

Installing Fusion

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7.1 Installation Requirements

Before and during installation, keep in mind these sources of potential problems:

- Faulty cabling/connector
- Dirty connectors and ports
- Malfunction of one or more Fusion components
- Antenna, base station, or repeater problem
- External RF interface
- Tripped circuit breaker
- Equipment is not grounded
- Using a crossover Ethernet cable that does not support full hardware handshaking when using AdminBrowser

NOTE: Faulty cabling is the cause of a vast majority of problems. All CATV cable should be tested to TIA-570-B specifications.

7.1.1 Component Location Requirements

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

If outdoor installation is desired, such as a parking garage, the Fusion components must be installed in the appropriate environmental enclosures.

7.1.2 Cable and Connector Requirements

Fusion equipment operates over the following:

- CATV 75 Ohm cable with F connectors
- Single-mode fiber (SMF) or multi-mode (MMF) cable with SC/APC fiber connectors throughout the fiber network, including fiber distribution panels

These cables are widely-used, industry standards for the cable TV industry. The regulations and guidelines for Fusion cable installation are identical to those specified by the TIA/EIA 568-B standard and the TIA/EIA/570-A standards.

LGC Wireless recommends solid copper center conductor, plenum-rated CATV cable and connectors for conformity to building codes, standards, and to ensure stated performance of maximum distance and RF specifications.

CommScope 2065V cable or equivalent is required for RG-59.

CommScope 2279V cable or equivalent is required for RG-6.

CommScope 2293K cable may also be used for RG-11.

NOTE: Refer to Appendix A for more information related to 75 Ohm CATV.

LGC Wireless recommends connectors with fixed centerpins to ensure proper seating and to eliminate oxidation, which occurs with bare center conductors. Recommended connectors are as follows:

CANARE Connectors

- FP-C4F for commScope 2065V cable
- FP-C55A for CommScope 2279V cable
- FP-C71A for CommScope 2293K cable

NOTE: The proper crimp tool and die must be matched by the connector type.

7.1.3 Distance Requirements

Table 7-1 shows the distances between Fusion components and related equipment.

Table 7-1 Distance Requirements

Equipment Combination	Cable Type	Cable Length	Additional Information
Repeater/BTS to Fusion Main Hub	Coaxial; N male connectors	3–6 m (10–20 ft) typical 10 m (33 ft) maximum	Limited by loss and noise. Refer to your link budget calculation. Limited by CE Mark requirements.
Fusion Expansion Hub to RAU	CATV 75 Ohm; shielded F male connectors	<ul style="list-style-type: none"> • Minimum: 10 meters (33 ft) • Maximum: 150 meters (492 ft) for RG-59; 170 meters (558 ft) for RG-6; 275 meters (902 ft) for RG-11 Refer to Table 5-1 and Table 5-2.	Refer to “System Gain” on page 6-11.
Main Hub to Expansion Hub	Multi-mode fiber: Single-mode fiber: SC/APC male connectors	500 m (1640 ft.) maximum 6 km (19,685 ft.) maximum	Limited by 3 dB optical attenuation
RAU to passive antenna	Coaxial; N male connectors	1–3.5 m (3–12 ft) typical	Limited by loss and noise. Refer to your link budget calculation.

7.2 Safety Precautions

7.2.1 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. 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 supplies have 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.
4. Verify that the Hub is grounded properly using the AC power cord third wire ground.

NOTE: Be careful with the mechanical loading of the rack mounted hub. Mount the equipment in the rack in such a way that a hazardous condition, due to uneven mechanical loading, does not result.

7.2.2 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)
- 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, firmly hand-tighten the N connector – DO NOT over-tighten the connector.



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 outdoors where it could be subject to lightning strikes, power crosses, or wind.

- The Expansion Hub and RAU units are designed for intra-building cabling only. Outdoor routing of any cabling to these units shall not exceed 140 feet.

NOTE: Outdoor cables farther than 140 feet must be installed with proper lightning protection.

7.2.3 Fiber Port Safety Precautions

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



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: 1993+A1:+A2:2001 and IEC106825-2.

**CLASS 1
LASER PRODUCT**

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

Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated July 26, 2001.

The hazard level at all locations within the equipment is Hazard Level 1.

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

7.3 Preparing for System Installation

7.3.1 Pre-Installation Inspection

Follow this procedure before installing Fusion 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 you unpack and inspect the contents because damage caused during transit is the responsibility of the shipping agent.
3. Open and check each package against the packing list. If any items are missing, contact LGC Wireless customer service (refer to Section 7.2.2 on page 7-4).
4. If damage is discovered at the time of installation, contact the shipping agent.

7.3.2 Installation Checklist

Table 7-2 Installation Checklist

✓	Installation Requirement	Consideration
	Floor Plans	Installation location of equipment clearly marked
	System Design	Used to verify frequency bands after installation
	Power available: Fusion Main Hub (AC) Fusion Expansion Hub (AC) To RAU (DC)	Hub's power cord is 2 m (6.5 ft) long. 115/230V, 2/1A, 50–60 Hz 115/230V, 6/3A, 50-60 Hz 54V (from the Hub)
	Rack space available (Main and Expansion Hub)	89 mm (3.5 in.) high (2U)
	Wallmount Fusion Main Hub	Hub must be mounted on 3/4" plywood backboard.
	Clearance for air circulation: Fusion Main or Expansion Hub RAU	76 mm (3 in.) front and rear, 51 mm (2 in.) sides 76 mm (3 in.) all around
	Suitable operating environment: Fusion Main or Expansion Hub 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-Fusion Configuration (for each Fusion Band)	
	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 50 Ohm coaxial cable and outdoor cables longer than 140 feet.
	Repeater	Installed between lightning arrestor/surge suppressor and Hub; N-male to N-male coaxial cable. The Repeater must be a UL listed product.

Table 7-2 Installation Checklist (continued)

