configuration, Installation, and Reference Manual*; LGC Wireless part number 8500-10
- *LGCell Version 4.0 Installation, Operation, and Reference Manual*; LGC Wireless part number 8100-50
- *OpsConsole User Guide*; LGC Wireless part number 8701-10
- *ARM2000 Installation, Operation, and Reference Manual*; LGC Wireless part number 8305-10
- *LGC Wireless Accessories Catalog*; LGC Wireless part number 8600-10
- *Neutral Host System Planning Guide*; LGC Wireless part number 9000-10

SECTION 2

InterReach™ Unison System Description

2.1 System Overview

InterReach™ Unison is an intelligent fiber optic wireless networking system that is designed to handle both wireless voice and data communications and provide high-quality, ubiquitous, seamless access to the Cellular or Personal Communications Services (PCS) network in any public or private facility, including:

- Campus environments
- Airports
- Office buildings
- Shopping Malls
- Hospitals
- Public Facilities (convention centers, sports venues, etc.)

Unlike other wireless distribution alternatives, Unison is an intelligent active system, using microprocessors to enable key capabilities such as software-selectable band settings, automatic gain control, ability to incrementally adjust downlink/uplink gain, end-to-end alarming of all components and the associated cable infrastructure, and a host of additional capabilities.

The Unison system supports major Cellular/PCS standards and air interface protocols in use around the world, including:

- Frequencies: 800 MHz, 900 MHz, 1800 MHz, 1900 MHz, 2100 MHz
- Protocols: AMPS, TDMA, CDMA, DCS, GSM, EGSM, iDEN, CDPD, EDGE, GPRS, WCDMA

Key System Features

- **Superior RF performance**, particularly in the areas of IP3 and noise figure.
- **High downlink composite power** (+26 dBm), IP3 (+38 dBm) and **low uplink noise figure** (22 dB for a system with 8 RAUs), enables support of a large number of channels and larger coverage footprint per antenna.
- The Main Hub and the Expansion Hub are **software configurable**. Thus, the frequency band can be field configured.
- The system supports flexible cabling alternatives, allowing the **use of either multimode or single-mode fiber** (in addition to standard Cat-5 or Cat-6 [Cat-5/6] twisted pair). Cabling type can be selected to meet the resident cabling infrastructure of the facility and unique building topologies.
- **Extended system "reach".** Using multimode fiber, fiber runs can be as long as 1.5 kilometers. Alternately, with single mode fiber the fiber run can be as long as 6 kilometers (creating a total system "wingspan" of 12 kilometers). And the Cat-5/6 twisted pair cable run can be up to 100 meters recommended maximum (150 meters with RF performance degradation).
- **Flexible RF configuration capabilities**, including:
  - System gain:
    - Ability to manually set gain in 1 dB steps on both downlink and uplink.
  - RAU:
    - RAU uplink and downlink gain can be attenuated 10 dB.
    - Uplink level control protects the system from input overload and can be optimized for either a single operator or multi-operators/protocols.
    - VSWR check on RAU reports if there is a problem with the antenna.
- The system **firmware effectively "future proofs" the product**. When any modifications are made to the product, including the addition of new software capabilities/services, systems that have already been installed can be upgraded simply by downloading new firmware (either locally or remotely).
- **Extensive OA&M capabilities**, including fault isolation to the field replaceable unit, automatic reporting of all warnings and alarms, and user-friendly graphical-user interface OA&M software packages.

2.2 System Hardware

The InterReach Unison system consists of three modular components:

- 19" rack-mountable **Main Hub** *(connects to up to 4 Expansion Hubs)*
  - Converts RF signals to optical on the downlink; optical to RF on the uplink
  - Microprocessor controlled (for alarms, monitoring, and control)
  - Software configurable band
  - Simplex interface to any RF source
  - System master – periodically polls all downstream units (Expansion Hubs/RAUs) for system status, and automatically reports any warnings/alarms
- 19" rack-mountable **Expansion Hub** *(connects to up to 8 Remote Access Units)*
  - Converts optical signals to electrical on the downlink and electrical signals to optical on the uplink
  - Microprocessor controlled (for alarms, monitoring, and control)
  - Software configurable band (based on command from Main Hub)
  - Supplies DC power to RAU
- **Remote Access Unit** (RAU)
  - Converts electrical signals to RF on the downlink; RF to electrical on the uplink
  - Microprocessor controlled (for alarms, monitoring, and control)
  - Protocol/band specific units

The minimum configuration of a Unison system is one Main Hub, one Expansion Hub, and one RAU (1-1-1). The maximum configuration of a system is one Main Hub, four Expansion Hubs, and 32 RAUs (1-4-32). Multiple systems can be combined to provide larger configurations.

2.3 System OA&M Capabilities

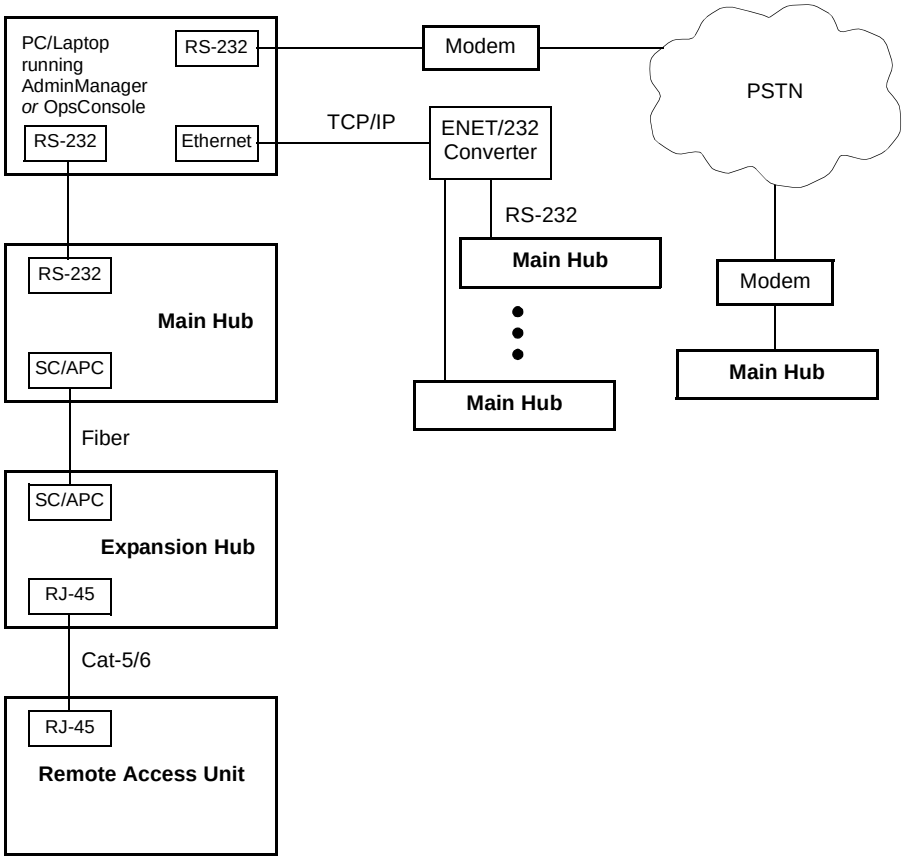
The InterReach Unison is microprocessor controlled and contains firmware which enables much of the OA&M functionality.

Complete alarming, down to the field replaceable unit (i.e., Main Hub, Expansion Hub, Remote Access Unit) and the cabling infrastructure, is available. All events occurring in a system, defined as a Main Hub and all of its associated Expansion Hubs and Remote Access Units, are automatically reported to the Main Hub. The Main Hub monitors system status and communicates that status using the following methods:

- Normally closed (NC) alarm contact closures can be tied to standard NC alarm monitoring systems or directly to a base station for alarm monitoring.
- The Main Hub's front panel serial port connects directly to a PC (for local access) or to a modem (for remote access).

Figure 2-1 OA&M Communications

AdminManager can only initiate communications with a remotely installed system; it cannot receive modem calls.
Use the OpsConsole for monitoring and receiving communications from remotely installed systems.



2.3.1 OA&M Software

The AdminManager software runs on a Laptop PC which is either directly connected to the DB-9 RS-232 male connector on the Main Hub's front panel or is remotely communicating through a modem that is connected to the DB-9 connector on the Main Hub's rear panel. The AdminManager communicates with one Main Hub, and its downstream units, at a time.

- Connected locally, you can access the Installation Wizard which lets you configure a newly installed system, or access the Configuration Panel which lets you query system status, configure a newly added or swapped unit, or change system parameters.
- Connected remotely, AdminManager initiates communications with the Main Hub. You can access a read-only Configuration & Maintenance panel which lets you check system status to help you determine if an on-site visit is required.

Refer to Section 7 for information about installing and using the AdminManager software.

Alternately, an LGC Wireless OA&M software application called the OpsConsole is available separately. The OpsConsole lets you manage, monitor, and maintain multiple sites and systems from a centralized location. This software is described in the *OpsConsole User Guide*, LGC Wireless part number 8701-10.

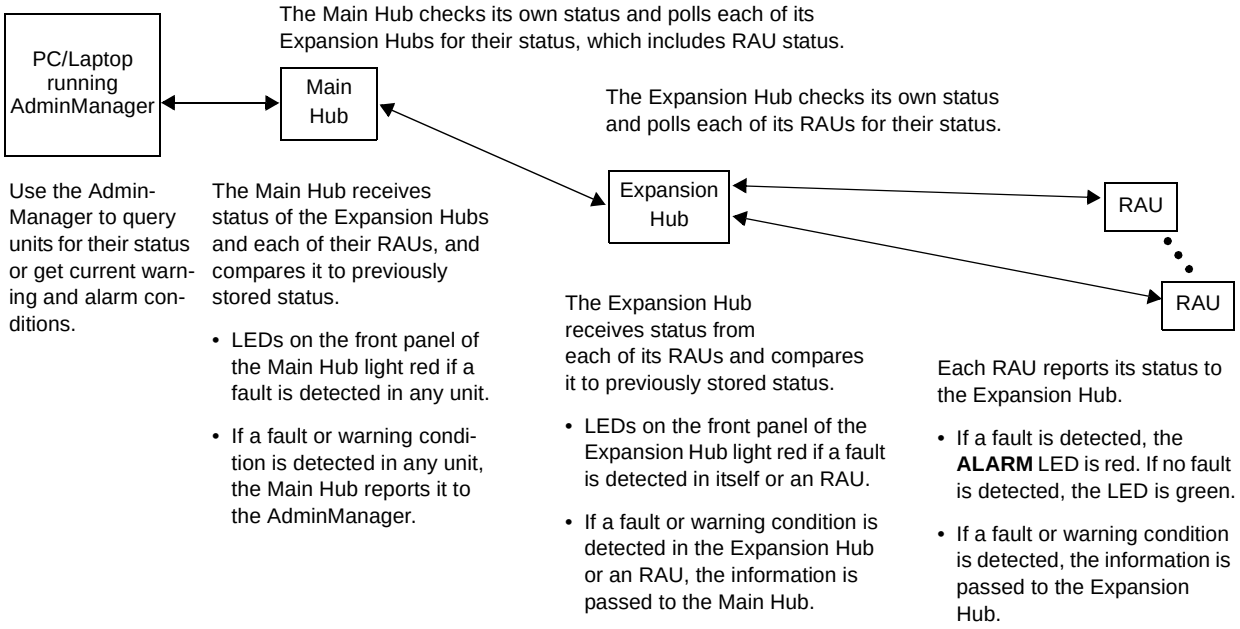
2.3.2 Configuring, Maintaining, and Monitoring Unison Locally

Each Main Hub, Expansion Hub, and RAU in the system constantly monitors itself and its downstream units for internal fault and warning conditions. The results of the monitoring are stored in memory and compared against new results.

The Expansion Hubs monitor their RAUs and store their status in memory. The Main Hub monitors its Expansion Hubs and stores their status and the status of the RAUs in its memory. When a unit detects a change in status, a fault or warning is reported. Faults are indicated locally by red status LEDs, and faults and warnings are reported to the Main Hub and displayed on a PC/laptop, via the Main Hub's serial port, that is running the AdminManager software.

Using AdminManager locally, you can install a new system or new components, change system parameters, and query system status. The following figure illustrates how the system reports its status to AdminManager.

Figure 2-2 Local System Monitoring and Reporting



2.3.3 Monitoring and Maintaining Unison Remotely

- **Using AdminManager Remotely**

  You can use AdminManager to query Unison status via a read-only Configuration & Maintenance panel. You cannot change system parameters or configure system components remotely with AdminManager. (Refer to Figure 2-1 on page 2-4.)

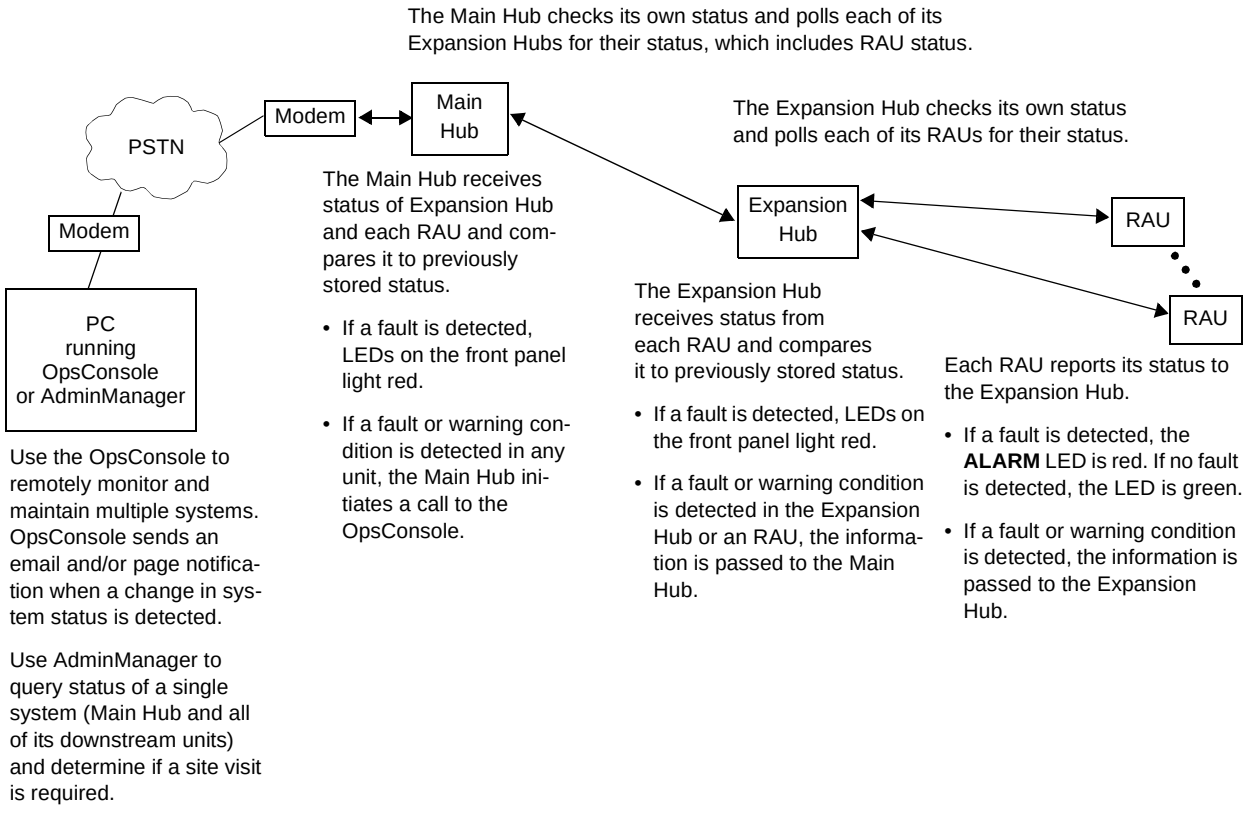
- **Using OpsConsole Remotely**

  When monitoring the system remotely, any change of state within the system causes the Main Hub to initiate an automatic call-out and report the system status to the OpsConsole. If the host does not acknowledge the connection, the Main Hub issues an automatic call-out every 15 minutes until an auto acknowledge or standard request for status (initiated by the host) is received.

  Refer to the *OpsConsole User Guide*, LGC Wireless part number 8701-10, for more information about using the OpsConsole for system monitoring.

The following figure illustrates how the system reports its status to AdminManager and the OpsConsole.

Figure 2-3 Remote System Monitoring and Reporting



2.3.4 Using Alarm Contact Closures

The DB-9 female connector on the rear panel of the Main Hub can be connected to a local base station or to a daisy-chained series of Unison, LGCell, and/or MetroReach Focus systems.