✓	Installation Requirement	Consideration
	Attenuator	Installed between the circulator and the Hub downlink port to prevent overload. Optionally, it may be installed between the uplink port and the circulator.
	Circulator or Duplexer	Installed between the repeater and the Hub uplink and downlink ports
Base Station-to-Fusion Configuration (for each Fusion Band)		
	Base Station	Installed, inspected; verify RF power (see tables in Section 6.3 on page 6-4); N-male to N-male coaxial cable
	Attenuator	Attenuation may be required to achieve the desired RF output at the RAU, and the desired uplink noise floor level
	Circulator or Duplexer	When using a duplex BTS: Installed between the BTS and the Hub uplink and downlink ports. Not used with a simplex BTS
Connecting Multiple Fusion Main Hubs Together		
	5-port Alarm Daisy-Chain Cable (PN 4024-3)	For contact alarm monitoring of fault and warning alarms. Used to feed the alarms from multiple Fusion Main Hubs into a BTS or MetroReach Focus. N.C. Operation.
Cabling		
	Coaxial: repeater, base station, Smart Source to Fusion Main Hub	Coax approved; N-type male connectors.
	Coaxial: RAU to passive antennas	Use low-loss cable; N male connector; typical 1 m (3.3 ft) using RG142 coaxial cable.
	Fiber: Main Hub to Expansion Hubs	SC/APC (angle-polished) male connectors for entire fiber run (can use SC/APC pigtailed, PN 4012SCAPC-10 for MMF or 4013SCAPC-10 for SMF); Use jumper fiber cables for collocated Main and Expansion Hubs (3 m/10 ft.): Multi-mode: PN 401SCAPC-10 Single-mode: PN 4018SCAPC-10 Distance limited by optical loss of 3 dB Multi-mode up to 500 m (1640 ft.) Single-mode up to 6 km (19,685 ft.)
	CATV	TIA-570-B approved; centerpin F male connectors. CATV cable must be screened and it must be grounded at both connector ends. The RAU will be damaged if it is mis-wired. Tie-off cables to avoid damaging the connectors because of cable strain.
	Fusion Expansion Hub to RAUs	<ul style="list-style-type: none"> • Minimum: 0 meters (0 ft) • Maximum: RG-59: 150 meters (472 ft) * <li style="padding-left: 40px;">RG-8: 170 meters (558 ft) <li style="padding-left: 40px;">RG-11: 275 meters (902 ft)

* Refer to Appendix A for CATV cable requirements.

Table 7-2 Installation Checklist (continued)

✓	Installation Requirement	Consideration
Configuring the System		
	PC/laptop running standard browser software	Refer to the <i>AdminBrowser User Manual</i> (PN D-620607-0020)
Miscellaneous		
	Cross-over Ethernet cable	Male connectors; Fusion Main Hub to a PC/laptop running a standard browser to the Fusion AdminBrowser software; local connection or LAN switch connector for remote connections.
	Straight-through cable	Female/male connectors; Fusion Main Hub to a modem for a remote connection.
Distances		
	Fusion Main Hub is within 3–6m (10–20 ft) of connecting repeater/BTS/MetroReach	If longer distance, determine the loss of the cable used for this connection and adjust the RF signal for each Band into the Fusion 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 Hub Bands (1 and 2).

7.3.3 Tools and Materials Required

Table 7-3 Tools and Materials Required for Component Installation

✓	Description
	Cable ties
	Screwdriver
	Mounting screws and spring nuts
	Screws, anchors (for mounting RAUs)
	Drill
	Fiber connector cleaning kit
	Fusion splicer
	Splicing tool kit (including snips, cladding strippers, fiber cleaver, isopropyl alcohol, lint-free wipes)
	Fusion splicing sleeves

7.3.4 Optional Accessories

Table 7-4 Optional Accessories for Component Installation

✓	Description
	Wall-mount bracket (PN 4712) When using this bracket with an Fusion Main Hub, the Hub's mounting bracket must be moved to the alternate mounting position (refer to the procedure on page 7-11).
	Cable management (Cable manager: PN 4759; Tie wrap bar: PN 4757)
	Splice trays
	Pigtails with SC/APC connectors, 3 m (10 ft.) Multi-mode fiber SC/APC pigtail: PN 402SCAPC-10 Single-mode fiber SC/APC pigtail: PN 4013SCAPC-10
	Jumper cable when Main and Expansion Hubs are collocated, 3 m (10 ft.) Multi-mode fiber SC/APC: PN 4018SCAPC-10
	Teltone Line Sharing Switch (M-394-B-01) When using a single POTS line with multiple Fusion Main Hub/Modems: Connect up to four modems to a line sharing switch; switches can be cascaded to accommodate up to 16 modems per POTS line
	Alarm Cables: 5-port Alarm Daisy-Chain Cable (PN 4024-3) Alarm Sense Adapter Cable (PN 4025-1)

7.4 Fusion Installation Procedures

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

If you are replacing components in a pre-installed system with either new units or units that may already be programmed (for example, re-using units from another system), refer to Section 8.

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7.4.1 Installing a Fusion Main Hub



CAUTION: Install Fusion Main Hubs in indoor locations only.

Installing a Fusion Main Hub in a Rack

The Fusion Main Hub (2U 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. No top or bottom clearance is required.

Figure 7-1 Flush Mounting Bracket Detail



Consideration:

- The Fusion 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 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 Optional Cable Manager in the Rack

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

✓ Installing a Main Hub Using the 12" Wall-Mounted Rack (PN 4712)

Considerations:

- The rack-mounting brackets on the Fusion Main Hub must be moved to the recessed mounting position (shown in Figure 7-2) to allow for the required 76 mm (3 in.) rear clearance.

- The maximum weight the bracket can hold is 22.5 kg (50 lbs).
- The bracket is designed to accommodate a Fusion Main Hub (12 lbs.) or an Expansion Hub (14.5 lbs.).
- The wall mount bracket should be securely mounted to wall, using the four key slot mounting holes on the bracket.

Using the Wall Rack-Mounting Option

You can flip the rack mounting brackets, as shown in Figure 7-2, so the hub can be mounted 76 mm (3 in.) forward in the rack.

Figure 7-2 Bracket Detail For Wall Mount Rack (PN 4712)



To install the Hub to the wall-mounted rack:

1. Attach the wall bracket (PN 4712) to wall the using #10 Pan Head wood screws, 1-1/2" minimum length for mounting in wood studs or 3/4" thick plywood.

The bracket must be positioned so that the Hub will be in a horizontal position when it is installed. (Refer to Figure 7-2.)

NOTE: If wall stud spacing of 16" is not available, LGC recommends that 3/4" plywood be pre-installed to the wall. You can then attach the bracket to the plywood using the wood screws.

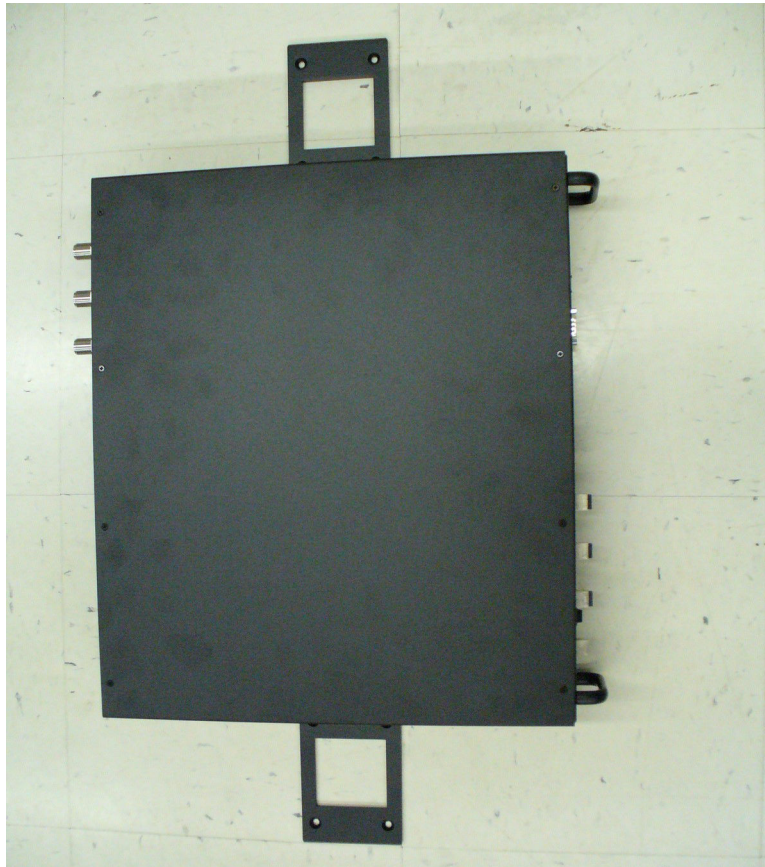
2. Remove both of the rack mounting brackets from the Hub.
3. Reattach each of the rack mounting brackets to the recessed wall mount position.
4. Install the Hub in the rack using the rack mounting screws.