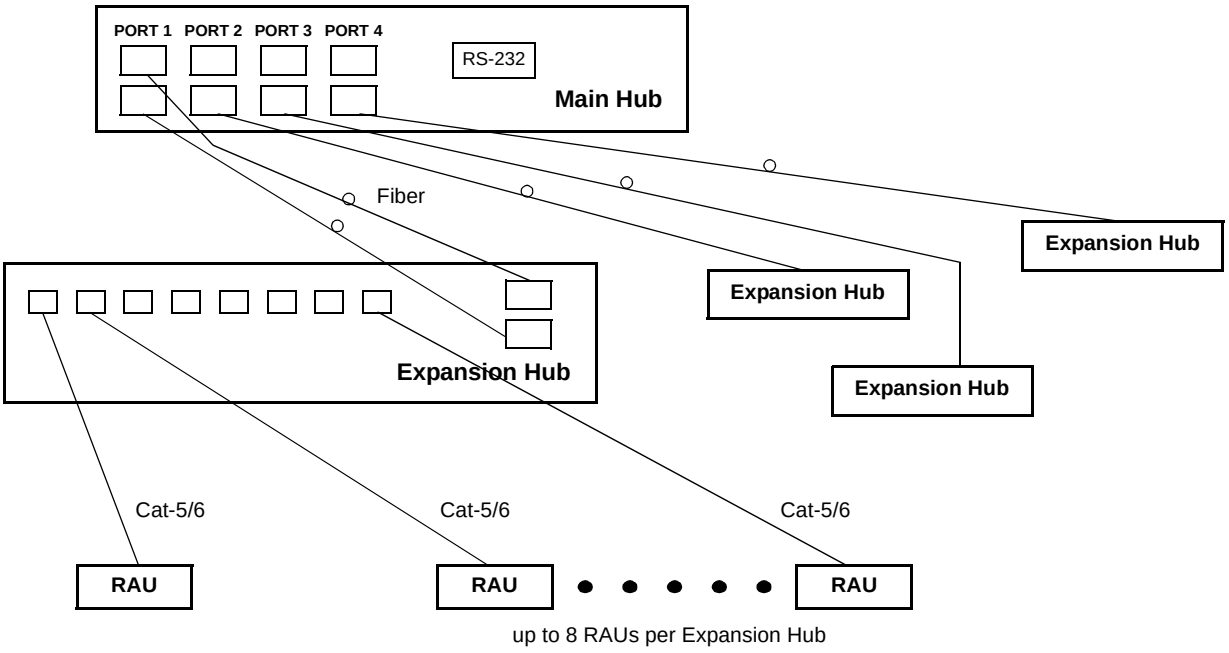
- When you connect MetroReach Focus or a BTS to Unison, the Unison Main Hub is the output of the alarms (alarm source) and Focus is the input (alarm sense).
- When you connect LGCell to Unison, the Unison Main Hub is the input of the alarms (alarm sense) and the LGCell is the output (alarm source).

Refer to Section 6.7 on page 6-37 for information on how to connect other equipment to a Unison system for monitoring.

2.4 System Connectivity

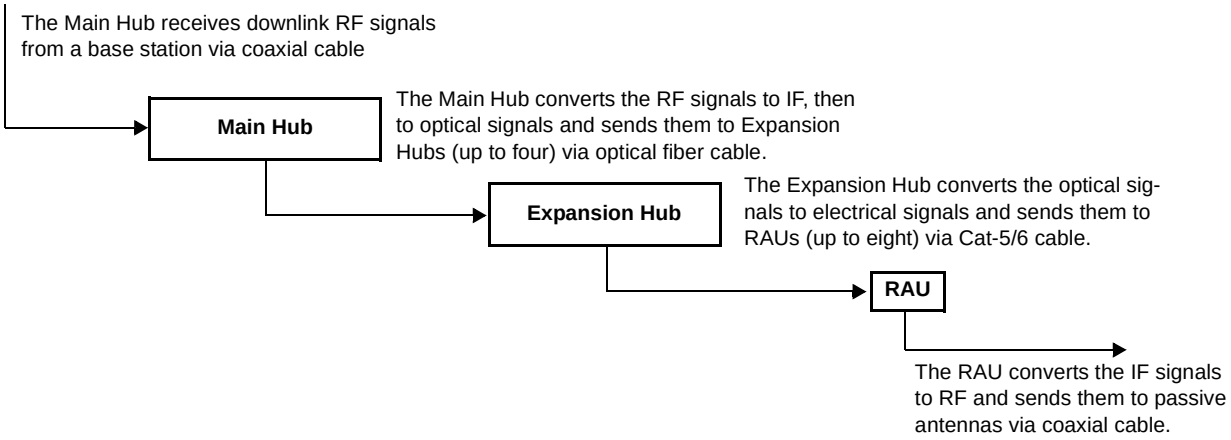
The double star architecture of the Unison system, illustrated in the following figure, provides excellent system scalability and reliability. The system requires only one pair of fiber for 8 antenna points. This makes any system expansion, such as adding an extra antenna for additional coverage, potentially as easy as pulling an extra twisted pair (instead of pulling additional fiber).

Figure 2-4 Unison's Double Star Architecture

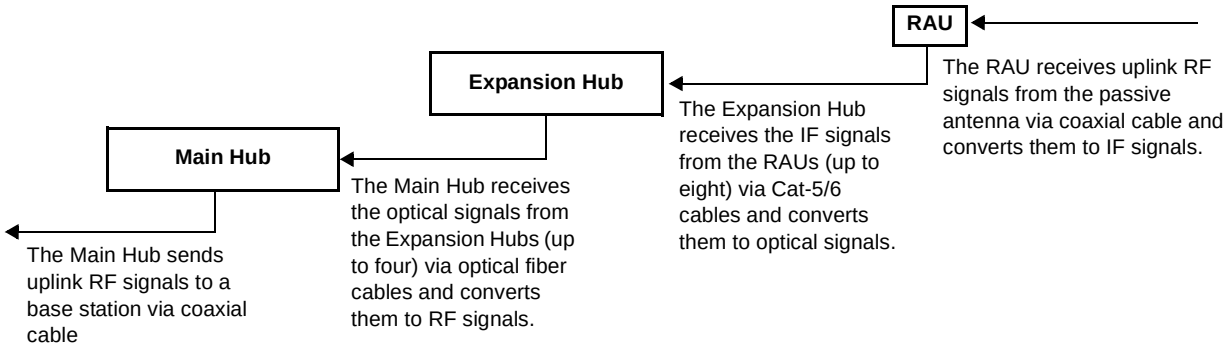


2.5 System Operation

- **Downlink (Base Station to Wireless Devices)**



- **Uplink (Wireless Devices to Base Station)**



2.6 System Specifications

2.6.1 Physical Specifications

Parameter	Main Hub	Expansion Hub	Remote Antenna Unit
RF Connectors	2 N-type, female	8 shielded RJ-45, female (Cat-5/6)	1 shielded RJ-45, female (Cat-5/6) 1 SMA, male (coaxial)
External Alarm Connector (contact closure)	1 9-pin D-sub, female	—	—
Serial Interface Connector	1 9-pin D-sub, male	—	—
Fiber Connectors	4 Pair, SC/APC	1 Pair, SC/APC	—
LED Alarm and Status Indicators	Unit Status (1 pair): • Power • Main Hub Status Downstream Unit Status (1 pair per fiber port): • Link • E-Hub/RAU	Unit Status (1 pair): • Power • E-Hub Status Fiber Link Status (1 pair): • DL Status • UL Status RAU/Link Status (1 pair per RJ-45 port): • Link • RAU	Unit Status (1 pair): • Link • Alarm
AC Power (Volts)	Rating: 100–240V, 0.5A, 50–60 Hz Operating Range: 85–250V, 2.4–0.8A, 47–63 Hz	Rating: 115/230V, 5/2.5A, 50–60 Hz Operating Range: 90–132V/170–250V auto-ranging, 2.2–1.5A/1.2–0.8A, 47–63 Hz	—
DC Power (Volts)	—	—	36V (from the Expansion Hub)
Power Consumption (W)	30	260 (includes 8 RAUs)	11
Enclosure Dimensions* (height × width × depth)	44.5 mm × 438 mm × 305 mm (1.75 in. × 17.25 in. × 12 in.)	89 mm × 438 mm × 305 mm (3.5 in. × 17.25 in. × 12 in.)	44 mm × 305 mm × 158 mm (1.7 in. × 12 in. × 6.2 in.)
Weight	< 3 kg (< 6.5 lb)	< 5 kg (< 11 lb)	< 1 kg (< 2 lb)
MTBF	106,272 hours	78,998 hours	282,207 hours

*Excluding angle-brackets for 19" rack mounting of hubs.

2.6.2 Environmental Specifications

Parameter	Main Hub and Expansion Hub	RAU
Operating Temperature	0° to +45°C (+32° to +113°F)	–25° to +45°C (–13° to +113°F)
Non-operating Temperature	–20° to +85°C (–4° to +185°F)	–25° to +85°C (–13° to +185°F)
Operating Humidity; non-condensing	5% to 95%	5% to 95%

2.6.3 Operating Frequencies

Freq. Band	Unison Band	Description	RF Passband	
			Downlink (MHz)	Uplink (MHz)
PCS	PCS1	A & D Band	1930–1950	1850–1870
PCS	PCS2	D & B Band	1945–1965	1865–1885
PCS	PCS3	B & E Band	1950–1970	1870–1890
PCS	PCS4	E & F Band	1965–1975	1885–1895
PCS	PCS5	F & C Band	1970–1990	1890–1910
DCS	DCS1	DCS1 Band	1805–1842.5	1710–1747.5
DCS	DCS2	DCS2 Band	1842.5–1880	1747.5–1785
DCS	DCS3	DCS3 Band	1840–1875	1745–1780
Cellular	CELL	–	869–894	824–849
iDEN	iDEN	–	851–869	806–824
EGSM	EGSM	–	925–960	880–915
GSM	GSM	–	935–960	890–915
UMTS	UMTS1	–	2110–2145	1920–1955
UMTS	UMTS2	–	2125–2160	1935–1970
UMTS	UMTS3	–	2135–2170	1945–1980

2.6.4 RF End-to-End Performance

Cellular

Table 2-1 Cellular RF End-to-End Performance using 2 km of Single-Mode Fiber

	Typical	
Parameter	**Downlink**	**Uplink**
Average gain with 75 m Cat-5/6 at 25°C (77°F)*	15 dB	15 dB
Ripple with 75 m Cat-5/6	3 dB	3.5 dB
Output IP3	40 dBm	
Input IP3†		–7 dBm
Output 1 dB Compression Point	27 dBm	
AMPS output power per carrier when 30 carriers are present	0.7 dBm	
TDMA output power per carrier when 16 carriers are present	4.0 dBm	
CDMA output power per carrier when 6 carriers are present	7.8 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAUs configuration		15 dB
Noise Figure with 1 MH – 4 EHs – 32 RAUs configuration		21 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step.

†For two tones into one RAU, IP3 higher in other circumstances.

Table 2-2 Cellular RF End-to-End Performance using 1 km of Multimode Fiber

	Typical	
Parameter	**Downlink**	**Uplink**
Average gain with 75 m Cat-5/6 at 25°C (77°F)*	15 dB	15 dB
Ripple with 75 m Cat-5/6	3 dB	3.5 dB
Output IP3	37 dBm	
Input IP3†		–10 dBm
Output 1 dB Compression Point	27 dBm	
AMPS output power per carrier when 30 carriers are present	0.7 dBm	
TDMA output power per carrier when 16 carriers are present	4.0 dBm	
CDMA output power per carrier when 6 carriers are present	7.8 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAUs configuration		15 dB
Noise Figure with 1 MH – 4 EHs – 32 RAUs configuration		21 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step.

†For two tones into one RAU, IP3 higher in other circumstances.

iDEN

Table 2-3 iDEN RF End-to-End Performance using 2 km of Single-Mode Fiber

	Typical	
Parameter	**Downlink**	**Uplink**
Average gain with 75 m Cat-5/6 at 25°C (77°F)*	15 dB	15 dB
Ripple with 75 m Cat-5/6	2 dB	3 dB
Output IP3	38 dBm	
Input IP3		–16 dBm
Output 1 dB Compression Point	26 dBm	
Output power per carrier when 6 carriers are present	6.4 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAUs configuration		17 dB
Noise Figure with 1 MH – 4 EHs – 32 RAUs configuration		23 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step.

GSM

Table 2-4 GSM RF End-to-End Performance using 2 km of Single-Mode Fiber

	Typical	
Parameter	**Downlink**	**Uplink**
Average gain with 75 m Cat-5/6 at 25°C (77°F)*	15 dB	15 dB
Ripple with 75 m Cat-5/6	2 dB	3 dB
Output IP3	38 dBm	
Input IP3		–16 dBm
Output 1 dB Compression Point	26 dBm	
GSM output power per carrier when 12 carriers are present	5.0 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAUs configuration		17 dB
Noise Figure with 1 MH – 4 EHs – 32 RAUs configuration		23 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step.

EGSM

Table 2-5 EGSM RF End-to-End Performance using 2 km of Single-Mode Fiber

	Typical	
Parameter	**Downlink**	**Uplink**
Average gain with 75 m Cat-5/6 at 25°C (77°F)*	15 dB	15 dB
Ripple with 75 m Cat-5/6	3 dB	4 dB
Output IP3	38 dBm	
Input IP3		–7 dBm
Output 1 dB Compression Point	26 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAU configuration		16 dB
Noise Figure with 1 MH – 4 EH – 32 RAU configuration		22 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step.

Table 2-6 EGSM RF End-to-End Performance using 1 km of Multimode Fiber

	Typical	
Parameter	**Downlink**	**Uplink**
Average gain with 75 m Cat-5/6 at 25°C (77°F)*	15 dB	15 dB
Ripple with 75 m Cat-5/6	3 dB	4 dB
Output IP3	38 dBm	
Input IP3		–10 dBm
Output 1 dB Compression Point	26 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAUs configuration		16 dB
Noise Figure with 1 MH – 4 EHs – 32 RAUs configuration		22 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step.

DCS

Table 2-7 DCS RF End-to-End Performance using 2 km of Single-Mode Fiber

	Typical	
Parameter	**Downlink**	**Uplink**
Average gain with 75 m Cat-5/6 at 25°C (77°F)*	15 dB	15 dB
DCS1 & DCS2 Ripple with 75 m Cat-5/6	2.5 dB	5 dB
DCS3 & center 35MHz of DCS or DCS2 Ripple with 75 m Cat-5/6	2 dB	2 dB
Output IP3	37 dBm	
Input IP3		–15 dBm
Output 1 dB Compression Point	25 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAUs configuration		17 dB
Noise Figure with 1 MH – 4 EHs – 32 RAUs configuration		23 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step.

Table 2-8 DCS RF End-to-End Performance using 1 km of Multimode Fiber

	Typical	
Parameter	**Downlink**	**Uplink**
Average gain with 75 m Cat-5/6 at 25°C (77°F)*	15 dB	15 dB
DCS1 & DCS2 Ripple with 75 m Cat-5/6	2.5 dB	5 dB
DCS3 & center 35MHz of DCS or DCS2 Ripple with 75 m Cat-5/6	2 dB	2 dB
Output IP3	37 dBm	
Input IP3		–17 dBm
Output 1 dB Compression Point	25 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAUs configuration		17 dB
Noise Figure with 1 MH – 4 EHs – 32 RAUs configuration		23 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step.

PCS

Table 2-9 PCS RF End-to-End Performance using 2 km of Single-Mode Fiber

Parameter	Typical	
	Downlink	Uplink
Average gain with 75 m Cat-5/6 at 25°C (77°F)*	15 dB	15 dB
Ripple with 75 m Cat-5/6	2.5 dB	3 dB
Output IP3	38 dBm	
Input IP3		–12 dBm
Output 1 dB Compression Point	26 dBm	
TDMA output power per carrier when 16 carriers are present	4.0 dBm	
GSM output power per carrier when 16 carriers are present	4.2 dBm	
CDMA output power per carrier when 8 carriers are present	7.8 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAUs configuration		16 dB
Noise Figure with 1 MH – 4 EHs – 32 RAUs configuration		22 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step..

Table 2-10 PCS RF End-to-End Performance using 1 km of Multimode Fiber

Parameter	Typical	
	Downlink	Uplink
Average gain with 75 m Cat-5/6 at 25°C (77°F)*	15 dB	15 dB
Ripple with 75 m Cat-5/6	2.5 dB	3 dB
Output IP3	36.5 dBm	
Input IP3		–14 dBm
Output 1 dB Compression Point	26 dBm	
TDMA output power per carrier when 16 carriers are present	4.0 dBm	
GSM output power per carrier when 16 carriers are present	4.2 dBm	
CDMA output power per carrier when 8 carriers are present	7.8 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAUs configuration		16 dB
Noise Figure with 1 MH – 4 EHs – 32 RAUs configuration		22 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step..

WCDMA

Table 2-11 WCDMA RF End-to-End Performance using 2 km of Single-Mode Fiber

Parameter	Typical	
	Downlink	Uplink
Average gain with 75 m Cat-5/6 at 25°C (77°F) *	15 dB	15 dB
Ripple with 75 m Cat-5/6	3 dB	3 dB
Output IP3	36.5 dBm	
Input IP3		–12 dBm
Output 1 dB Compression Point	26 dBm	
Output power per carrier when 7 carriers are present	4.5 dBm	
Noise Figure with 1 MH – 1 EH – 8 RAUs configuration		16 dB
Noise Figure with 1 MH – 4 EHs – 32 RAUs configuration		22 dB

*The system gain is adjustable in 1 dB steps from 0 to 15 dB, and the gain of each RAU can be attenuated 10 dB in one step.

SECTION 3

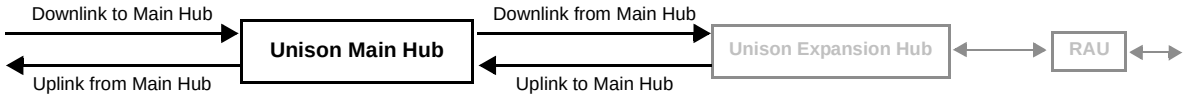
Unison Main Hub

The Main Hub distributes downlink RF signals from a base station, repeater, or MetroReach Focus system to up to four Expansion Hubs, which in turn distribute the signals to up to 32 Remote Access Units. The Main Hub also combines uplink signals from the Expansion Hubs for a base station or MetroReach Focus system.

Figure 3-1 Main Hub in a Unison System

Downlink Path: The Main Hub receives downlink RF signals from a base station, repeater, or MetroReach Focus system via coaxial cable. It converts the signals to optical and sends them to up to four Expansion Hubs via fiber optic cables.

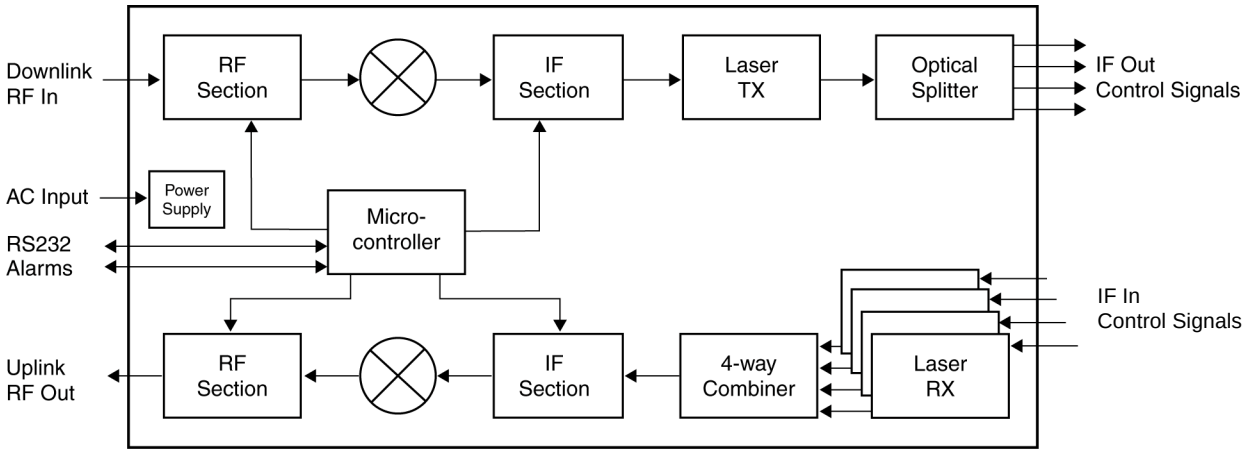
The Main Hub also sends OA&M communication to the Expansion Hubs via the fiber optic cable. The Expansion Hubs, in turn, communicate the OA&M information to the RAUs via Cat-5/6 cable.



Uplink Path: The Main Hub receives uplink optical signals from up to four Expansion Hubs via fiber optic cables. It converts the signals to RF and sends them to a base station, repeater, or MetroReach Focus system via coaxial cable.

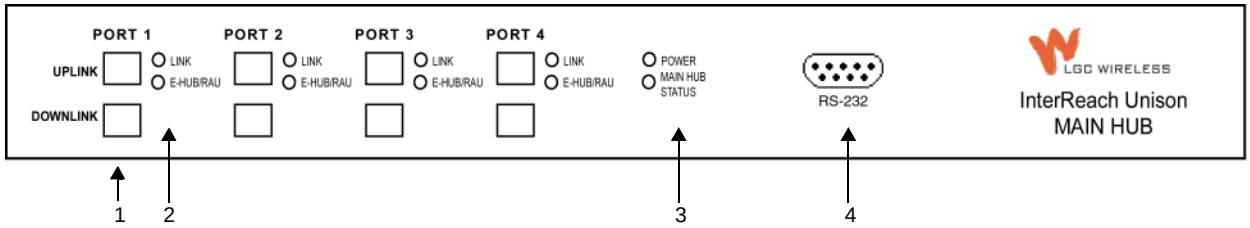
The Main Hub also receives status information from the Expansion Hubs and all RAUs via the fiber optic cable.

Figure 3-2 Main Hub Block Diagram



3.1 Main Hub Front Panel

Figure 3-3 Main Hub Front Panel



1. Four fiber optic ports (labeled **PORT 1**, **PORT 2**, **PORT 3**, **PORT 4**)
   - One standard female SC/APC connector per port for MMF/SMF input (labeled **UPLINK**)
   - One standard female SC/APC connector per port for MMF/SMF output (labeled **DOWNLINK**)
2. Four sets of fiber port LEDs (one set per port)
   - One LED per port for port link status (labeled **LINK**)
   - One LED per port for downstream unit status (labeled **E-HUB/RAU**)
3. One set of unit status LEDs
   - One LED for unit power status (labeled **POWER**)
   - One LED for unit status (labeled **MAIN HUB STATUS**)
4. One 9-pin D-sub male connector for system communication and diagnostics using a PC/laptop (labeled **RS-232**)

3.1.1 Optical Fiber Uplink/Downlink Ports

The optical fiber uplink/downlink ports transmit and receive optical signals between the Main Hub and up to four Expansion Hub(s) using industry-standard SMF or MMF cable. There are four fiber ports on the front panel of the Main Hub; one port per Expansion Hub. Each fiber port has two female SC/APC connectors:

- **Optical Fiber Uplink Connector**

  This connector (labeled **UPLINK**) is used to receive the uplink optical signals from an Expansion Hub.

- **Optical Fiber Downlink Connector**

  This connector (labeled **DOWNLINK**) is used to transmit the downlink optical signals to an Expansion Hub.

CAUTION: To avoid damaging the Main Hub's fiber connector ports, use only SC/APC fiber cable connectors.

3.1.2 Communications RS-232 Serial Connector

Remote Monitoring

Use a standard serial cable to connect a modem to the 9-pin D-sub male serial connector for remote monitoring or configuring. The cable typically has a DB-9 female and a DB-25 male connector. The following figure shows the cable pinout.

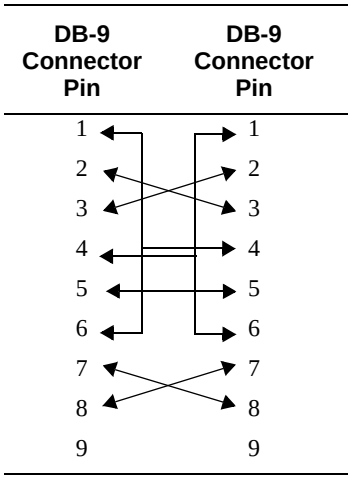
Figure 3-4 Standard Serial Cable Pinout

DB-9 Connector Pin		DB-25 Connector Pin
1	◄——►	8
2	◄——►	3
3	◄——►	2
4	◄——►	20
5	◄——►	7
6	◄——►	6
7	◄——►	4
8	◄——►	5
9	◄——►	22

Local Monitoring

Use a null modem cable to connect a laptop or PC to the 9-pin D-sub male serial connector for local monitoring or configuring. The cable typically has a DB-9 female connector on both ends. The following figure shows the cable pinout.

Figure 3-5 Null Modem Cable Pinout



Note that for each connector, pins 1 and 6 are tied together and sent to pin 4 of the opposite connector.

3.1.3 LED Indicators

The unit's front panel LEDs indicate fault conditions and commanded or fault lockouts. The LEDs do not indicate warnings or if the system test has not been performed. Use the LEDs as a go/no go test or as a backup when you are not using AdminManager.

Upon power up, the Main Hub goes through a five-second test to check the LED lamps. During this time, the LEDs blink through the states shown in Table 3-2, letting you visually verify that the LED lamps and the firmware are functioning properly.

NOTE: Refer to Section 10 for troubleshooting using the LEDs.

Unit Status LEDs

The Main Hub status LEDs can be in one of three states, as shown in Table 3-1. These LEDs can be:

- steady green
- steady red
- blinking green/red (alternating green/red)

There is no off state when the unit's power is on.

Table 3-1 Main Hub Status LED States

	LED State	Indicates
POWER MAIN HUB STATUS	Green Green	• Main Hub is connected to power • Main Hub is not reporting a fault; but the system test may need to be performed or a warning condition could exist
POWER MAIN HUB STATUS	Green Red	• Main Hub is connected to power • Main Hub is reporting a fault or lockout condition
POWER MAIN HUB STATUS	Green Alternating Green/Red	• Main Hub is connected to power • Main Hub input signal level too high

Port LEDs

The Main Hub has one pair of fiber port LEDs for each of the four Expansion Hub ports. The LED pairs can be in one of four states, as shown in the following table, in a combination of the following:

- ○ off
- ● steady green
- ● steady red

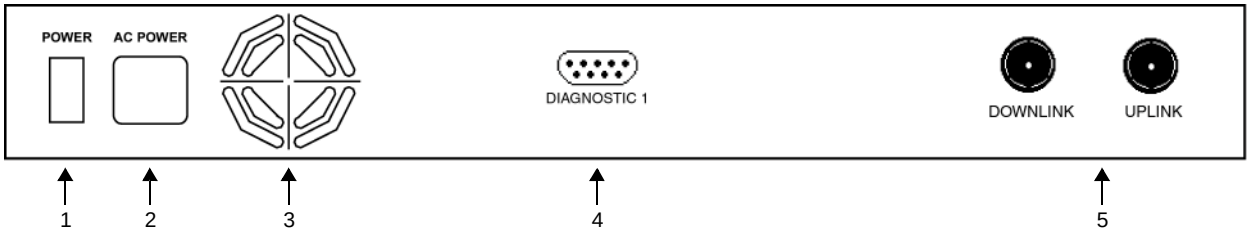
The port LEDs indicate the status of the Expansion Hub and RAUs; however, they do not indicate which particular unit is having a problem (i.e., the Expansion Hub vs. one of the RAUs).

Table 3-2 Main Hub Port LED States

	LED State	Indicates
LINK ○ E-HUB/RAU ○	Off Off	• Expansion Hub not connected
LINK ● E-HUB/RAU ●	Green Green	• Expansion Hub connected, communications normal • No faults from Expansion Hub or any connected RAU
LINK ● E-HUB/RAU ○	Red Off	• Loss of communications with Expansion Hub
LINK ● E-HUB/RAU ●	Green Red	• Expansion Hub connected • Fault or lockout reported by Expansion Hub or any connected RAU

3.2 Main Hub Rear Panel

Figure 3-6 Main Hub Rear Panel



1. Power on/off switch
2. AC power cord connector
3. Fan exhaust vent
4. One 9-pin D-sub female connector for contact closure monitoring (labeled **DIAGNOSTIC 1**)
5. Two N-type, female connectors:
   - Downlink (labeled **DOWNLINK**)
   - Uplink (labeled **UPLINK**)

3.2.1 Main Hub Rear Panel Connectors

3.2.1.1 N-type Female Connectors

There are two N-type female connectors on the rear panel of the Main Hub:

- The **UPLINK** connector transmits uplink RF signals to a repeater, local base station, or MetroReach Focus system.
- The **DOWNLINK** connector receives downlink RF signals from a repeater, local base station, or MetroReach Focus system.

3.2.1.2 9-pin D-sub Connector

The 9-pin D-sub connector (labeled **DIAGNOSTIC 1**) provides contact closure for major error and minor error system alarm monitoring.

The following table lists the function of each pin on the 9-pin D-sub connector. Pin locations are labeled on the figure.

Pin	Function
1	Ground / Alarm Input
2	Reserved
3	Reserved
4	Minor Error (positive connection)
5	Minor Error (negative connection)
6	DC Ground (common)
7	Major Error (positive connection)
8	Alarm Input
9	Major Error (negative connection)

This interface can either generate contact alarms or sense a single external alarm contact.

3.3 Faults and Warnings

The Main Hub monitors and reports changes in system performance to:

- Ensure that Expansion Hubs and Remote Access Units are connected and functioning properly.
- Ensure that the fiber receivers, amplifiers, and IF/RF path in the Main Hub are functioning properly.

The Main Hub periodically polls attached Expansion Hubs and their Remote Access Units for status. Both fault and warning conditions are reported to a connected PC/laptop that is running the AdminManager software or to the optional remote OpsConsole. Only faults are indicated by LEDs.

The faults and warnings that the Main Hub is responsible for monitoring and reporting are listed in Section 10.

3.4 Main Hub Specifications

Table 3-3 Main Hub Specifications

Specification	Description
Enclosure Dimensions (H × W × D):	44.5 mm × 438 mm × 305 mm (1.75 in. × 17.25 in. × 12 in.)
Weight	< 3 kg (< 6.5 lb)
Operating Temperature	0° to +45°C (+32° to +113°F)
Non-operating Temperature	–20° to +85°C (–4° to +185°F)
Operating Humidity, non-condensing	5% to 95%
External Alarm Connector (contact closure)	1 9-pin D-sub, female
Serial Interface Connector	1 9-pin D-sub, male
Fiber Connectors	4 Pair, SC/APC
RF Connectors	2 N-type, female
LED Fault and Status Indicators	Unit Status (1 pair): • Power • Main Hub Status Downstream Unit/Link Status (1 pair per fiber port): • Link • E-Hub/RAU
AC Power	Rating: 100–240V, 0.5A, 50–60 Hz Operating Range: 85–250V, 2.4–0.8A, 47–63 Hz
Power Consumption (W)	30
MTBF	106,272 hours

SECTION 4

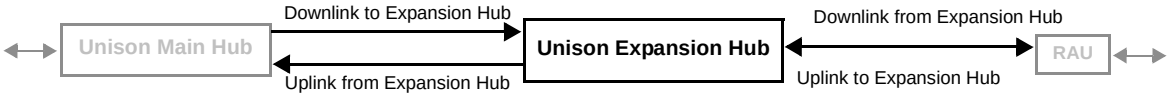
Unison Expansion Hub

The Expansion Hub interfaces between the Main Hub and the Remote Access Unit(s) by converting optical signals to electrical signals. It also supplies the DC power to operate the Remote Access Unit(s).

Figure 4-1 Expansion Hub in a Unison System

Downlink Path: The Expansion Hub receives downlink optical signals from the Main Hub via fiber optic cable. It converts the signals to electrical and sends them to up to eight Remote Access Units (RAUs) via Cat-5/6 cables.

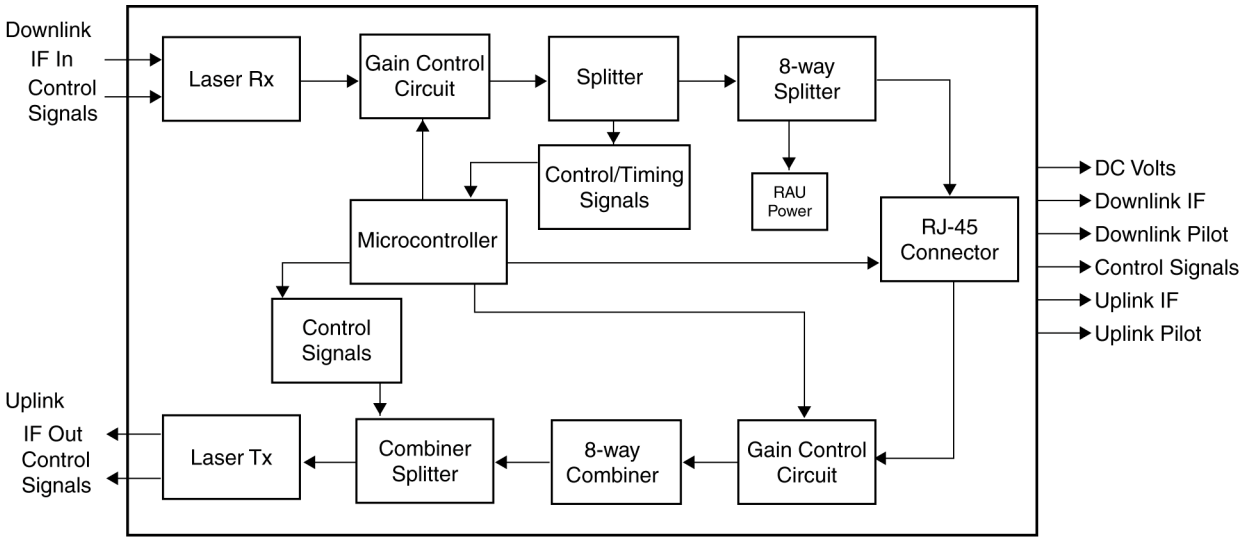
Also, the Expansion Hub receives configuration information from the Main Hub via the fiber optic cable and relays configuration information to the RAUs via the Cat-5/6 cable.



Uplink Path: The Expansion Hub receives uplink IF signals from up to eight RAUs via Cat-5/6 cables. It converts the signals to optical and sends them to a Main Hub via fiber optic cable.

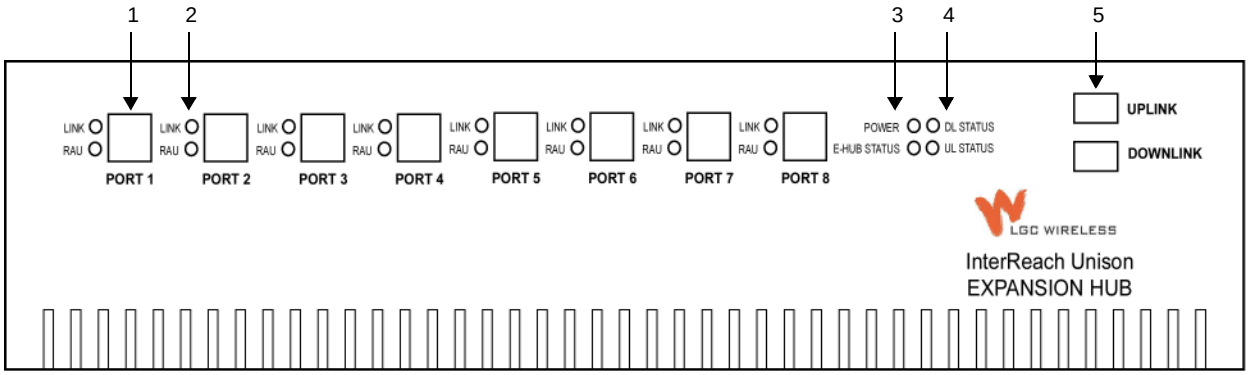
Also, the Expansion Hub receives RAU status information via the Cat-5/6 cable and sends it and its own status information to the Main Hub via the fiber optic cable.