✓ **Installing a Fusion Main Hub Directly to the Wall**

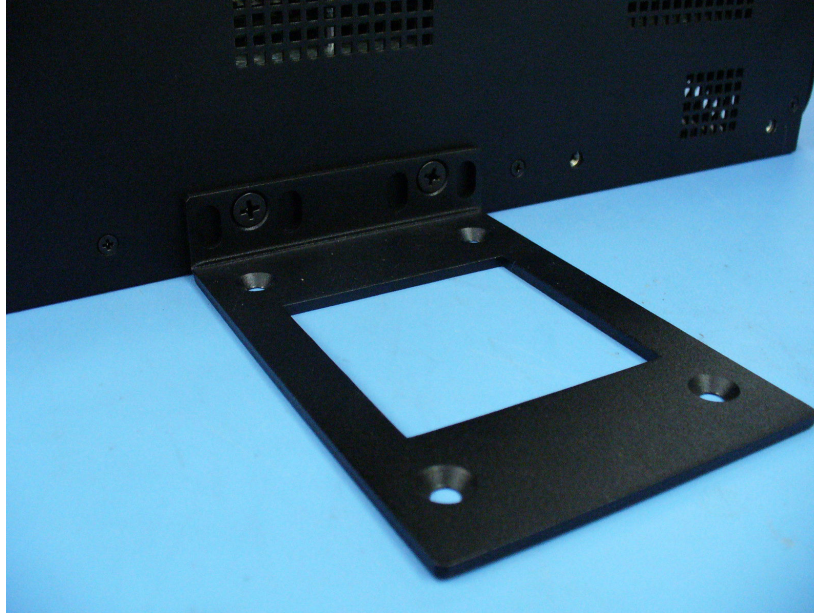
To install the Hub directly to the wall:

1. Pre-install 3/4" plywood to the wall.
2. Mount both of the rack mounting brackets using #10-32 machine screws (refer to illustration Figure 7-4).
3. Attach the Hub to the wall so the mounting brackets are orientated at the top and bottom of the wall mounted hub. (Refer to Figure 7-3.)

Figure 7-3 Installing Directly to the Wall



Use two #10 Pan Head wood screws, 1-1/2" length, to secure each bracket to the plywood. In this orientation the enclosure fans shall face to the left.

Figure 7-4 Using Hub Rack-Mounting Brackets for Direct Wall Installation

✓ Connecting the Fiber Cables to the Main Hub

Considerations:

- Before connecting the fiber cables, confirm that their optical loss does not exceed the 3 dB optical budget.
- If you are using fiber distribution panels, 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. Refer to "Fusion Splicing of Fiber and Pigtail" on page 7-37. Or, you can change the fiber's connector to SC/APC.)

NOTE: Observe all Fiber Port Safety Precautions listed in Section 7.2.3 on page 7-5.

To clean the fiber ports:

You can clean the Hub's fiber ports using canned compressed air or isopropyl alcohol and foam tipped swabs.

Considerations:

- If using compressed air:
 - The air must be free of dust, water, and oil.
 - Hold the can level during use.
- If using isopropyl alcohol and foam tipped swabs:
 - Use only 98% pure or more alcohol

Procedure using compressed air:

1. Remove the port's dust cap.
2. Spray the compressed air away from the unit for a few seconds to clean out the nozzle and then blow dust particles out of each fiber port.

Procedure using isopropyl alcohol:

1. Remove the connector's dust cap.
2. Dip a 2.5mm lint-free, foam-tipped swab in isopropyl alcohol and slowly insert the tip into the connector.
3. Gently twist the swab to clean the port.
4. Insert a dry swab into the port to dry it.

Additionally, you can use compressed air after the alcohol has completely evaporated.

To clean the fiber ends:

Be sure that the fiber cable's SC/APC connectors are clean and free of dust and oils. You need lint-free cloths, isopropyl alcohol, and compressed air

1. Moisten a lint-free cloth with isopropyl alcohol.
2. Gently wipe the fiber end with the moistened cloth.
3. Using a dry lint-free cloth, gently wipe the fiber end.
4. Spray the compressed air away from the connector for a few seconds to clean out the nozzle and then use it to completely dry the connector.

To test the fiber cables:

Perform cable testing and record the results. Test results are required for the final As-Built Document.

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.

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.

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

1. Connect **1s** to **UPLINK** ports on the Main Hub.
2. Connect **2s** to **DOWNLINK** ports on the Main Hub.
3. Record which cable number and port number you connected to **UPLINK** and **DOWNLINK**.

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

The fiber port LEDs should be off, indicating that the Expansion Hub(s) are not connected.

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

1. Connect "blue" to **UPLINK** ports on the Main Hub.
2. Connect "red" to **DOWNLINK** ports on the Main Hub.
3. 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 Expansion Hub's fiber ports.

The fiber port LEDs should be off, indicating that the Expansion Hub(s) are not connected.

 **Powering On the Main Hub**

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 to the Main Hub and check that all the LED lamps are functioning properly.

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

LED states during power on will vary, depending on whether Expansion Hubs are connected. Refer to Table 7-5 for possible combinations.

Table 7-5 Troubleshooting Main Hub LEDs During Installation

During Installation Power On	LED	State	Action	Impact
1. 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 the Main Hub	The Main Hub is not powering on.
	POWER	Red	Replace the Main Hub	The power supply is out-of-specification.
	PORT	LEDs are on but they didn't blink through all states	Replace the Main Hub.	The micro controller is not resetting properly; flash memory corrupted.
	PORT	Red Off	The port is unusable; replace the Main Hub when possible.	Fiber sensor fault, do not use the port.

Table 7-5 Troubleshooting Main Hub LEDs During Installation (continued)

During Installation Power On	LED	State	Action	Impact
2. Main Hub power is On with Expansion Hubs connected and powered on.	PORT	Off	<ul style="list-style-type: none"> • If the port LEDs do not illuminate, check the fiber uplink for excessive optical loss. • If Expansion Hub's DL STATUS LED is red: <ul style="list-style-type: none"> • Verify that the fiber is connected to the correct port (that is, uplink/downlink) • Swap the uplink and downlink cables. • Connect the fiber pair to another port. If the second port's LEDs do not illuminate Green/Red, replace the Main Hub. • If the second port works, flag the first port as unusable; replace the Main Hub when possible. 	<p>No uplink optical power, the Expansion Hub is not recognized as being present.</p> <p>No communication with the Expansion Hub.</p>
	PORT	Red (60 ppm)	<ul style="list-style-type: none"> • 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. • If the second port works, flag the first port as unusable; replace the Main Hub when possible. 	<p>No communication with the Expansion Hub.</p>
	PORT	Red	<p>The Expansion Hub or connected RAU reports a fault</p> <p>Use AdminManager to determine the problem.</p>	<p>The Expansion Hub or one or more RAUs are off-line.</p>

7.4.2 Installing Expansion Hubs

The Expansion Hub (2U high) can be installed in a standard 19 in. (483 mm) equipment rack or in a wall-mountable equipment rack that is available from LGC Wireless. Allow a clearance of 76 mm (3 in.) front and rear and 51 mm (2 in.) sides for air circulation. No top and bottom clearance is required.



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.

Figure 7-5 Flush Mounting Bracket Detail



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 Using the 12" Wall-Mounted Rack

Considerations:

- The rack (PN4712) is 305 mm (12 in.) deep. The Expansion Hub is 381 mm (15 in.) deep. You must move the rack mounting brackets on the Expansion Hub, as shown in Figure 7-6) to the center mounting position to allow for the 76 mm (3 in.) rear clearance that is required.
- The maximum weight the rack can hold is 22.5 kg (50 lbs).

Figure 7-6 Bracket Detail For Wall Mount Rack (PN 4712)



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.

NOTE: If wall stud spacing of 16" is not available, LGC recommends that 3/4" plywood be pre-installed to the wall. You can then attach the bracket to the plywood using the wood screws.

2. Remove both of the rack mounting brackets from the Hub.
3. Reattach each of the rack mounting brackets to the recessed wall mount position (Figure 7-6).
4. Install the Hub in the rack using the rack mounting screws.
5. Tighten the mounting screws.

✓ **Installing a Fusion Expansion Hub Directly to the Wall**

To install the Hub directly to the wall:

1. Pre-install 3/4" plywood to the wall.
2. Mount both of the rack mounting brackets using #10-32 machine screws (refer to illustration Figure 7-7).
3. Attach the Hub to the wall so the mounting brackets are orientated at the top and bottom of the wall mounted hub. (Refer to Figure 7-8.)

Figure 7-7 Using Hub Rack-Mounting Brackets for Direct Wall Installation

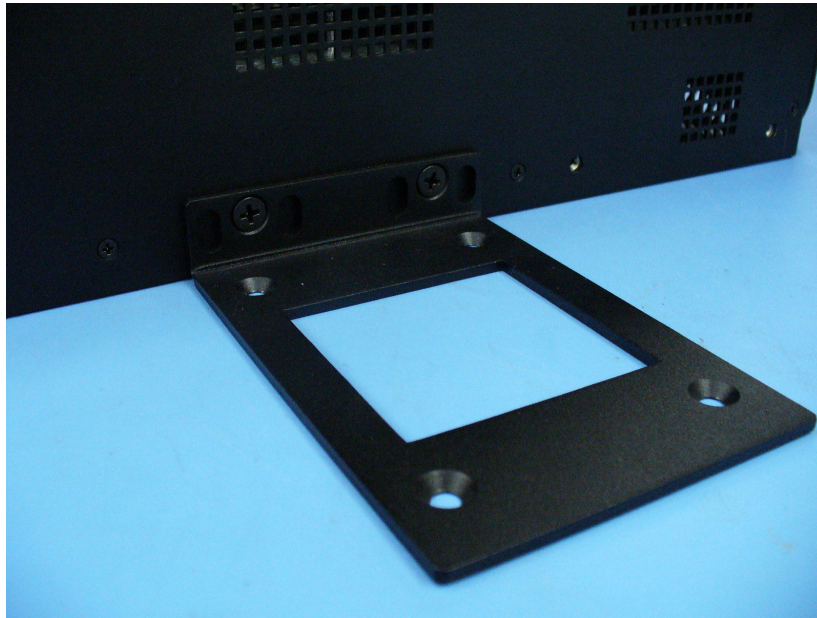
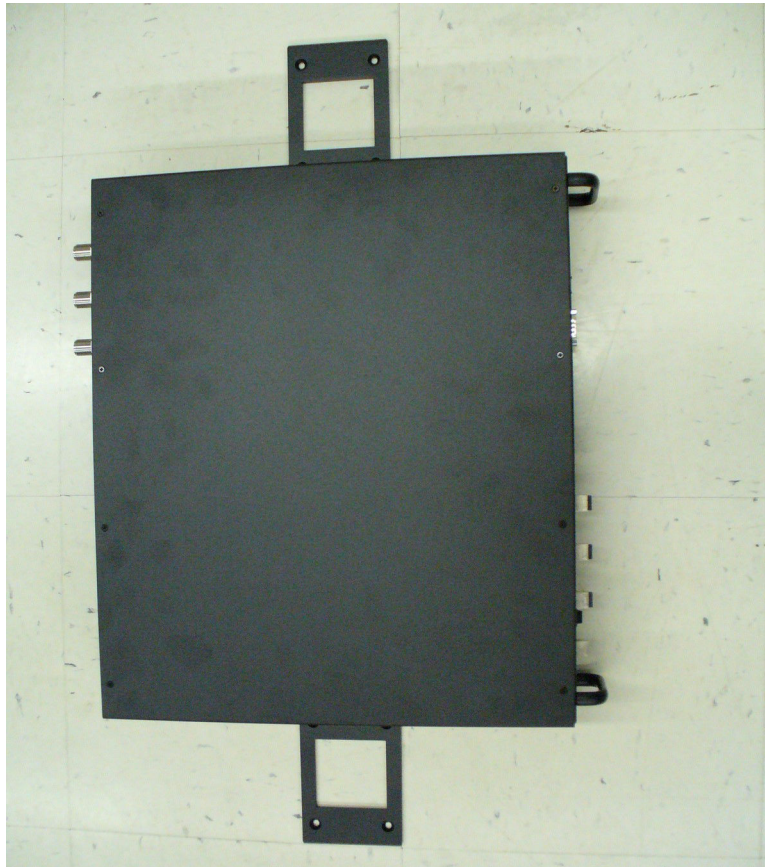


Figure 7-8 Installing Directly to the Wall



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

✓ 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 blink for five seconds as a visual check that they are functioning. After the five-second test:

- The **POWER** and **UL STATUS** LEDs should be green.
 - If the uplink fiber is not connected, the **UL STATUS** LED turns red indicating that there is no communication with the Main Hub.
- The **E-HUB STATUS** and **DL STATUS** LEDs should be red.
- All port LEDs should be off because no RAUs are connected yet.