Figure 4-2 Expansion Hub Block Diagram



4.1 Expansion Hub Front Panel

Figure 4-3 Expansion Hub Front Panel



1. Eight standard Cat-5/6 ScTP cable RJ-45 connectors (labeled **PORT 1**, **2**, **3**, **4**, **5**, **6**, **7**, **8**)
2. Eight sets of RJ-45 port LEDs (one set per port)
   - One LED per port for link status (labeled **LINK**)
   - One LED per port for downstream unit status (labeled **RAU**)
3. One set of unit status LEDs
   - One LED for unit power status (labeled **POWER**)
   - One LED for unit status (labeled **E-HUB STATUS**)
4. One set of fiber connection status LEDs
   - One LED for fiber downlink status (labeled **DL STATUS**)
   - One LED for fiber uplink status (labeled **UL STATUS**)
5. One fiber optic port which has two connectors
   - One standard female SC/APC connector for MMF/SMF input (labeled **UPLINK**)
   - One standard female SC/APC connector for MMF/SMF output (labeled **DOWN-LINK**)

4.1.1 RJ-45 Connectors

The eight RJ-45 connectors on the Expansion Hub are for the Cat-5/6 ScTP cable that is used to transmit and receive signals to and from RAUs. Use shielded RJ-45 connectors on the Cat-5/6 cable.

The Cat-5/6 cable also delivers DC electrical power to the RAUs. The Expansion Hub's DC voltage output is 36V DC nominal. A current limiting circuit is used to protect the Expansion Hub if any port draws excessive power.

4.1.2 Optical Fiber Uplink/Downlink Connectors

The optical fiber uplink/downlink port transmits and receives optical signals between the Expansion Hub and the Main Hub using industry-standard SMF or MMF cable. The fiber port has two female SC/APC connectors:

- **Optical Fiber Uplink Connector**

  This connector (labeled **UPLINK**) is used to transmit (output) uplink optical signals to the Main Hub.

- **Optical Fiber Downlink Connector**

  This connector (labeled **DOWNLINK**) is used to receive (input) downlink optical signals from the Main Hub.

CAUTION: To avoid damaging the Expansion Hub's fiber connector port, use only SC/APC fiber cable connectors.

4.1.3 LED Indicators

The unit's front panel LEDs indicate fault conditions and commanded or fault lockouts. The LEDs do not indicate warnings or if the system test has not been performed. Use the LEDs as a go/no go test or as a backup when you are not using AdminManager.

Upon power up, the Expansion Hub goes through a five-second test to check the LED lamps. During this time, the LEDs blink through the states shown in Table 4-2, letting you visually verify that the LED lamps and the firmware are functioning properly.

NOTE: Refer to Section 10 for troubleshooting using the LEDs.

Unit Status and DL/UL Status LEDs

The Expansion Hub unit status and DL/UL status LEDs can be in one of five states, as shown in the following table. These LEDs can be:

- steady green
- steady red

There is no off state when the unit's power is on.

Table 4-1 Expansion Hub Unit Status and DL/UL Status LED States

	LED State	Indicates
POWER ● ● DL STATUS E-HUB STATUS ● ● UL STATUS	Green / Green Green / Green	• Expansion Hub is connected to power • Expansion Hub is not reporting a fault or lockout; but the system test may need to be performed or a warning condition could exist • Optical power in is above minimum (Main Hub is connected) although the cable length may be longer than recommended maximum • Optical power out (uplink laser) is normal
POWER ● ● DL STATUS E-HUB STATUS ● ● UL STATUS	Green / Green Red / Green	• Expansion Hub is reporting a fault or commanded lockout, but optical power in and out are normal
POWER ● ● DL STATUS E-HUB STATUS ● ● UL STATUS	Green / Red Red / Green	• Fault condition detected, optical power in is below minimum. (Main Hub is not connected, is not powered, or Main Hub's DL laser has failed.)
POWER ● ● DL STATUS E-HUB STATUS ● ● UL STATUS	Green / Green Red / Red	• Expansion Hub is reporting a fault condition • Optical power in is normal, optical power out is below minimum (Expansion Hub uplink laser has failed; unable to communicate with Main Hub)
POWER ● ● DL STATUS E-HUB STATUS ● ● UL STATUS	Green / Red Red / Red	• No downlink or uplink: replace Expansion Hub

Port LEDs

The Expansion Hub has one pair of port LEDs for each of the eight RJ-45 ports. The port LEDs can be in one of four states, as shown in the following table. These LEDs can be:

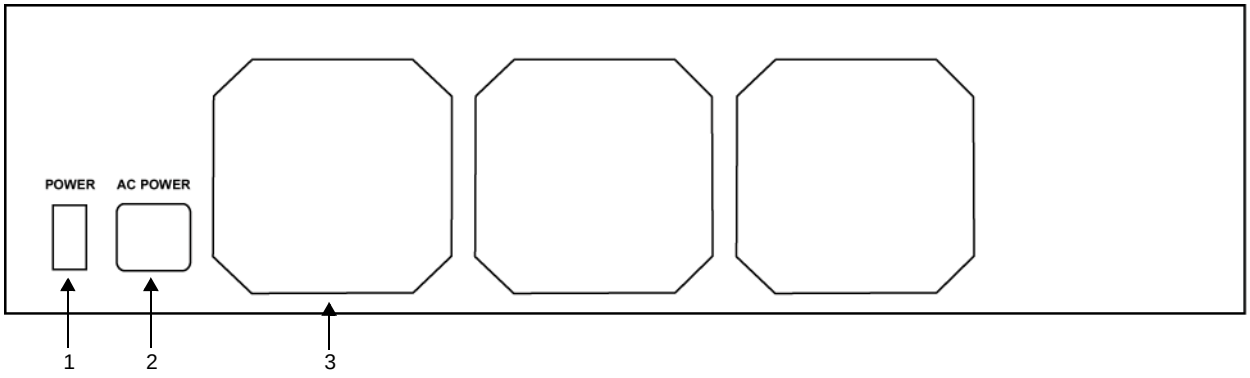
- ○ off
- ● steady green
- ● steady red

Table 4-2 Expansion Hub Port LED States

	LED State	Indicates
LINK ○ RAU ○	Off Off	• RAU is not connected
LINK ● RAU ●	Green Green	• RAU is connected • No faults from RAU
LINK ● RAU ○	Red Off	• Loss of communications to RAU
LINK ● RAU ●	Green Red	• RAU is connected • Fault/lockout condition reported by RAU

4.2 Expansion Hub Rear Panel

Figure 4-4 Expansion Hub Rear Panel



1. Power on/off switch
2. AC power cord connector
3. Three air exhaust vents

4.3 Faults and Warnings

The Main Hub periodically polls attached Expansion Hubs and their Remote Access Units for status. Both fault and warning conditions are reported to a connected PC/laptop that is running the AdminManager software or to the optional remote OpsConsole. Only faults are indicated by LEDs.

The faults and warnings that the Expansion Hub is responsible for monitoring and Reporting are listed in Section 10.

4.4 Expansion Hub Specifications

Table 4-3 Expansion Hub Specifications

Specification	Description
Enclosure Dimensions (H × W × D)	89 mm × 438 mm × 305 mm (3.5 in. × 17.25 in. × 12 in.)
Weight	< 5 kg (< 11 lb)
Operating Temperature	0° to +45°C (+32° to +113°F)
Non-operating Temperature	–20° to +85°C (–4° to +185°F)
Operating Humidity, non-condensing	5% to 95%
Cat-5/6 Connectors	8 shielded RJ-45, female (Cat-5/6)
Fiber Connectors	1 Pair, SC/APC
LED Alarm and Status Indicators	Unit Status (1 pair): • Power • E-Hub Status Fiber Link Status (1 pair): • DL Status • UL Status RAU/Link Status (1 pair per RJ-45 port): • Link • RAU
AC Power (Volts) (47–63 Hz)	Rating: 115/230V, 5/2.5A, 50–60 Hz Operating Range: 90–132V/170–250V auto-ranging, 2.2–1.5A/1.2–0.8A, 47–63 Hz
Power Consumption (W)	260 (includes 8 RAUs)
MTBF	78,998 hours

SECTION 5

Unison Remote Access Unit

The Remote Access Unit (RAU) is an active transceiver that connects to an Expansion Hub using industry-standard Cat-5/6 ScTP cable. The cable also delivers electrical power to the RAU.

An RAU passes RF signals between an Expansion Hub and an attached passive antenna where the signals are transmitted to wireless devices.

Figure 5-1 Remote Access Unit in a Unison System

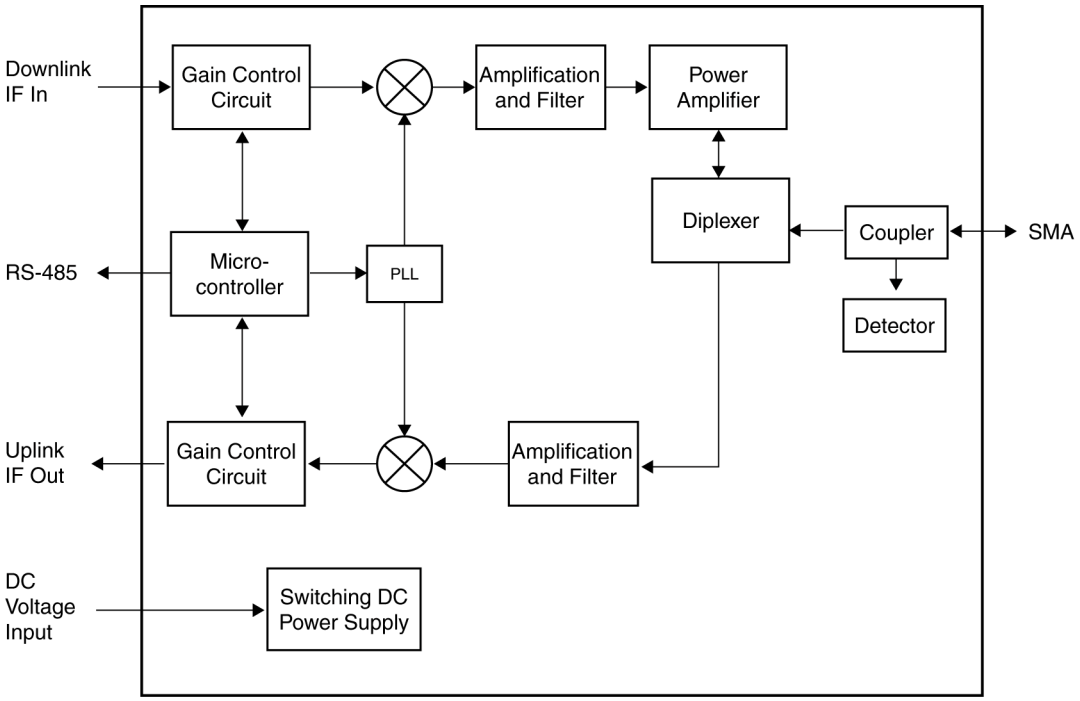
Downlink Path: The RAU receives downlink IF signals from an Expansion Hub via Cat-5/6 cable. It converts the signals to RF and sends them to a passive RF antenna via coaxial cable.

Also, the RAU receives configuration information from the Main Hub via the Cat-5/6 cable.

Uplink Path: The RAU receives uplink RF signals from a passive RF antenna via coaxial cable. It converts the signals to IF and sends them to an Expansion Hub via Cat-5/6 cable.

Also, the RAU sends its status information to the Expansion Hub via the Cat-5/6 cable.

Figure 5-2 Remote Access Unit Block Diagram



5.1 Remote Access Unit Connectors

5.1.1 SMA Connector

The RAU has one female SMA connector. The connector is a duplexed RF input/output port that connects to a standard passive antenna using coaxial cable.

5.1.2 RJ-45 Port

The RAU has one RJ-45 port that connects it to an Expansion Hub using Cat-5/6 ScTP cable. Use shielded RJ-45 connectors on the Cat-5/6 cable.

5.2 LED Indicators

Upon power up, the RAU goes through a two-second test to check the LED lamps. During this time, the LEDs blink through the states shown in Table 5-1, letting you visually verify that the LED lamps and the firmware are functioning properly.

NOTE: Refer to Section 10 for troubleshooting using the LEDs.

Status LEDs

The RAU status LEDs can be in one of four states, as shown in the following table. These LEDs can be:

- ○ off
- ● steady green
- ● steady red

Table 5-1 Remote Access Unit LED States

	LED State	Indicates
LINK ○ ALARM ○	Off Off	• RAU is not receiving DC power
LINK ● ALARM ●	Green Green	• RAU is powered and is not indicating a fault condition. Communication with Expansion Hub is normal; but the system test may need to be performed or a warning condition could exist (use AdminManager to determine)
LINK ● ALARM ●	Green Red	• RAU is indicating a fault or lockout condition, but communication with the Expansion Hub is normal
LINK ● ALARM ●	Red Red	• RAU is reporting a fault or lockout condition, and it is not able to communicate with the Expansion Hub

5.3 Faults and Warnings

The Main Hub periodically polls attached Expansion Hubs and their Remote Access Units for status. Both faults and warning conditions are reported to a connected PC/laptop that is running the AdminManager software, or to the optional remote OpsConsole. Only faults are indicated by LEDs.

The faults and warnings that the RAU is responsible for monitoring and reporting are listed in Section 10.

5.4 Remote Access Unit Specifications

Table 5-2 Remote Access Unit Specifications

Specification	Description
Dimensions (H × W × D)	44 mm × 305 mm × 158 mm (1.7 in. × 12 in. × 6.2 in.)
Weight	< 1 kg (< 2 lb)
Operating Temperature	–25° to +45°C (–13° to +113°F)
Non-operating Temperature	–25° to +85°C (–13° to +185°F)
Operating Humidity, non-condensing	5% to 95%
RF Connectors	1 shielded RJ-45, female (Cat-5/6) 1 SMA, male (coaxial)
LED Alarm and Status Indicators	Unit Status (1 pair): • Link • Alarm
Maximum Heat Dissipation (W)	11
MTBF	282,207 hours

SECTION 6

Installing Unison Components

6.1 Installation Requirements

6.1.1 Component Location Requirements

Unison components are intended to be installed in indoor locations only.

6.1.2 Cable and Connector Requirements

The Unison equipment operates over standard Category 5 or 6 (Cat-5/6) screened twisted pair (ScTP) and industry-standard single-mode fiber (SMF) or multimode fiber (MMF) cable.

These cables are widely used industry standards for Local Area Networks (LANs). The regulations and guidelines for Unison cable installation are identical to those specified by the TIA/EIA 568-A standard and the TIA/EIA/IS-729 supplement for LANs.

LGC Wireless recommends plenum-rated Cat-5/6 ScTP and fiber cable and connectors for conformity to building codes and standards. ScTP is required in order to meet FCC and CE Mark emissions requirements.

6.1.3 Neutral Host System Requirements

As in any Unison system, a neutral host system requires one pair of fiber strands between each Main Hub and each Expansion Hub, and one Cat-5/6 cable between each Expansion Hub and each RAU. To help achieve the cost savings possible in a neutral host system, it is advantageous to install additional cables for future growth.

6.1.4 Distance Requirements

The following table shows the distances between Unison components and related equipment.

Table 6-1 Unison Distance Requirements

Equipment Combination	Cable Type	Distance	Additional Information
Repeater to Main Hub	Coaxial; N male connectors	3–6 m (10–20 ft) typical	Limited by loss and noise. Refer to your link budget calculation.
Base Station to Main Hub	Coaxial; N male connectors	3–6 m (10–20 ft) typical	Limited by loss and noise. Refer to your link budget calculation.
Main Hub to Expansion Hub	Multimode Fiber: Single-Mode Fiber: SC/APC male connectors	1.5 km (4,921 ft) max. 6 km (19,685 ft) max.	Limited by 3 dB optical loss.
Expansion Hub to RAU	Cat-5/6 ScTP; shielded RJ-45 male connectors	25 meters (82 ft) minimum 100 m (328 ft) recommended max. 150 m (492 ft) absolute max.	See “System Gain (Loss) Relative to ScTP Cable Length” on page 8-31.
RAU to passive antenna	Coaxial; SMA male connectors	1–3.5 m (3–12 ft) typical	Limited by loss and noise. Refer to your link budget calculation.

6.2 Safety Precautions

6.2.1 Installation Guidelines

Use the following guidelines when installing LGC Wireless equipment:

1. Provide sufficient airflow and cooling to the equipment to prevent heat build-up from exceeding the maximum ambient air temperature specification. Do not compromise the amount of airflow required for safe operation of the equipment.
2. Be careful when servicing these products. If you are removing the system, turn it off and remove the power cord first. There are no user-serviceable parts inside the components.
3. The internal power supply has internal fuses that are not user replaceable. Consider the worst-case power consumption shown on the product labels when provisioning the equipment's AC power source and distribution.

6.2.2 General Safety Precautions

The following precautions apply to LGC Wireless products:

- The units have no user-serviceable parts. Faulty or failed units are fully replaceable through LGC Wireless. Please contact us at:

  1-800-530-9960 (U.S. only)
  +1-408-952-2400 (International)
  +44(0) 1223 597812 (Europe)

- Although modeled after an Ethernet/LAN architecture and connectivity, the units are not intended to connect to Ethernet data hubs, routers, cards, or other similar data equipment.
- When you connect the fiber optic cable, take the same precaution as if installing Ethernet network equipment. All optical fiber SC/APC connectors should be cleaned according to the cable manufacturer's instructions.
- When you connect a radiating antenna to an RAU, **DO NOT** over-tighten the SMA connector. Firmly hand-tightening the connector is adequate.

WARNING: To reduce the risk of fire or electric shock, do not expose this equipment to rain or moisture. The components are intended for indoor use only. Do not install the RAU outdoors. Do not connect an RAU to an antenna that is located outside where it could be subject to lightning strikes, power crosses, or wind.

6.2.3 Fiber Port Safety Precautions

The following are suggested safety precautions for working with fiber ports. For information about system compliance with safety standards, see Appendix C.

WARNING: Observe the following warning about viewing fiber ends in ports. Do not stare with unprotected eyes at the connector ends of the fibers or the ports of the hubs. Invisible infrared radiation is present at the front panel of the Main Hub and the Expansion Hub. Do not remove the fiber port dust caps unless the port is going to be used. Do not stare directly into a fiber port.

- **Test fiber cables:** When you test fiber optic cables, connect the optical power source last and disconnect it first. Use Class 1 test equipment.
- **Fiber ends:** Cover any unconnected fiber ends with an approved cap. Do not use tape.
- **Broken fiber cables:** Do not stare with unprotected eyes at any broken ends of the fibers. Laser light emitted from fiber sources can cause eye injury. Avoid contact with broken fibers; they are sharp and can pierce the skin. Report any broken fiber cables and have them replaced.
- **Cleaning:** Be sure the connectors are clean and free of dust or oils. Use only approved methods for cleaning optical fiber connectors.
- **Modifications:** Do not make any unauthorized modifications to this fiber optic system or associated equipment.
- **Live work:** Live work is permitted because LGC Wireless equipment is a Class 1 hazard.
- **Signs:** No warning signs are required.
- **Class 1 laser product:** The system meets the criteria for a Class 1 laser product per IEC 60825-1:1998-01 and IEC 60825-2:2000-05.

This label appears on the front panel of the Main Hub and the Expansion Hub.

- **CAUTION**: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

6.3 Preparing for System Installation

6.3.1 Pre-Installation Inspection

Follow this procedure before installing Unison equipment:

1. Verify the number of packages received against the packing list.
2. Check all packages for external damage; report any external damage to the shipping carrier. If there is damage, a shipping agent should be present before unpacking and inspecting the contents because damage caused during transit is the responsibility of the shipping agent.
3. Open and check each package against the packing slip. If any items are missing, contact LGC Wireless customer service.
4. If damage is discovered at the time of installation, contact the shipping agent.

6.3.2 Installation Checklist

Table 6-2 Installation Checklist

✓	Installation Requirement	Consideration
	Floor Plans	Installation location of equipment clearly marked
	Power available: Main Hub (AC) Expansion Hub (AC) To RAU (DC)	Power cord is 2 m (6.5 ft) long. Rating: 100–240V, 0.5A, 50–60 Hz Rating: 115/230V, 5/2.5A, 50–60 Hz 36V (from the Expansion Hub)
	Rack space available: Main Hub Expansion Hub	 44 mm (1.75 in.) high (1U) 89 mm (3.5 in.) high (2U)
	Clearance for air circulation: Main and Expansion Hubs RAU	 76 mm (3 in.) front and rear, 51 mm (2 in.) sides 76 mm (3 in.) all around
	Suitable operating environment: Main and Expansion Hubs RAUs	Indoor location only 0° to +45°C (+32° to +113°F) 5% to 95% non-condensing humidity –25° to +45°C (–13° to +113°F) 5% to 95% non-condensing humidity
	Donor Antenna-to-Unison Configuration	
	Donor Antenna	Installed, inspected; N-male to N-male coaxial cable to lightning arrestor/surge suppressor
	Lightning Arrestor or Surge Suppressor	Installed between roof-top antenna and repeater; N-male to N-male coaxial cable
	Repeater	Installed between lightning arrestor/surge suppressor and Main Hub; N-male to N-male coaxial cable
	Attenuator	Installed between the circulator and the Main Hub downlink port to prevent overload. Optionally, it may be installed between the uplink port and the circulator
	Circulator	Installed between the repeater and the Main Hub uplink and downlink ports
	Base Station-to-Unison Configuration	
	Base Station	Verify RF power (see tables in Section 8.1 on page 8-3); N-male to N-male coaxial cable; installed, inspected
	Attenuator	Attenuation may be required to achieve the desired RF output at the RAU and the desired uplink noise floor level
	Circulator	When using a duplex BTS: Installed between the repeater and the Main Hub uplink and downlink ports. Not used with a simplex BTS

Table 6-2 Installation Checklist (continued)

✓	Installation Requirement	Consideration
	Connecting Multiple Main Hubs Together	
	Power combiner/splitter	N-male to N-male coaxial cables; power combiner/splitter to Main Hub and base station or repeater
	Attenuator	Attenuation may be required to achieve the desired RF output at the RAU and the desired uplink noise floor level
	Circulator	When using a duplex BTS: Installed between the repeater the Main Hub uplink and downlink ports. Not used with a simplex BTS
	Cabling	
	Coaxial: repeater or base station to Main Hub	Coax approved; N-type male connectors
	Coaxial: RAU to passive antennas	Use low-loss cable; SMA male connector; typical 1 m (3.3 ft) using RG142 coaxial cable
	Fiber: Main Hub to Expansion Hubs	SC/APC (angle-polished) male connectors (can use SC/APC pigtails); MMF: limited by optical loss of 3 dB, up to 1.5 km (4,921 ft); SMF: limited by optical loss of 3 dB, up to 6 km (19,685 ft)
	Cat-5/6 ScTP: Expansion Hub to RAUs	TIA/EIA 568-A approved; shielded RJ-45 male connectors • Absolute Minimum: 10 meters (33 ft) • Recommended Minimum: 25 meters (82 ft) • Recommended Maximum: 100 meters (328 ft) • Absolute Maximum: 150 meters (492 ft) Tie-off cables to avoid damaging the connectors because of cable strain
	Daisy-chain cable	For contact alarm monitoring: connecting up to 5 LGCell systems to Unison, or connecting up to 5 Unison systems to MetroReach Focus or to a base station
	Alarm Sense Adapter Cable	If connecting LGCell to Unison
	Null modem cable	Female connectors; Main Hub to a laptop that is running the AdminManager software; local connection
	Straight-through cable	Female/male connectors; Main Hub to a modem; remote connection
	Configuring System	
	Laptop running AdminManager software	Refer to requirements in Section 7.1.1, “PC/Laptop Requirements,” on page 7-2
	Distances	
	Main Hub is within 3–6m (10–20 ft) of connecting repeater	If longer distance, determine the loss of the cable used for this connection and adjust the RF signal into the Main Hub accordingly. This can be done by readjusting the power from the base station, or by changing the attenuation value between the base station/repeater and the Main Hub
	Main Hub is within 3–6m (10–20 ft) of connecting base station	
	Main Hub is within correct distance of Expansion Hub(s); SMF and MMF optical link budget: 3 dB	

6.3.3 Tools and Materials Required

Table 6-3 Tools and Materials Required for Component Installation

✓	Description
	Cable ties
	Philips screwdriver
	Mounting screws and spring nuts
	Fiber cleaning supplies
	Compressed air
	Screws, anchors, pipe clamp, etc. (for mounting RAUs)
	Drill
	Fusion splicer
	Fiber connector cleaning kit
	Splicing tool kit (including: snips, cladding strippers, fiber cleaver, isopropyl alcohol, lint-free wipes)
	Fusion splicing sleeves

6.3.4 Optional Accessories

Table 6-4 Optional Accessories for Component Installation

✓	Description
	Wall-mount equipment rack(s) (PN 4712)
	Cable management (Cable manager: PN 4759; Tie wrap bar: PN 4757)
	Splice trays
	Pigtails with SC/APC connector: Multimode Fiber SC/APC Pigtail (PN 4012SCAPC-3) Single-mode Fiber SC/APC Pigtail (PN 4013SCAPC-3)
	Alarm Cables: 5-port Daisy-Chain Alarm Cable (PN 4022-5) Alarm Source Daisy-Chain Cable (PN 4024-3) Alarm Sense Adapter Cable (PN 4025-1)
	RAU Dust Cover

6.4 Unison Component Installation Procedures

The following procedures assume that the system is new from the factory and that it has not been programmed with a band.

If you are replacing components in a pre-installed system with either new units or units that may already be programmed (i.e., re-using units from another system), refer to Section 9.

The following procedures assume that the system is installed and programmed.

6.4.1 Installing RAUs and Passive Antennas

CAUTION: Install RAUs in indoor locations only.

Installing RAUs

Mount all RAUs in the locations marked on the floor plans.

Considerations:

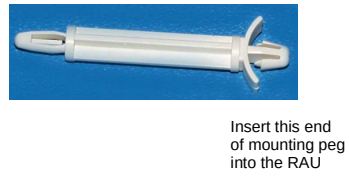
- **Install iDEN and 800 MHz cellular RAUs so that their antennas will be at least 6 to 8 meters (20 to 26 feet) apart.**
- Keep at least 76 mm (3 in.) clearance around the RAU to ensure proper venting
- Always mount the RAU with the unpainted mounting face against the mounting surface

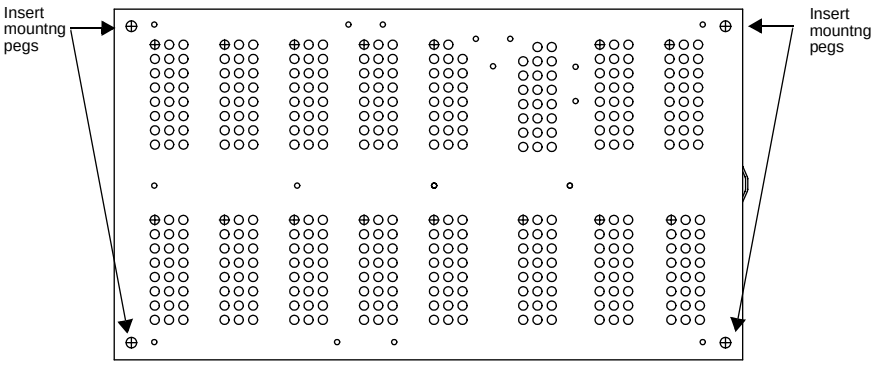
Attaching the Optional RAU Dust Cover

Use the optional RAU dust cover when installing the RAU in an area where excessive dust or debris could enter its venting holes.

To attach the optional RAU dust cover:

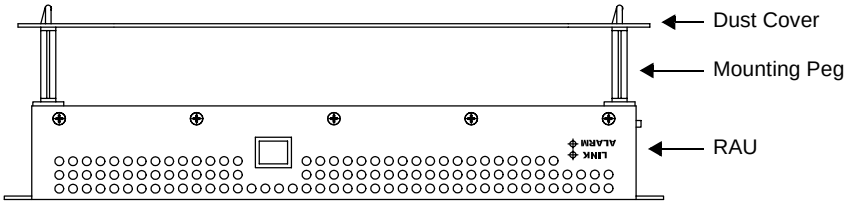
1. Firmly insert the four mounting pegs into the four corners on the top side of the RAU, as shown in the following diagram.





2. Position the dust cover over the mounting pegs and press to snap into place.

   The following diagram shows a side view of the dust cover attached to the RAU.



Installing Passive Antennas

Refer to the manufacturer's installation instructions to install passive antennas.

Passive antennas are usually installed below the ceiling. If they are installed above the ceiling, the additional loss due to the ceiling material must be considered when estimating the antenna coverage area.

Considerations:

- Use coaxial cable with the least amount of loss possible.
- **Keep iDEN and 800 MHz cellular antennas at least 6 to 8 meters (20 to 26 ft) apart.**

Connecting the Antenna to the RAU

Connect a passive antenna to the SMA male connector on the RAU using coaxial cable.

CAUTION: When connecting to the SMA female connector on the RAU and passive antenna, **DO NOT** over-tighten the connector. Firmly hand-tightening the connector is adequate.

Testing and Connecting the ScTP Cable

Consideration:

- Before connecting the ScTP cable to the RAU, confirm that it meets TIA/EIA 568-A standard and the TIA/EIA/IS-729 supplement.

To test and connect the ScTP cable:

1. Perform cable testing.

   Test results are required for the final As-Built Document.

   Cable length:

   – Absolute Minimum: 10 m (33 ft)

   – Recommended Minimum: 25 m (82 ft)

   – Recommended Maximum: 100 m (328 ft)

   – Absolute Maximum: 150 m (492 ft)

2. Label the cable and make a note of the designation.

   This information is needed when connecting the cable to the Expansion Hub.

3. Connect the cable to the RJ-45 female port on the RAU.

   Power is supplied by the Expansion Hub. Because the Expansion Hub is not yet connected, no LEDs will illuminate.

6.4.1.1 Installing RAUs in a Neutral Host System

When installing both iDEN and cellular systems in parallel, either as dual-band or neutral host systems, special provision must be taken to assure that the individual RAUs do not interfere with each other.

The 800 MHz cellular and iDEN RAU's antennas must be separated by 6 to 8 meters (20 to 26 feet) to assure that the iDEN downlink signals do not interfere with the cellular uplink signals.

6.4.2 Installing Expansion Hubs

The Expansion Hub (2U high) can mount in a standard 19 in. (483 mm) equipment rack or in a wall-mountable equipment rack that is available from LGC Wireless. Allow clearance of 76 mm (3 in.) front and rear and 51 mm (2 in.) sides for air circulation.

Install the Expansion Hub in a horizontal position only.

CAUTION: Install Expansion Hubs in indoor locations only.

Installing an Expansion Hub in a Rack

Consideration:

- The Expansion Hub is shipped with #10-32 mounting screws. Another common rack thread is #12-24. Confirm that the mounting screws match the rack's threads.
- If you want to move the mounting brackets to a mid-mounting position, see Installing an Expansion Hub in a Wall-Mounted Rack on page 6-15.

To install the hub in a rack:

1. Insert spring nuts into the rack where needed or use existing threaded holes.
2. Place the Expansion Hub into the rack from the front.
3. Align the flange holes with the spring nuts installed in Step 1.
4. Insert the mounting screws in the appropriate positions in the rack.
5. Tighten the mounting screws.

Installing an Expansion Hub in a Wall-Mounted Rack

Considerations:

- The rack and the Expansion Hub are both 305 mm (12 in.) deep. The rack mounting brackets on the Expansion Hub must be moved from the front position to allow for the 76 mm (3 in.) rear clearance required.
- The maximum weight the rack can hold is 22.5 kg (50 lbs).

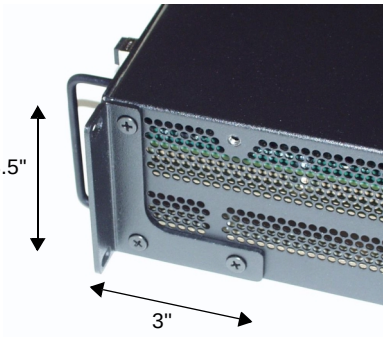
To install the hub in a wall-mounted rack:

1. Attach the equipment rack to the wall using the screws that are provided.

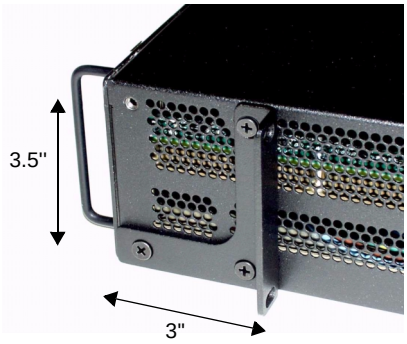
   The rack must be positioned so that the Expansion Hub will be in a horizontal position when it is installed.
2. Remove both of the rack mounting brackets from the hub.
3. Reattach each of the rack mounting brackets to the opposite side of the hub from which it came.

   Refer to the following figure for bracket placement.

Right Rack Mounting Bracket as installed from the factory.



Left Rack Mounting Bracket installed on the right side of the hub.



4. Attach the Expansion Hub to the rack.

Installing an Optional Cable Manager in the Rack

- Using the screws provided, fasten the cable manager to the rack, immediately above or below the Expansion Hub.

Powering On the Expansion Hub

1. Connect the AC power cord to the Expansion Hub.
2. Plug the power cord into an AC power outlet.
3. Turn on the power to the Expansion Hub and check that all the LED lamps are functioning properly.

   Upon power-up, the LEDs will blink for five seconds for a visual check that they are functioning. After the five-second test:

   - The **POWER** and **UL STATUS** LEDs should be green.
   - The **E-HUB STATUS** and **DL STATUS** LEDs should be red because the Main Hub is not yet connected.
   - All port LEDs should be off because no RAUs are connected yet.

NOTE: Leave the dust caps on the fiber ports until you are ready to connect the fiber optic cables.