Connecting the Fiber Cables to the Expansion Hub

Considerations:

- Before connecting the fiber cables, confirm that their optical loss does not exceed 3 dB optical budget. RL is less than -60dB.
- 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, refer to "Fusion Splicing of Fiber and Pigtail" on page 7-37, or replace the connectors.)

NOTE: Observe all Fiber Port Safety Precautions listed in Section 7.2.3 on page 7-5.

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 Main Hub(s).

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

1. Connect **2** to **DOWNLINK** on Expansion Hub.

The **DL STATUS** LED should turn green as soon as you connect the fiber. If it does not, there is a downlink problem. Make sure you are connecting the correct cable to the port.

2. Connect **1** to **UPLINK** on Expansion Hub.

The **UL STATUS** LED turns green on the first Main Hub communication. It may take up to 20 seconds to establish communication.

The Expansion Hub's **E-HUB STATUS** LED turns green when the Main Hub sends it the frequency band command.

If the **UL STATUS** and **E-HUB STATUS** LEDs do not turn green/green, check the Main Hub LEDs. Refer to page 7-18, item 2 in Table 7-5.

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

1. Connect “red” to **DOWNLINK** on Expansion Hub.

The **DL STATUS** LED should turn green as soon as you connect the fiber. If it does not, there is a downlink problem. Make sure you are connecting the correct cable to the port.

2. Connect “blue” to **UPLINK** on Expansion Hub.

The **UL STATUS** LED turns green on the first Main Hub communication. It may take up to 20 seconds to establish communication.

The Expansion Hub’s **E-HUB STATUS** LED turns green when the Main Hub sends it the frequency band command.

If the **UL STATUS** and **E-HUB STATUS** LEDs do not turn green/green, check the Main Hub LEDs. See page 7-18, item 2 in Table 7-5.

✓ Connecting the 75 Ohm CATV Cables

Considerations:

- Verify that the cable has been tested and the test results are recorded. This information is required for the As-Built Document.
- Verify that only captive centerpin F connectors are used on the solid copper center conductor CATV cable from CommScope (or equivalent).
- Verify that the CATV cable is labeled with:
 - Fusion Expansion Hub port number being used
 - RAU identifier
 - Carrier (for multiple operator systems)

To connect the CATV cables:

1. Connect the CATV cables to the F ports according to the labels on the cables.

The **STATUS** LEDs should be off because the RAUs are not connected at the other end of the CATV cable.

2. Record which cable you are connecting to which port (that is, from the label on the cable).

This information is required for the As-Built Document.

3. Tie-off the cables or use the optional cable manager to avoid damaging the connectors because of cable strain.

 **Troubleshooting Expansion Hub LEDs During Installation**

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

Table 7-6 Troubleshooting Expansion Hub LEDs During Installation

During Installation	LED	State	Action	Impact
1. Expansion Hub power is On and no RAUs are connected	POWER	Off	Check AC power; make sure the Expansion Hub power-on switch is on; replace the Expansion Hub.	The Expansion Hub is not powering on.
	PORT	LEDs are on but didn't blink through all states.	Replace the Expansion Hub.	The Microcontroller is not resetting properly; flash memory corrupted.
	PORT	Flashing Red (6 PPM)	Port unusable; replace the Expansion Hub when possible.	Current sensor fault; do not use the port.
	UL STATUS	Red, after power-up blink	Replace the Expansion Hub.	The Expansion Hub laser is not operational; no uplink between the Expansion Hub and Main Hub.
	UL STATUS	Red	Check the Main Hub LEDs Refer to page 7-18, item 2 in Table 7-5. Use AdminBrowser to determine the problem.	No communication with Main Hub.
	DL STATUS	Red	Check the downlink fiber for optical power; verify that the cables are connected to correct ports (that is, uplink/downlink) Check the Main Hub LEDs. Refer to page 7-18, item 2 in Table 7-5.	No downlink between the Expansion Hub and Main Hub.
2. Expansion Hub power is On and RAUs are connected	PORT	Off	Check the CATV cable.	Power is not getting to the RAU.
	PORT	Flashing Red (60 PPM)	Test the CATV 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.
	PORT	Red	Use AdminBrowser to determine the problem.	RAU is off-line.

7.4.3 Installing RAUs



CAUTION: Install RAUs in indoor locations only. Do not connect an antenna that is installed in an outdoor location to an RAU. For outdoor installations, a protective enclosure is required.

✓ Installing RAUs

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

Considerations:

- Install 800 iDEN and 850/1900 MHz RAUs so that their antennas will be separated by enough space to reduce signal interference between the 800 and 850 bands. Refer to Section , “800/850 MHz Isolation Requirements,” on page 7-27 for recommended distance between antennas.
- You can place the unit, without its fastening hardware, on a flat surface, such as a shelf, desk, cabinet, or any other horizontal surface that allows stable placement with the mounting base facing down to the mounting surface. For mounting to other locations (that is, walls, ceilings, poles) the RAU must be securely mounted using the 4 slotted mounting holes provided with #6 diameter fasteners. This method of mounting must securely hold a minimum of 7 lbs. load.
- Attach the RAU securely to a stationary object (that is, a wall, pole, or ceiling tile).
- For proper ventilation:
 - Keep at least 76 mm (3 in.) clearance around the RAU to ensure proper venting.
 - Do not stack RAUs on top of each other.
 - Always mount the RAU with the solid face (containing the mounting holes) against the mounting surface.

✓ Installing Passive Antennas

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

Location

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

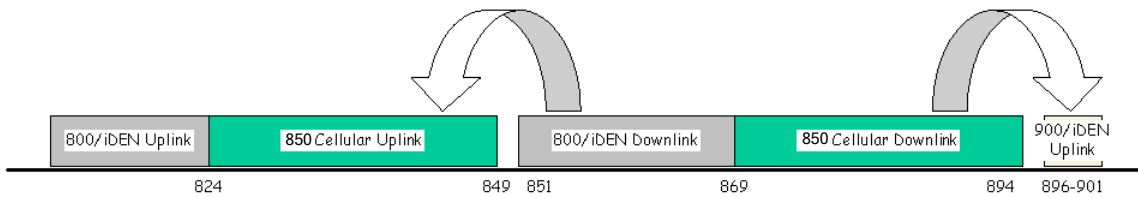
800/850 MHz Isolation Requirements

When deploying any RF system, give special attention to preventing receiver blocking or desensitization by out-of-band transmitters. Typically, sharp filters in the receiver front-end will reduce the interfering transmitters to tolerable levels. In select cases, the interferers may occupy a frequency band that is directly adjacent to the receiving band and cannot be adequately rejected by filtering. The only recourse in

these situations is to provide sufficient isolation by physically separating the interfering transmitters and receivers.

iDEN occupies spectrum at both 800 MHz and 900 MHz (Tx:806–825/Rx:851–870 and Tx:896–901/Rx:935–940), while the Cellular A and B carriers share a single 850 MHz block (Tx:869–894/Rx:824–849). The combination of these frequency bands, 800/900 MHz iDEN and 850 MHz Cellular, result in uplink (BTS receive) bands that are adjacent to downlink (BTS transmit) bands. Figure 7-9 depicts these nearly contiguous bands, with arrows indicating the interfering downlink and receiving uplink bands.

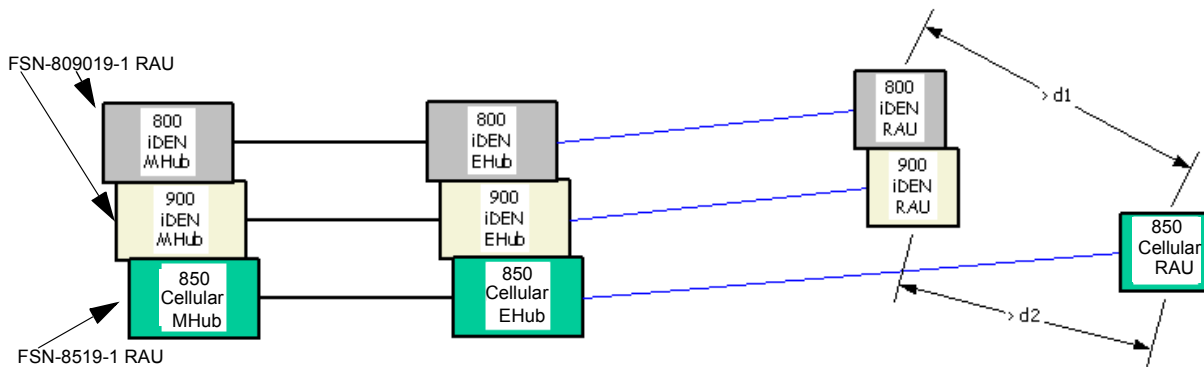
Figure 7-9 800/850 MHz Spectrum



Installation of an in-building distributed antenna system (DAS) to provide coverage for both 800/900 MHz iDEN and 850 MHz Cellular must account for these downlink-to-uplink interference issues and provide adequate isolation.

LGC offers the following guidelines toward achieving the proper amount of isolation when deploying LGC Wireless Unison DAS products.

Figure 7-10 Guideline for Unison RAU Antenna Placement



800 MHz iDEN Downlink and 850 MHz Cellular Uplink

A 2 MHz frequency gap (851 – 849 MHz) separates the 800 iDEN downlink and 850 Cellular uplink frequency bands. Because of this narrow spacing, 800 iDEN downlink intermodulation products may fall within the 850 Cellular uplink band. In addition, 800 iDEN downlink signals near the lower edge of the band at 851 MHz may

cause the 850 Cellular uplink automatic level control (ALC) circuitry in the RAU to engage and thereby reduce uplink gain.

To prevent either of these conditions, use the following guidelines:

- In-band 800 iDEN intermodulation products < -90dBm
- Lower frequency 800 iDEN signals < -30dBm for Fusion

Given a typical DAS configuration (4 iDEN carriers, omni-directional antennas, line of sight), these guidelines translate to an antenna spacing (d1) of 6 – 9 meters.

850 MHz Cellular Downlink and 900 MHz iDEN Uplink

A 2 MHz frequency gap (896 – 894 MHz) separates the 850 Cellular downlink and 900 iDEN uplink frequency bands. Because of this narrow spacing, 850 Cellular downlink intermodulation products may fall within the 900 iDEN uplink band. In addition, 850 Cellular downlink signals near the upper edge of the band at 894 MHz may cause the 900 iDEN uplink ALC to engage and thereby reduce uplink gain.

To prevent either of these conditions, use the following guidelines:

- In-band 850 Cellular intermodulation products < -90dBm
- Upper frequency 850 Cellular signals < -30dBm for Fusion

Given a typical DAS configuration (6 CDMA carriers for Fusion, omni-directional antennas, line of sight), these guidelines translate to an antenna spacing (d2) of 8-14 meters.

Spacing between RAUs FSN-8519-1 and FSN-809019-1 should be in a range of from 8 to 14 meters.

✓ Connecting the Antenna to the RAU

Connect a passive multi-band antenna to the N connector on the RAU using coaxial cable with the least amount of loss possible.



CAUTION: Firmly hand-tighten the N connector – DO NOT over-tighten the connector.

✓ Connecting the CATV Cable

Considerations:

- Verify that the cable has been tested and the test results are recorded. This information is required for the As-Built Document.
- Verify that only captive centerpin 75 Ohm Type-F connectors are used on the solid copper center conductor CATV 75 Ohm cable.
- Verify that the CATV cable is labeled with:

- Fusion Main Hub port number being used
- RAU identifier
- Carrier (for multiple operator systems)

To connect the CATV cable:

1. Connect the CATV cables to the F female port on the RAU according to the label on the cable.

Power is supplied by the Fusion Main Hub over the CATV cable conductors. Upon power up, the LEDs will blink for two seconds as a visual check that they are functioning. After the two-second test:

- The **LINK** LED should be green indicating it is receiving power and communications from the Fusion Main Hub.
- The **ALARM** LED should be red until the Fusion Main Hub issues the band command, within about 20 seconds, then it should be green.

2. Record which cable you are connecting to the RAU (from the label on the cable). 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.

7.4.3.1 Troubleshooting Using RAU LEDs During Installation

- The **LINK** LED should be green and remain green for longer than 90 seconds. The **ALARM** LEDs are red when the system band has not been programmed.

Table 7-7 Troubleshooting RAU LEDs During Installation

During Installation	LED	State	Action	Impact		
The RAU is connected to the Fusion Expansion Hub, which is powered on	LINK	Off	Check CATV cable.	No power to the RAU.		
	ALARM	Off				
	LINK	Green	<ul style="list-style-type: none"> • Check CATV cable • Check Hub LEDs Refer to page 7-26, item 2 in Table 7-6. • Use AdminBrowser to determine the problem. 	The RAU is off-line.		
	ALARM	Red				
	LINK	Red from green, after cables are connected for 60 seconds			<ul style="list-style-type: none"> • Check CATV cable. • Check the Hub LEDs. • Use AdminBrowser to determine the problem. 	No communications between the RAU and the Hub.
	ALARM	Red				

7.4.3.2 Installing RAUs in a Multiple Operator System

When installing both iDEN and Cellular systems in parallel, either as dual-band or multiple operator systems, you must take special provision to assure that the individual RAUs do not interfere with each other.

The 850/1900 MHz and 800/900/1900 MHz RAU's antennas must be separated by at least 8 meters (26 feet) to assure that the iDEN downlink signals do not interfere with the Cellular uplink signals.

7.4.4 Configuring the System

Before the system can operate properly, use AdminBrowser to program the Fusion Main Hub with the frequency bands that are to be distributed. The Hub must be programmed with the same frequencies as the RAU used.

NOTE: The frequency bands should automatically be set on power up and this step should not be required.

Considerations:

- The AdminBrowser software, described in the *AdminBrowser User Manual* (PN D-620607-0-20), must be running on a PC/laptop.
- Crossover Ethernet cable with male connectors required.