Testing and Connecting the Fiber Cables

Considerations:

- Before connecting the fiber cables, confirm that their optical loss does not exceed 3 dB optical budget.
- If fiber distribution panels are used, confirm that the total optical loss of fiber cable, from the Main Hub through distribution panels and patch cords to the Expansion Hub, does not exceed the optical budget.
- Make sure the fiber cable's connectors are SC/APC (angle-polished).Using any other connector type will result in degraded system performance and may damage the equipment. (You can use an SC/APC pigtail if the fiber cable's connectors are not SC/APC, see "Splicing Fiber and Pigtail" on page 6-18.)

NOTE: Observe all Fiber Port Safety Precautions listed in Section 6.2.3 on page 6-4.

To test the fiber cables:

1. Perform cable testing and record the results.

   Test results are required for the final As-Built Document.
2. Make a note of which cable you will use for uplink and downlink.

   This information is needed when connecting the cables to the Main Hub.

To clean the fiber ports:

Use compressed air to blow dust out of each fiber port before you insert the SC/APC connector. Note that compressed air should not leave any residue as this will contaminate the fiber port.

To clean the fiber connectors:

Be sure that the fiber cable's SC/APC connectors are clean and free of dust or oils. If the fiber connector front face is not free of dust or oils, follow the manufacturer's recommendations for cleaning it.

To connect the fiber cables:

The fiber cable is labeled with either **1** or **2**, or is color-coded. In addition to these labels, you should add a code that identifies which port on the Main Hub is being used and which Expansion Hub the cables are intended for. This differentiates the connectors for proper connection between the Main Hub and Expansion Hubs.

If the fiber jumper is labeled with **1** or **2**:

1. Connect **1** to **UPLINK** on Expansion Hub.
2. Connect **2** to **DOWNLINK** on Expansion Hub.
3. Label both ends of each cable with which Main Hub port is used.

   For example:
   First pair to Main Hub port 1: 11 (uplink), 12 (downlink);
   Second pair to Main Hub port 2: 21 (uplink), 22 (downlink);
   Third pair to Main Hub port 3: 31 (uplink), 32 (downlink); and so on.
4. Record which number you connected to **UPLINK** and **DOWNLINK**.

   This information is needed when connecting the other end of the fiber cable to the Main Hub's fiber ports.

If the fiber jumper is color-coded (for example, "blue" or "red"):

1. Connect "blue" to **UPLINK** on Expansion Hub.
2. Connect "red" to **DOWNLINK** on Expansion Hub.
3. Label both ends of each cable with which Main Hub port is used.

   For example:
   First pair to Main Hub port 1: 11 (uplink), 12 (downlink);
   Second pair to Main Hub port 2: 21 (uplink), 22 (downlink);
   Third pair to Main Hub port 3: 31 (uplink), 32 (downlink); and so on.
4. Record which color and port number you connected to **UPLINK** and **DOWNLINK**.

   This information is needed when connecting the other end of the fiber cable to the Main Hub's fiber ports.

Splicing Fiber and Pigtail

The fiber cable must have SC/APC connectors. If it does not, you can splice a pigtail, which has SC/APC connectors, to the fiber cable.

There are two different pigtails: 1 for single-mode fiber (PN 4013SCAPC-3) and 1 for multimode fiber (PN 4012SCAPC-3).

To splice the fiber optic cable to the SC/APC pigtail: Option A

1. Secure both the fiber cable and the SC/APC pigtail in a splice tray that is installed immediately adjacent to the Hub.
2. Prepare the fiber end by ring-cutting the polyethylene jacket, cutting back the Kevlar strands, and stripping back the fiber cladding.

   Ensure that sufficient slack is maintained in order to be able to reach the fusion splicer.
3. Clean the unclad fiber core using isopropyl alcohol and lint-free wipes.
4. Cleave the unclad fiber to the length prescribed by the fusion splicer's specification sheets.
5. Repeat steps 2 through 4 for the SC/APC pigtail.
6. Pass the splice sleeve onto the fiber strand.
7. Position both fiber ends in the fusion splicer and complete splice in accordance with the fusion splicer's operation instructions.
8. Ensure that the estimated loss for the splice as measured by the fusion splicer is 0.10 dB or better.
9. Slide the fusion splicing sleeve over the point of the fusion splice.
10. Place the sleeve and fused fiber into the fusion splicer's heater.
11. Allow time for the splice sleeve to cure.
12. Return fiber splice to the splice tray, store the sleeve in a splice holder within the tray, and store excess cable length in accordance with the tray manufacture's directions.

    After successfully testing the fiber, plug the SC/APC pigtail into the proper optical port on the Hub.

To splice the fiber optic cable to the SC/APC pigtail: Option B

1. Secure both the fiber cable and the SC/APC pigtail in a splice tray portion of a fiber distribution panel.
2. Prepare the fiber end by ring-cutting the polyethylene jacket, cutting back the Kevlar strands, and stripping back the fiber cladding.

   Ensure that sufficient slack is maintained in order to be able to reach the fusion splicer.
3. Clean the unclad fiber core using isopropyl alcohol and lint-free wipes.
4. Cleave the unclad fiber to the length prescribed by the fusion splicer's specification sheets.
5. Repeat steps 2 through 4 for the SC/APC pigtail.
6. Pass the splice sleeve onto the fiber strand.
7. Position both fiber ends in the fusion splicer and complete splice in accordance with the fusion splicer's operation instructions.
8. Ensure that the estimated loss for the splice as measured by the fusion splicer is 0.10 dB or better.
9. Slide the fusion splicing sleeve over the point of the fusion splice.
10. Place the sleeve and fused fiber into the fusion splicer's heater.
11. Allow time for the splice sleeve to cure.
12. Return fiber splice to the splice tray, store the sleeve in a splice holder within the tray, and store excess cable length in accordance with the tray manufacture's directions.
13. After successfully testing the fiber cable, plug the SC/APC pigtail into the back side of the SC/APC bulkhead in the Fiber Distribution Panel.

    Install a SC/APC patch cord between the front side of the SC/APC bulkhead and the proper optical port on the Hub.

Connecting the ScTP Cables

Considerations:

- Confirm that the cables have been tested and the results recorded.

To connect the ScTP cables:

1. Connect the ScTP cables to any available RJ-45 port on the Expansion Hub.
2. Record which RAU you are connecting to which port.

   This information is required for the As-Built Document.
3. Tie-off cables or use the optional cable manager to avoid damaging the connectors because of cable strain.

Checking the RJ-45 Port LEDs

- The **LINK** LED should be green indicating that power is being supplied to the RAU.
- The **RAU** LED should be red indicating that communication is established but a band is not programmed.
  - If the **LINK** LED is red and the **RAU** LED is off, then the RAUs are not communicating with the Expansion Hub.
- If the LEDs are off, the RAU is not drawing power.

6.4.2.1 Troubleshooting Expansion Hub LEDs During Installation

- All Expansion Hub **LINK** and **E-HUB/RAU** LEDs with RAUs connected should indicate Green/Red, which indicates that the RAU is powered on and communication has been established.
- The Expansion Hub **UL STATUS** LED should be Green.

Table 6-5 Troubleshooting Expansion Hub LEDs During Installation

During Installation	LED	State	Action	Impact
Expansion Hub power is On and no RAUs are connected	**POWER**	Off	Check AC power; check that the Expansion Hub power-on switch is on; replace the Expansion Hub.	Expansion Hub is not powering on.
	LINK	LEDs on but didn't blink through all states	Replace the Expansion Hub.	Microcontroller not resetting properly; flash memory corrupted.
	E-HUB/RAU			
	UL STATUS	Red	Replace the Expansion Hub.	The Expansion Hub laser is not operational; no uplink between the Expansion Hub and Main Hub.
	LINK	Red	Port unusable; replace the Expansion Hub when possible.	Current sensor fault; do not use the port.
	E-HUB/RAU	Off		
Connect RAU	**LINK**	Off	Check the Cat-5/6 cable.	Power is not getting to the RAU.
	E-HUB/RAU	Off		
	LINK	Red	Test the Cat-5/6 cable. If the cable tests OK, try another port. If the second port's LEDs are Red/Off, replace the RAU. If the second RAU doesn't work; replace the Expansion Hub.	Power levels to RAU are not correct; communications are not established. If the second port works, flag the first port as unusable; replace EH when possible.
	E-HUB/RAU	Off		

6.4.2.2 Installing Expansion Hubs in a Neutral Host System

Installing Expansion Hubs in a neutral host system is the same as described in Section 6.4.2 on page 6-14.

If rack-mounting the Expansion Hubs, we recommend mounting all neutral host system hubs in the same rack(s) or location, grouped by frequency or carrier. For example, group the Expansion Hubs for the iDEN carrier(s) together, then the 800 MHz cellular carrier(s), and so on.

6.4.3 Installing a Main Hub

CAUTION: Install Main Hubs in indoor locations only.

Installing a Main Hub in a Rack

The Main Hub (1U high) mounts in a standard 19 in. (483 mm) equipment rack. Allow clearance of 76 mm (3 in.) front and rear, and 51 mm (2 in.) on both sides for air circulation.

Consideration:

- The Main Hub is shipped with #10-32 mounting screws. Another common rack thread is #12-24. Confirm that the mounting screws match the rack's threads.

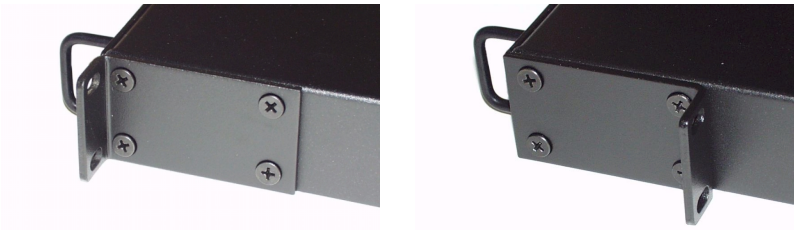
To install the hub in a rack:

1. Insert spring nuts into rack where needed or use existing threaded holes.
2. Place the Main Hub into the rack from the front.
3. Align the flange holes with the spring nuts installed in Step 1.
4. Insert the mounting screws in the appropriate positions in the rack.
5. Tighten the mounting screws.

NOTE: Do not turn on the Main Hub until you've started the AdminManager software (see Section 6.5 on page 6-24).

Rack-mounting Option

You can flip the rack mounting brackets, as shown in the following figure, so the hub can be mounted 76 mm (3 in.) forward in the rack.



Installing an Optional Cable Manager in the Rack

- Using the screws provided, fasten the cable manager to the rack, immediately above or below the Main Hub.

6.4.4 Installing Main Hubs in a Neutral Host System

Installing Main Hubs in a neutral host system is the same as described in Section 6.4.3 on page 6-22.

We recommend mounting all neutral host system Main Hubs in the same rack(s), grouped by frequency or carrier. For example, group the Main Hubs for the iDEN carrier(s) together, then the 800 MHz cellular carrier(s), and so on.

Connecting to base stations and repeaters is the same as described in Section 6.6 on page 6-29 and Section 6.6.1 on page 6-33.

6.5 Starting and Configuring the System

Connecting a Laptop and Starting the AdminManager Software

Considerations:

- The AdminManager software is installed on a laptop computer that meets the requirements that are listed on page 7-2.
- Null modem cable with female connectors is needed.

To connect the laptop and start the AdminManager software:

1. Connect the null modem cable to the laptop and then to the **RS-232** port on the Main Hub's front panel.
2. Turn on the laptop and start the AdminManager software.

   The main Installation Wizard window is displayed when the software is ready.

Powering On the Main Hub

After mounting the Main Hub in the rack, connect it to the AC power. You may use multiple outlet surge protectors for multiple Main Hubs.

1. Connect the AC power cord to the Main Hub.
2. Plug the power cord into an AC power outlet.
3. Turn on the power.

   Upon power-up, the LEDs will blink for five seconds for a visual check that they are functioning. After the five-second test:

   - The **POWER** LED should be green.
   - The **MAIN HUB STATUS** LED should be red because a band has not been programmed.
   - All fiber port LEDs should be off, indicating that no fiber cables are connected.

NOTE: Leave the dust caps on the fiber ports until you are ready to connect the fiber optic cables.

Connecting the Fiber Cables to the Main Hub

Considerations:

- Before connecting the fiber cables, confirm that their optical loss does not exceed 3 dB optical budget.
- If fiber distribution panels are used, confirm that the total optical loss of fiber cable, from the Main Hub through distribution panels and patch cords to the Expansion Hub, does not exceed the optical budget.
- Make sure the fiber cable's connectors are SC/APC (angle-polished). Using any other connector type will result in degraded system performance and may damage the equipment. (You can use an SC/APC pigtail if the fiber cable's connectors are not SC/APC, see "Splicing Fiber and Pigtail" on page 6-18.)

NOTE: Observe all Fiber Port Safety Precautions listed in Section 6.2.3 on page 6-4.

To clean the fiber ports:

Use compressed air to blow dust out of each fiber port before you insert the SC/APC connector. Note that compressed air should not leave any residue as this will contaminate the fiber port.

To clean the fiber connectors:

Be sure that the fiber cable's SC/APC connectors are clean and free of dust or oils. If the fiber connector front face is not free of dust or oils, follow the manufacturer's recommendations for cleaning it.

To connect the fiber cables:

The fiber cable is labeled with either **1** or **2**, or is color-coded. For proper connection between the Main Hub ports and the Expansion Hub ports, refer to the numbering or color-coded connections you recorded when installing the Expansion Hub(s).

If the fiber jumper is labeled with **1** or **2**:

1. Connect **1**s to **UPLINK** ports on the Main Hub.

   Refer to the connections you recorded, or the cable label, when the Expansion Hub(s) were installed to know which Main Hub **UPLINK** port to use.

2. Connect **2**s to **DOWNLINK** ports on the Main Hub.

   Refer to the connections you recorded, or the cable label, when the Expansion Hub(s) were installed to know which Main Hub **DOWNLINK** port to use.

If the fiber jumper is color-coded (for example, "blue" or "red"):

1. Connect "blue" to **UPLINK** ports on the Main Hub.

   Refer to the connections you recorded, or the cable label, when the Expansion Hub(s) were installed to know which Main Hub **UPLINK** port to use.

2. Connect "red" to **DOWNLINK** ports on the Main Hub.

   Refer to the connections you recorded, or the cable label, when the Expansion Hub(s) were installed to know which Main Hub **DOWNLINK** port to use.

Checking the Main Hub's Fiber Port LEDs

- The **LINK** LED should be green if the fiber is connected to the Expansion Hub, and communication and optical power are okay.
- The **E-HUB/RAU** LED should be red because a band has not been programmed.
  - If the **LINK** LED is red and the **E-HUB/RAU** LED is off, there is no communication with the Expansion Hub. Check the fiber cables (downlink first); a cable may be broken or the optical link budget may be exceeded.
  - If the **PORT** LEDs are blank (off), the Main Hub does not recognize the presence of an Expansion Hub. Check the fiber cables (uplink first); a cable may be broken or the optical link budget may be exceeded. Check to ensure that the cables are connected at the Expansion Hub, and that the Expansion Hub's power is on.

NOTE: Refer to Section 10 for troubleshooting.

6.5.1 Troubleshooting Main Hub LEDs During Installation

The following Main Hub LED indications assume that the Expansion Hub LEDs have already been checked.

- All Main Hub fiber port LEDs that have Expansion Hubs connected to them should be Green/Red, indicating that the Expansion Hub is powered on and communication has been established.

Table 6-6 Troubleshooting Main Hub LEDs During Installation Power On

During Installation Power On	LED	State	Action	Impact
Main Hub power is On with no Expansion Hubs connected.	**POWER**	Off	Check AC power; check that the Main Hub power-on switch is on; replace Main Hub	Main Hub is not powering on.
	LINK **E-HUB/RAU**	LEDs on but didn't blink through all states	Replace the Main Hub.	Microcontroller not resetting properly; flash memory corrupted.
	LINK	Red	The port is unusable; replace the Main Hub when possible.	Fiber sensor fault, do not use the port.
	E-HUB/RAU	Off		
Connect Expansion Hub Fiber Pair	**LINK**	Off	Swap the uplink and downlink cables. If the port LEDs do not illuminate, check the fiber uplink for excessive optical loss. Connect the fiber pair to another port. If the second port's LEDs do not illuminate Green/Red, replace the Main Hub.	The Main Hub does not sense the presence of the Expansion Hub. If the second port works, flag the first port as unusable; replace the Main Hub when possible.
	E-HUB/RAU	Off		
	LINK	Red	If the Expansion Hub **DL STATUS** LED is red, check the downlink fiber cable for excessive optical loss. Connect the fiber pair to another port. If the second port's LEDs do not illuminate Green/Red, replace the Main Hub.	The Expansion Hub does not sense the presence of the Main Hub. If the second port works, flag the first port as unusable; replace the Main Hub when possible.
	E-HUB/RAU	Off		

Configuring the Unison System

The system will not work until a band has been set and a system test is performed.

- The AdminManager software must be running on a PC/laptop that is connected to the Main Hub's front panel RS-232 connector.

1. Select the Installation Wizard (Local) mode radio button and click RUN.

   The Step 1, Verify Hardware window is displayed.

   Refer to Section 7.2 on page 7-13 for a description of the Installation wizard.

2. Confirm that all system devices are displayed in the System Status box and click NEXT.

   The Step 2, Set Operation Band window is displayed.

3. Select the desired frequency band and click APPLY.
4. Click NEXT if the message displayed indicates a successful band setting.