✓ Connecting the PC to the Fusion Main Hub to Run AdminBrowser

1. Connect the AC power cord to the Hub.

Make sure the Hub is grounded through the ground lug on the AC power and the frame ground lug as required. The warranty does not cover damage caused when an ungrounded Hub is powered on.

2. Plug the power cord into an AC power outlet.
3. Verify that all cables are properly connected on the Hub.
4. Turn on the power to the Hub.

All LEDs blink through the power up sequence. At each port where an RAU is detected (drawing current), the port LEDs lights green. The Fusion **STATUS** LED is orange during system boot and should turn green after about 90 seconds if it finds no faults. This state indicates the band's are not programmed and provides feedback on the status of the RAU connections.

The LEDs blink for 20 seconds as a visual check that they are functioning.

5. Connect the cross-over Ethernet cable to the PC/laptop and then to the **RJ-45 100-BASE-T** port on the Hub's front panel.

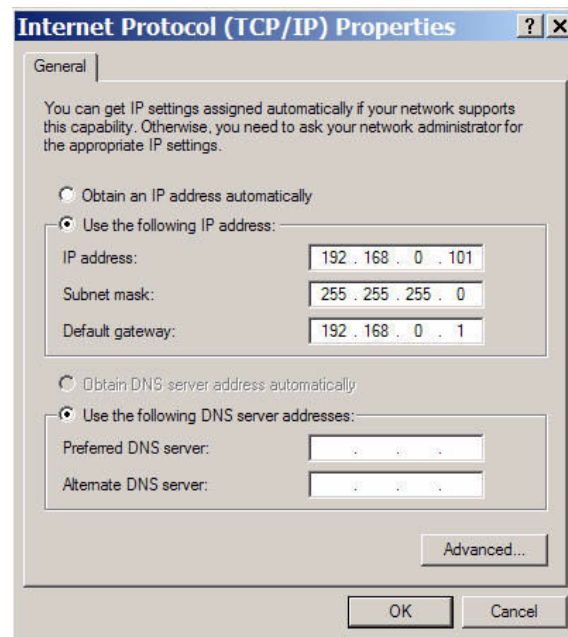
✓ Programming the Fusion Main Hub Using AdminBrowser

- Connect the provided TCP/IP crossover cable to the laptop and then to the Admin/LAN **RJ-45** port on the Fusion Main Hub's front panel.
- Turn on the laptop and start the Fusion Main Hub.

Windows 2000

1. Right-click **My Network Places** and select **Properties**.
2. Highlight **Internet Protocol (TCP/IP)** and click **Properties**. A screen similar to the Figure 7-11 appears.

Figure 7-11 Internet Protocol (TCP/IP) Properties Window

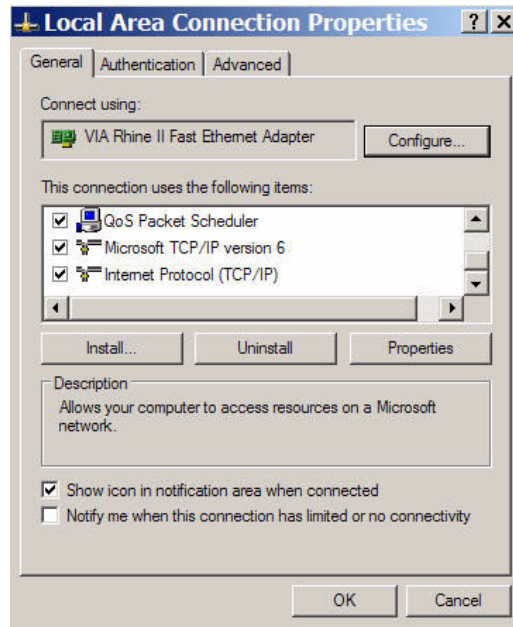


3. Make note of the current IP address, Subnet mask, and Default gateway, if they are configured. You will need to re-enter them after you have configured the Fusion Main Hub.
4. Select **Use the following IP address**.
5. Change the **IP address** to 192.168.0.101
6. Change the **Subnet mask** to 255.255.255.0
7. Change the **Default gateway** to 192.168.0.1
8. Click **OK** twice. You may be asked if you want to reboot your computer. If so, click **Yes**.

Windows XP

1. Click **Start>Settings>Network Connections>Local Area Connection**. The window shown in Figure 7-12 appears.

Figure 7-12 Local Area Connection Properties Window



2. In the **This connection uses the following items**, scroll down to and select **Internet Protocol (TCP/IP)** and click **Properties**.
3. Perform steps 3 through 8 in the preceding section.

Using AdminBrowser

1. Launch your web browser, type `Https://192.168.0.100` in the URL line, and click **Go**.
2. When AdminBrowser appears, log in using the default password: **password**.

3. Click System Configuration and then click Set Date/Time. A page similar to Figure 7-13 appears.

Old System Date and Time
Date 04/25/2006
Time 13:40:54

New System Date and Time
Date 04/25/2006 (MM/DD/YYYY)
Time 13:40:54 (hh:mm:ss)

Set Date/Time

Figure 7-13 Set Time and Date Window

4. Enter the desired time and date in the format indicated on the page and click Set Date/Time. A page appears requiring you to reboot the system for the new date and time to take effect.
5. Select the Fusion Main Hub and click Install/Configure System. A screen similar to the Figure 7-14 appears.

Figure 7-14 AdminBrowser Configuration Window

Label: FUSION_SINGLESTAR_LCC_SanJ

System Date and Time
Date: 02/23/2006
Time: 18:24:54

Schedule System Test
Warning: A system test will take the system offline.
Enable
System test on power up
Date: 30/00/0000
Time: 30:00:00
Recurrence: Day 1 Week 0

Bands
850+1900
Uplink Gain: 0 1900MHz
Downlink Gain: 9
Uplink Automatic Level Control: Multiple

6. If desired, type in a label.

The label is the system name displayed next to the icons and used in messages. It can be up to 32 characters long depending upon the firmware version.

The default system label is “Fusion” and will be used if you enter nothing.

7. Type in a Date and Time or leave the current system date and time unchanged. Enter time is a 24-hour format.
8. Use the next section to schedule a System Test.

This section allows you to do the following:

- Click the check box to enable this feature.
- Click the check box to cause system test on power up.
- Enter values to schedule the date and time of the next system test.
- Enter values to specify the recurrence of the test by day or by week.

Schedule System Test allows periodic, automatic execution of the system end-to-end test. Just like Perform System Test, a Schedule System Test suspends normal service for the duration of the test; calls are dropped, and no new calls can be established during the test. Test duration depends on the configuration (number of RAUs) and requires one or two minutes to complete.

After completion of the system test, the scheduled system test time is updated to the next test time, and an event log entry is made.

9. Use the scroll bar on the left side of the page to scroll down to view the rest of the page as shown in Figure 7-15.

Figure 7-15 AdminBrowser Configuration Window (continued)

The screenshot shows the configuration window with the following sections:

- Bands:** A dropdown menu is set to "850+1900". Below it are two columns of settings for "850MHz" and "1900MHz".