   The Step 3, Configure System Parameters window is displayed.

5. Enter the desired parameters and click APPLY.
6. Click NEXT if the message displayed indicates a successful parameter setting.

   The Step 4, Final System Test window is displayed.

7. Click APPLY to initiate the final system test.

   During testing the system is off-line and a center band tone is being transmitted.

8. Click NEXT if the message displayed indicates a successful test.

   The Finish window is displayed.

9. Click FINISH.

   The AdminManager session is ended and the window is closed.

NOTE: Refer to Section 10 for troubleshooting.

6.6 Interfacing a Main Hub to a Base Station or Roof-top Antenna

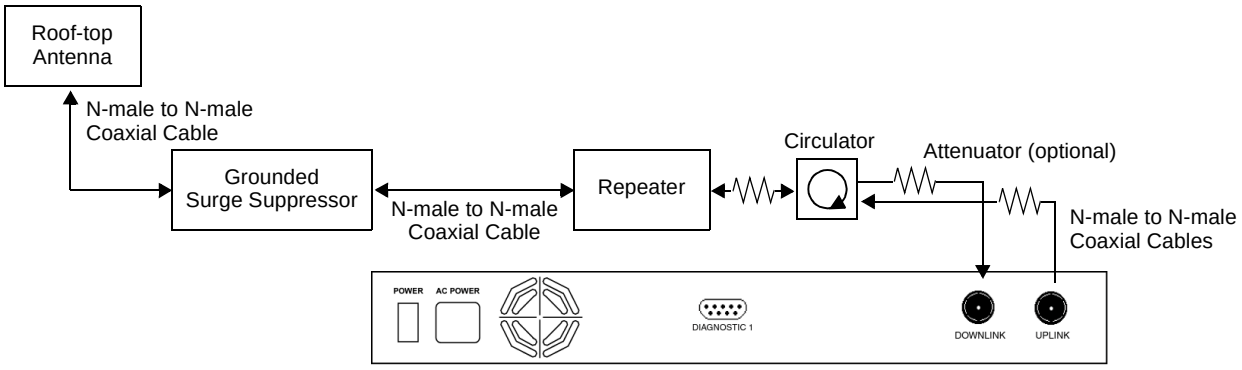
WARNING: Exceeding the maximum input power could cause failure of the Main Hub (refer to Section 8.1 on page 8-3 for maximum power specifications). If the maximum composite power is too high, attenuation is required.

Connecting a Main Hub to a Roof-top Antenna

It is recommended that you use a lightning arrestor or surge protector in a roof-top antenna configuration. Insert the lightning arrestor or surge protector between the roof-top antenna and the repeater that is connected to the Main Hub.

1. Connect an N-male to N-male coaxial cable to the roof-top antenna.
2. Connect the other end of the N-male to N-male coaxial cable to the grounded surge suppressor.
3. Connect an N-male to N-male coaxial cable to the grounded surge suppressor.
4. Connect the other end of the N-male to N-male coaxial cable to the repeater.
5. Connect an N-male to N-male coaxial cable to the repeater.
6. Connect the other end of the N-male to N-male coaxial cable to the circulator **1** connector.
7. Connect an N-male to N-male coaxial cable to the circulator **2** connector.
8. Connect the other end of the N-male to N-male coaxial cable to the **DOWNLINK** connector on the Main Hub.

   Attenuation may be required to achieve the desired RF output at the RAU.
9. Connect an N-male to N-male coaxial cable to the circulator **3** connector.
10. Connect the other end of the N-male to N-male coaxial cable to the **UPLINK** connector on the Main Hub.

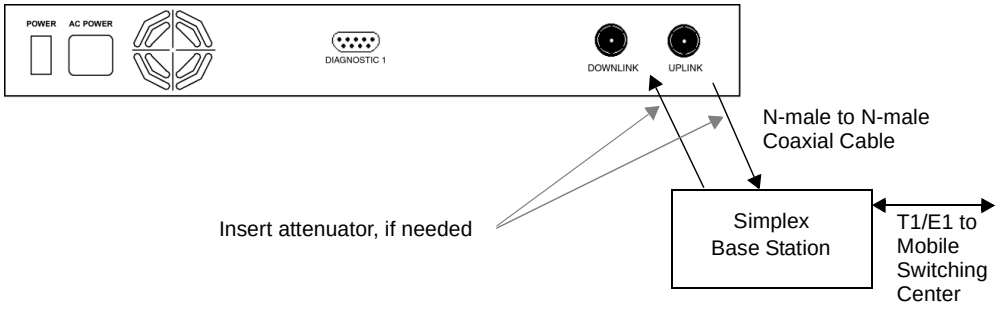


Connecting a Main Hub to an In-Building Base Station

Connecting a Simplex Base Station to a Main Hub:

1. Connect an N-male to N-male coaxial cable to the transmit simplex connector on the base station.
2. Connect the other end of the N-male to N-male coaxial cable to the **DOWNLINK** connector on the Main Hub.
3. Connect an N-male to N-male coaxial cable to the receive simplex connector on the base station.
4. Connect the other end of the N-male to N-male coaxial cable to the **UPLINK** connector on the Main Hub.

Figure 6-1 Simplex Base Station to a Main Hub



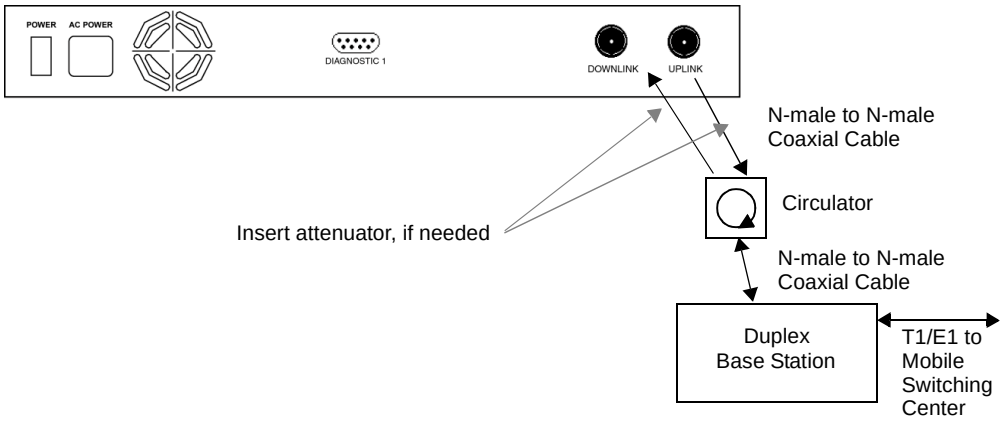
Connecting a Duplex Base Station to a Main Hub:

When connecting to a duplex base station, use a circulator between it and the Main Hub.

You can insert attenuators between the circulator and Main Hub as needed; refer to Section 8.6.1 on page 8-47 for more information.

1. Connect an N-male to N-male coaxial cable to the duplex connector on the base station.
2. Connect the other N-male connector to a circulator.
3. Connect an N-male to N-male coaxial cable to the **DOWNLINK** connector on the Main Hub.
4. Connect the other end of the N-male coaxial cable to the transmit connector on the circulator.
5. Connect an N-male to N-male coaxial cable to the **UPLINK** connector on the Main Hub.
6. Connect the other end of the N-male coaxial cable to the receive connector on the circulator.

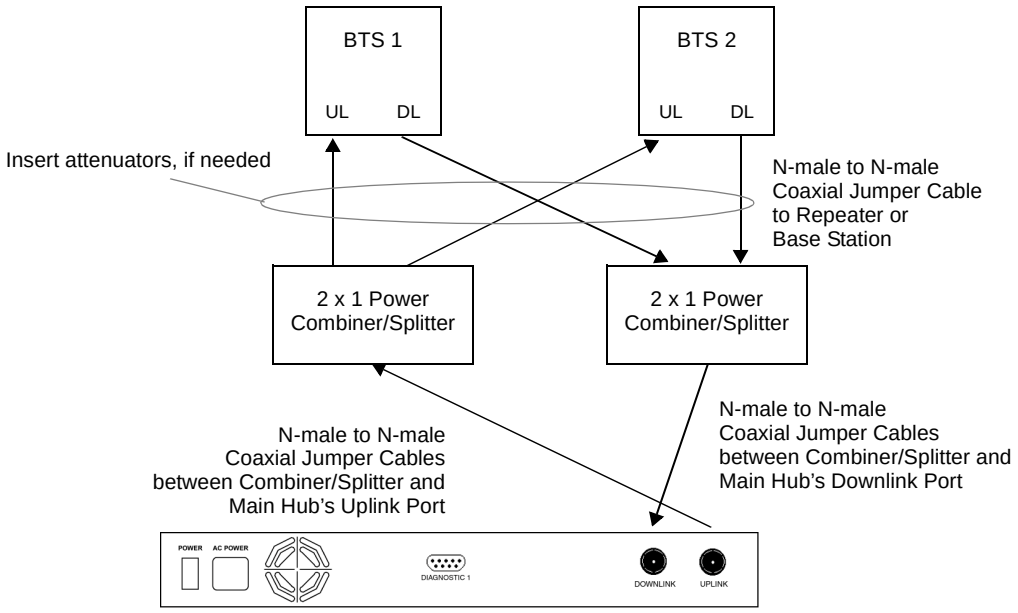
Figure 6-2 Duplex Base Station to a Main Hub



Connecting a Main Hub to Multiple Base Stations

You can use power combiner/splitters to connect a Main Hub to multiple base stations, as shown in the following figure.

Figure 6-3 Connecting a Main Hub to Multiple Base Stations

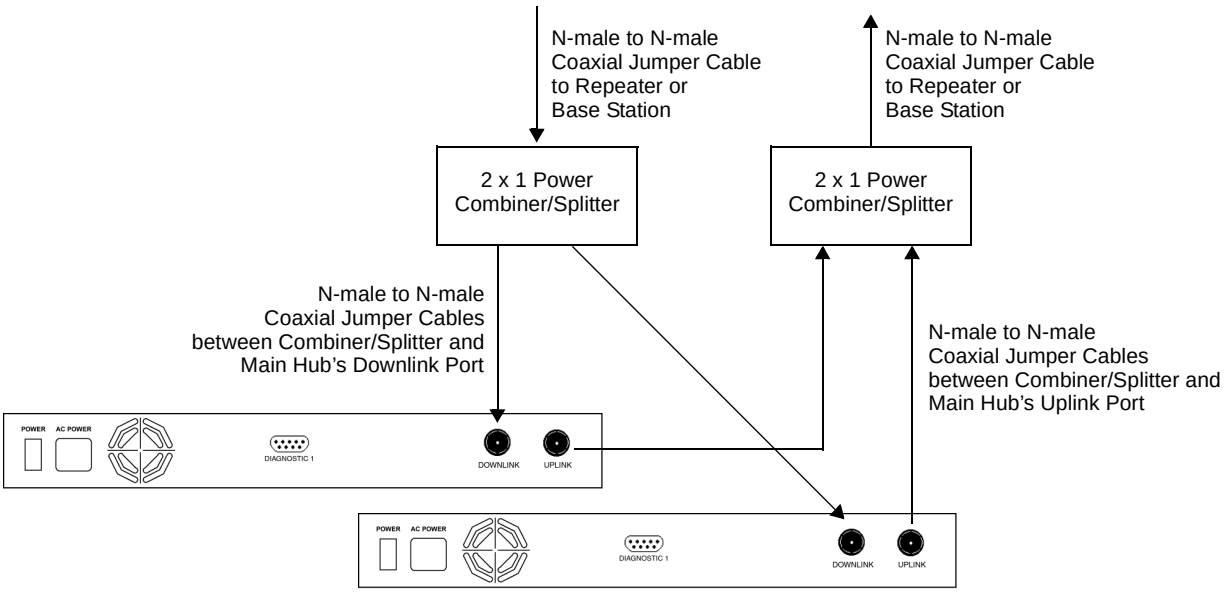


6.6.1 Connecting Multiple Main Hubs

You can use power combiner/splitters as splitters to connect multiple Main Hubs in order to increase the total number of RAUs in a system. You can also use power combiner/splitters to combine base station channels in order to increase the number of RF carriers the system transports.

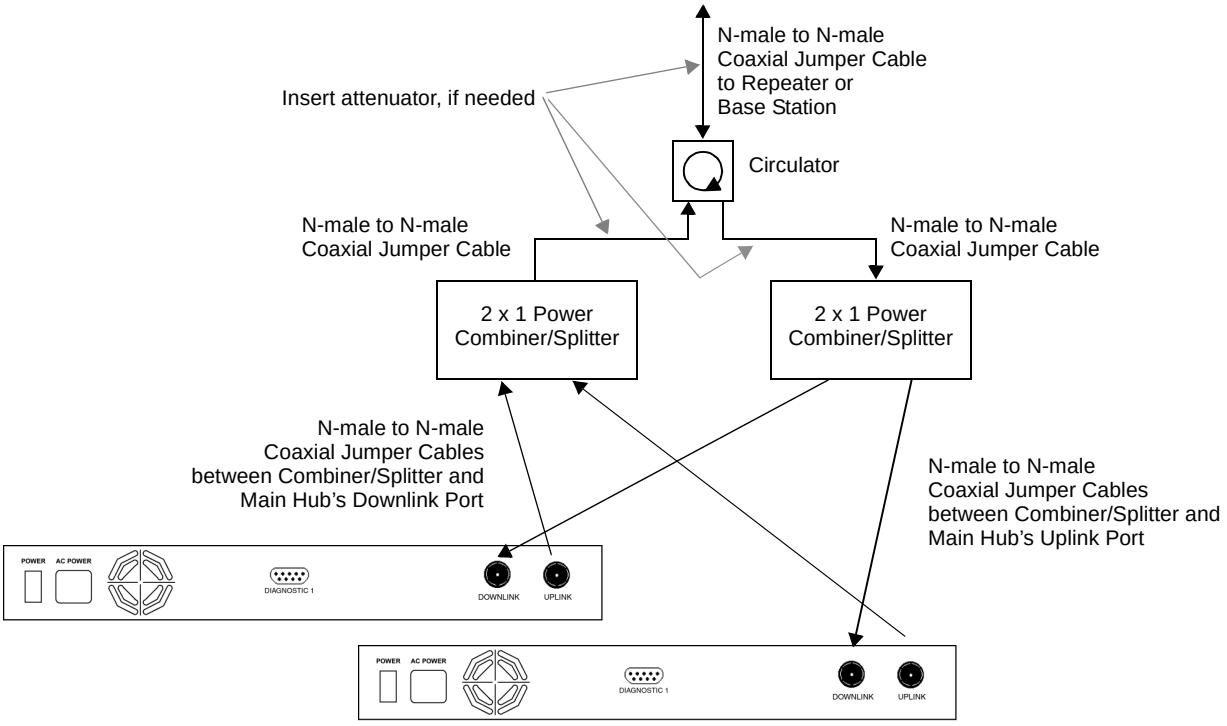
The following figure shows connecting two Main Hubs to a simplex repeater or base station. Connecting two Main Hubs increases the total number of supportable RAUs from 32 to 64. Two Main Hubs support up to 8 Expansion Hubs which in turn support up to 64 RAUs.

Figure 6-4 Connecting Two Main Hubs to a Simplex Repeater or Base Station



To connect two Main Hubs to a duplex repeater or base station, you need to use one circulator and one more coaxial jumper cable, as shown in the following figure.

Figure 6-5 Connecting Two Main Hubs to a Duplex Repeater or Base Station



Connecting Multiple Main Hubs to a Simplex Repeater or Base Station

You will need the following:

- 2 hybrid power combiner/splitters; one for uplink and one for downlink (2x1 for two Main Hubs, 3x1 for three, 4x1 for four, etc.)
- 1 N-male to N-male coaxial jumper cable between each power combiner/splitter and the base station
- 2 N-male to N-male coaxial jumper cables between each power combiner/splitter and each Main Hub

Figure 6-4 on page 6-33 illustrates this procedure.

1. Connect the power combiner/splitters to the repeater or base station using N-male to N-male coaxial jumper cables:
   a. From the first power combiner/splitter to the repeater or base station
   b. From the second power combiner/splitter to the repeater or base station
2. Connect the power combiner/splitters to the Main Hubs:
   a. From the first Main Hub's **UPLINK** port to the first power combiner/splitter
   b. From the first Main Hub's **DOWNLINK** port to the second power combiner/splitter
   c. From the second Main Hub's **UPLINK** port to the first power combiner/splitter
   d. From the second Main Hub's **DOWNLINK** port to the second power combiner/splitter
3. Check Main Hub LEDs.

   After connecting and powering on the Main Hub, check all LEDs to ensure that the system is operating properly.

NOTE: Use a 50 ohm terminator on any unused power combiner/splitter ports.

Connecting Multiple Main Hubs to a Duplex Repeater or Base Station

You will need the following:

- 2 hybrid power combiner/splitters; one for uplink and one for downlink (2x1 for two Main Hubs, 3x1 for three, 4x1 for four, etc.)
- 2 N-male to N-male coaxial jumper cables to connect each Main Hub to the power combiner/splitters
- 1 circulator
- 1 N-male to N-male coaxial jumper cable between each circulator and the repeater or base station
- 1 N-male to N-male coaxial jumper cable1 between each circulator and power combiner/splitter

Figure 6-5 on page 6-34 illustrates this procedure.

1. Connect the Circulator to the power combiner/splitters and to the repeater or base station using one N-male to N-male coaxial jumper cable.
2. Connect each power combiner/splitter to the circulator using one N-male to N-male coaxial jumper cable.
3. Connect the power combiner/splitter to the Main Hubs:
   a. From the first Main Hub's **UPLINK** port to the first power combiner/splitter
   b. From the first Main Hub's **DOWNLINK** port to the second power combiner/splitter
   c. From the second Main Hub's **UPLINK** port to the first power combiner/splitter
   d. From the second Main Hub's **DOWNLINK** port to the second power combiner/splitter
4. Check Main Hub LEDs.

   After connecting and powering on the Main Hub, check all LEDs to ensure that the system is operating properly.

NOTE: Use a 50 ohm terminator on any unused power combiner/splitter ports.

6.7 Connecting Contact Alarms to a Unison System

The Unison Main Hub can generate (source) two contact alarms as well as sense an external contact alarm.

- **Alarm Source**

  The Main Hub has two alarm contacts, major and minor errors. These contacts are normally-closed (NC) and will open when an internal alarm is detected.

  - Major error is active when any faults or disconnects are detected.
  - Minor error is active during a lockout or warning, or when the end-to-end system test is not valid.

- **Alarm Sense**

  The Main Hub can monitor an external alarm contact using this feature. The port can be configured for normally-open (NO) or normally-closed (NC) contacts. The interface expects a set of floating contacts. An external voltage source is not required for this interface. AdminManager or OpsConsole is used to monitor the port status.

The following table lists the alarm types, equipment that Unison is connected to, cable(s) used, and the errors (major and/or minor) that are detected.

Alarm Type	Unison connected to	Cable(s) Used	Errors Detected
Source	MetroReach	5-port Daisy-Chain Alarm Cable and male-to-male adapter cable that is provided with MetroReach	Major
		Alarm Source Daisy-Chain Cable	Major
Source	BTS	5-port Daisy-Chain Alarm Cable	Major
		Alarm Source Daisy-Chain Cable	Major and Minor
Source	ARM2000	Alarm Source Daisy-Chain Cable	Major and Minor
Sense	LGCell	5-port Daisy-Chain Alarm Cable and the Alarm Sense Adapter Cable	Major
		Alarm Source Daisy-Chain Cable and the Alarm Sense Adapter Cable	Major

Note that only major errors are supported on MetroReach and LGCell, and that the 5-port Daisy-Chain Alarm Cable supports only major errors as well. Therefore, using the 5-port Daisy-Chain Alarm Cable with equipment that supports both major and minor errors will result in only major errors being detected. This is also the case when using the Alarm Source Daisy-Chain Cable, which supports both major and minor alarms, with MetroReach or LGCell because these systems only support major errors.

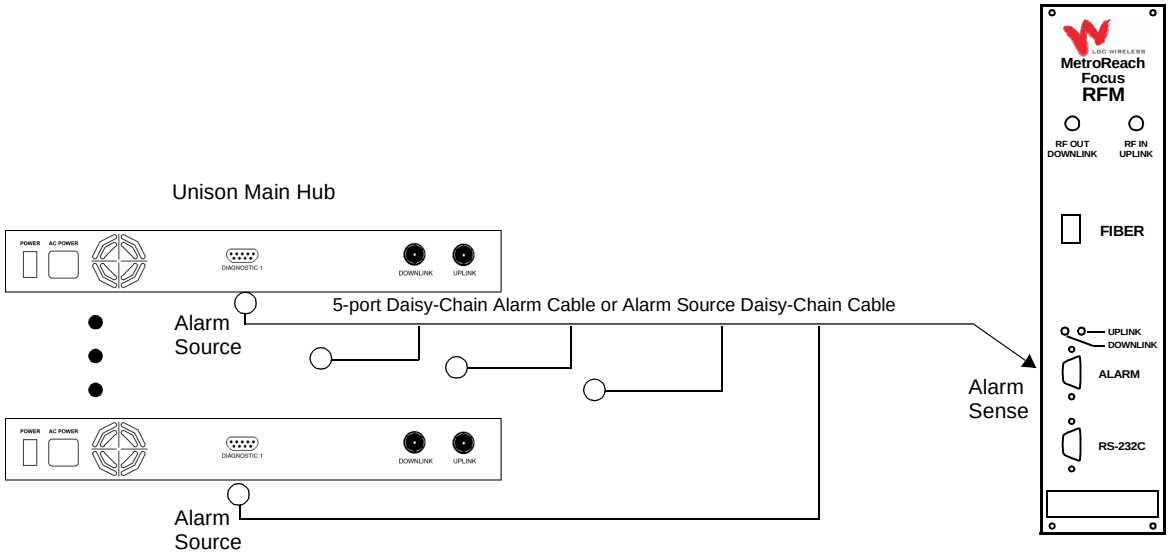
6.7.1 Alarm Source

Unison is always an alarm source, no matter what type of equipment you are connecting to.

Using MetroReach Focus to Monitor Unison

When you connect MetroReach Focus to Unison, the Unison Main Hub is the output of the alarms (alarm source) and Focus is the input (alarm sense), as shown in the following figure.

Figure 6-6 Connecting MetroReach to Unison

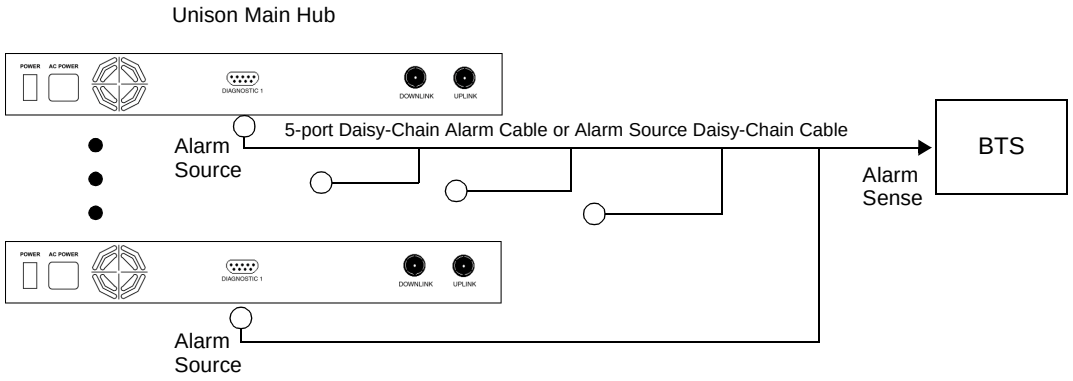


Focus supports only major errors. However, you can use either the 5-port Daisy-Chain Alarm Cable (see page 6-41) or the Alarm Source Daisy-Chain Cable (see page 6-42).

Using a Base Station to Monitor Unison

When you connect a BTS to Unison, the Unison Main Hub is the output of the alarms (alarm source) and the BTS is the input (alarm sense), as shown in the following figure.

Figure 6-7 Connecting a BTS to Unison



Use the Alarm Source Daisy-Chain Cable (see page 6-42) to support both major and minor errors or the 5-port Daisy-Chain Alarm Cable (see page 6-41) to support major errors only.

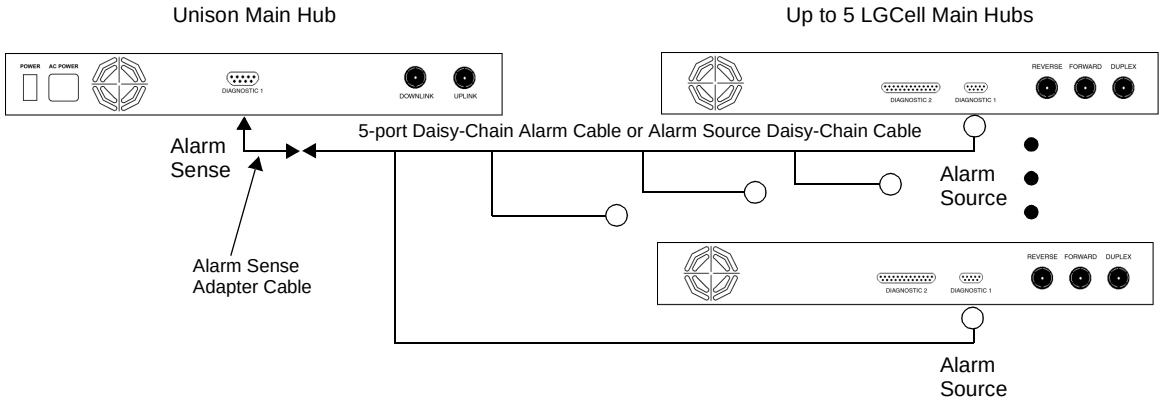
6.7.2 Alarm Sense

Use the AdminManager to enable the Unison system for “alarm sense” when connecting to the contact closure of LGCell Main Hubs or other external alarms.

Using Unison to Monitor LGCells

When you connect LGCell to Unison, the Unison Main Hub is the input of the alarms (alarm sense) and the LGCell is the output (alarm source), as shown in the following figure.

Figure 6-8 Connecting LGCell to Unison



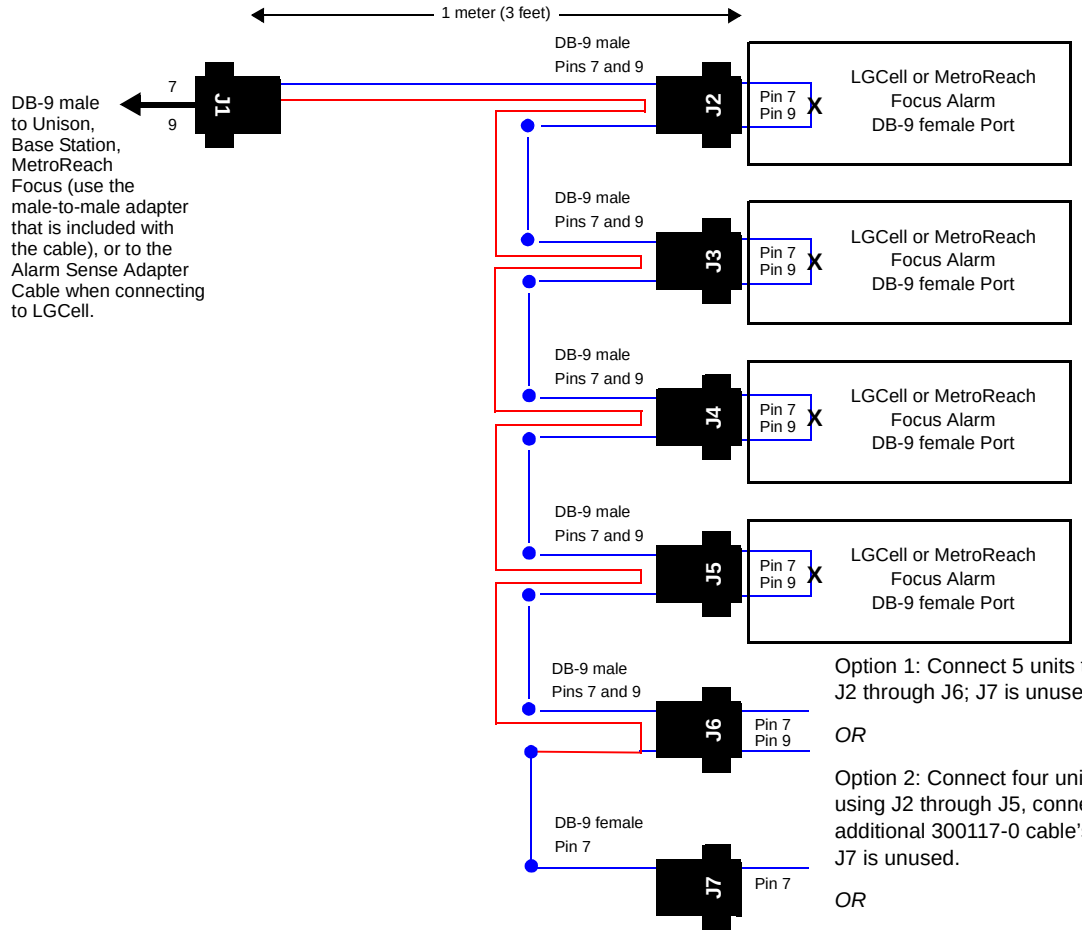
LGCell supports only major errors. However, you can use either the 5-port Daisy-Chain Alarm Cable (see page 6-41) or the Alarm Source Daisy-Chain Cable (see page 6-42) . You must use the Alarm Sense Adapter Cable (see page 6-43) to interface either cable to LGCell. The adapter cable is required to translate the LGCell major error pinout to the sense input pins on the Unison Main Hub.

6.7.3 Alarm Cables

5-port Daisy-Chain Alarm Cable

The 5-port Daisy-Chain Alarm Cable (PN 4022-5) supports only major errors. It is shown in Figure 6-9.

Figure 6-9 5-port Daisy-Chained Alarm Cable



Option 1: Connect 5 units to cable using J2 through J6; J7 is unused.

OR

Option 2: Connect four units to first cable using J2 through J5, connect J6 to an additional 300117-0 cable's J1 connector; J7 is unused.

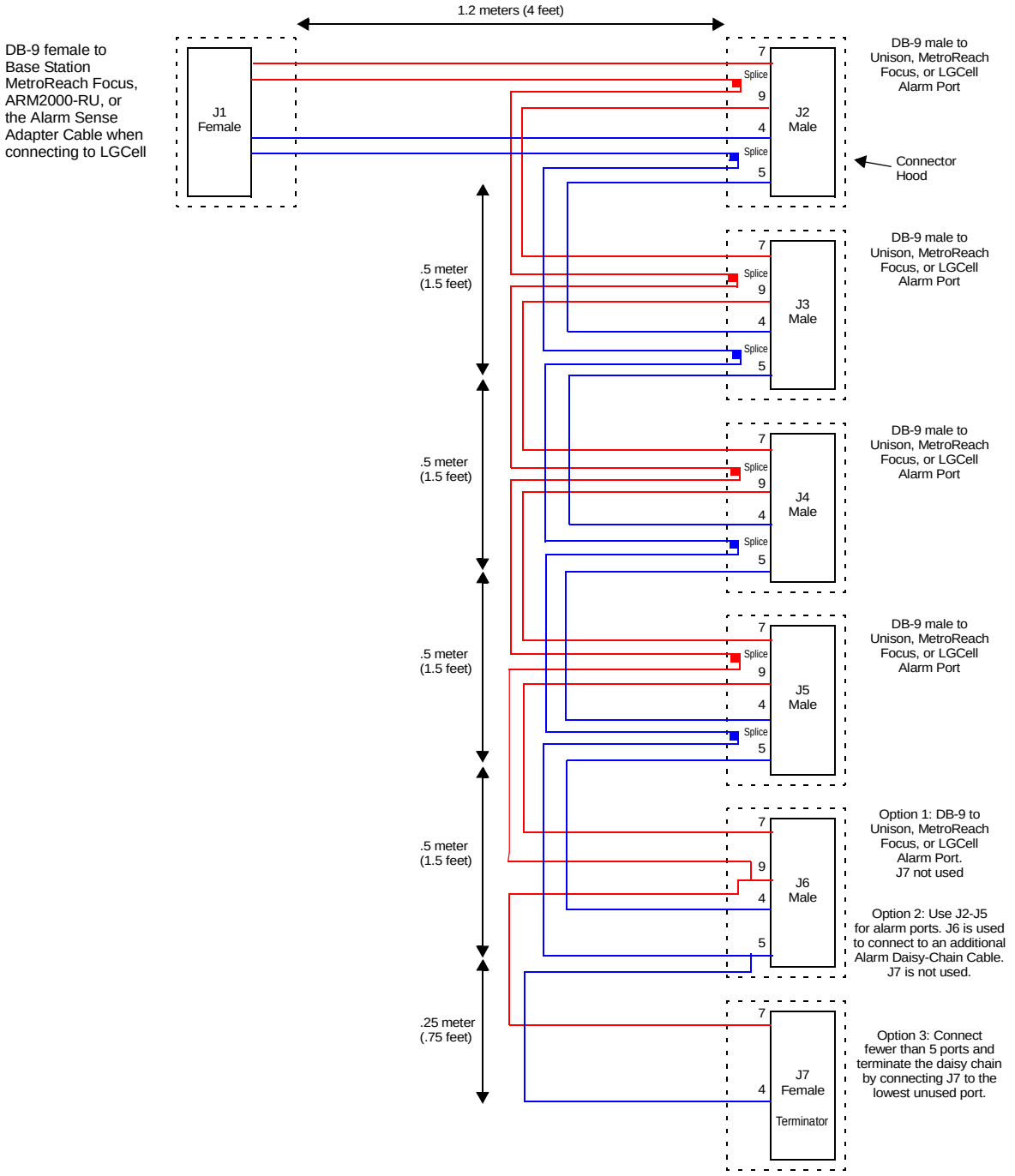
OR

Option 3: Connect less than four units to cable and terminate the circuit by connecting the J7 connector into the lowest numbered unused male connector.

Alarm Source Daisy-Chain Cable

The Alarm Source Daisy-Chain Cable (PN 4024-3) is shown in Figure 6-10.

Figure 6-10 Alarm Source Daisy-Chain Cable



Alarm Sense Adapter Cable

The alarm sense adapter cable (PN 4025-1) translates the LGCell major error pinout to the sense input pins on the Unison Main Hub. You must use this adapter cable, as illustrated in Figure 6-11, with the 5-port Daisy-Chain Alarm Cable or the Alarm Source Daisy-Chain Cable when connecting LGCell to Unison.

Figure 6-11 Alarm Sense Adapter Cable