	850MHz	1900MHz
Uplink Gain	0	0
Downlink Gain	0	0
Uplink Automatic Level Control	Multiple	Multiple
- Input Alarms:** A table with columns for "Enable", "Normal State", and "Label".

	Enable	Normal State	Label
Alarm Sense 1	<input checked="" type="checkbox"/>	Opened	AS_1
Alarm Sense 2	<input checked="" type="checkbox"/>	Opened	AS_2
Alarm Sense 3	<input checked="" type="checkbox"/>	Opened	AS_3
- Output Alarms:** A table with columns for "Enable" and "Normal State".

	Enable	Normal State
Fault Source	<input checked="" type="checkbox"/>	Closed
Warning Source	<input checked="" type="checkbox"/>	Closed

10. In the Band area, do the following:

- You should not have to select the bands. The system self configures the band by validating that all the RAUs connected are the same type.
 - Use the pull-down to specify the Uplink and Downlink gain for each band. You can set system gain within the specified range in 1 dB increments.
 - Use the pull-down to set the Uplink Automatic Level Control to either “Single” or “Multiple” for each band in the system. (The default is “Multiple.”
11. In the Input/Output Alarms area, do the following for each Alarm Sense:
- Enable each Alarm Sense by using the check box.
 - Use the pull-down to set the Normal State to Closed or Opened. (The default is “Closed.”
 - Assign a label to each alarm sense.
12. When you have completed inputting the desired information, click **Install System** to configure the system.

During configuration all disconnect statuses are cleared for attached RAUs; the frequency band, gain, and system label are set; logs are cleared; the system test is performed; and finally the system tree is refreshed. The icons should be:



Indicating that the band is correctly set.



Indicating that communications are OK.

If there are problems, the icons will be different and a message is displayed in the Messages pane.

13. Connect the Main Hub to the RF source (for example, BTS or BDA).

Do not exceed the maximum input RF power (1 Watt) to the Fusion Main Hub. Exceeding the limit could cause permanent damage to the Hub.

CAUTION: Only carriers and their approved installers or LGC-authorized installers are allowed to connect to the RF source. **Serious damage to the equipment can occur if it is over-driven.**

The Fusion system should now be operational. Using a mobile phone, walk your site and test the signal strength.

14. Make sure to change the TCP/IP setting in your laptop back to their original values.

NOTE: NOTE: LGC Wireless’ equipment is designed to operate in the licensed frequency bands of mobile, cellular, and PCS operators. In the USA, the EU, and most countries this equipment may only be used by the licensee, his authorized agents or those with written authorization to do so. Similarly, unauthorized use is illegal, and subjects the owner to the corre-

spending legal sanctions of the national jurisdiction involved. Ownership of LGC Wireless equipment carries no automatic right of use.

7.5 Splicing Fiber Optic Cable

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

LGC offers two pigtails: one for single-mode fiber (PN 4013SCAPC-3) and one for multi-mode fiber (PN 4012SCAPC-3).

LGC Wireless recommends fusion splices because they have the lowest splice loss and return loss. Mechanical splices have higher losses and higher back reflection than fusion splices and are not recommended.

Using a fusion splicer involves fusing together two butted and cleaved ends of fiber. The fusion splicer aligns the fibers and maintains alignment during the fusion process. Fusion splices have very low loss (typically less than 0.05 dB) and very low back reflection (return loss). Fusion splices should be organized in a splice tray designed to store and protect the splices.

✓ Fusion Splicing of Fiber and Pigtail

Before you begin, make sure the fusion splicer is set to the proper mode (that is, single- or multi-mode).

To fusion 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 cutting back the polyethylene jacket, the kevlar or fiber-glass strength members, the extruded coating, and the buffer coating in order to expose the “bare fiber” – cladding plus core.
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 fusion 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 cutting back the polyethylene jacket, the kevlar or fiber-glass strength members, the extruded coating, and the buffer coating in order to expose the "bare fiber" – cladding plus core.

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.

NOTE: Refer to Section 9 for troubleshooting.

7.6 Interfacing the Fusion Main Hub to an RF Source



WARNING: Only LGC personnel or LGC-authorized installation personnel should connect the Fusion Main Hub to its Band associated base station or repeater. Exceeding the maximum input power could cause failure of the Fusion Main Hub (refer to Section 5.2 on page 5-4 for maximum power specifications). If the maximum composite power is too high, attenuation is required.

7.6.1 Connecting a Single Fusion Main Hub to an RF Source

The Fusion system supports three RF sources, one for Band 1, Band 2, and Band 3. This section explains how each Band can be connected to its associated RF source.



Connecting a Fusion Main Hub to an In-Building BTS



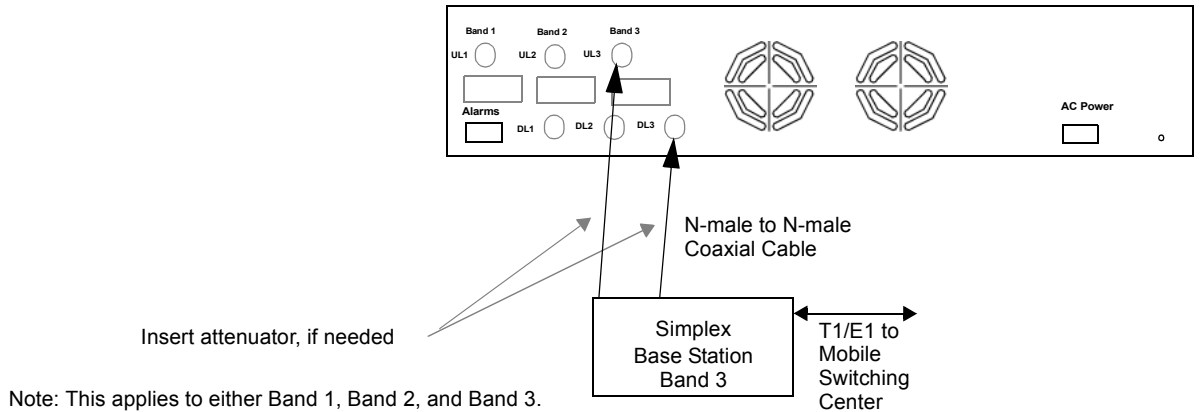
WARNING: Only LGC personnel or LGC-authorized installation personnel should connect the Fusion Main Hub to a base station or repeater. Exceeding the maximum input power could cause failure of the Fusion Main Hub (refer to Section 5.2 on page 5-4 for maximum power specifications). If the maximum composite power is too high, attenuation is required.

CAUTION: The **UPLINK** and **DOWNLINK** ports cannot handle a DC power feed from the base station. If DC power is present, a DC block must be used or the hub may be damaged.

Connecting a Simplex Base Station to a Fusion Main Hub RF Band:

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 Hub for the corresponding Band 1, Band 2, or Band 3.
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 Hub for the corresponding Band 1, Band 2, or Band 3.

Figure 7-16 Simplex Base Station to a Fusion Main Hub



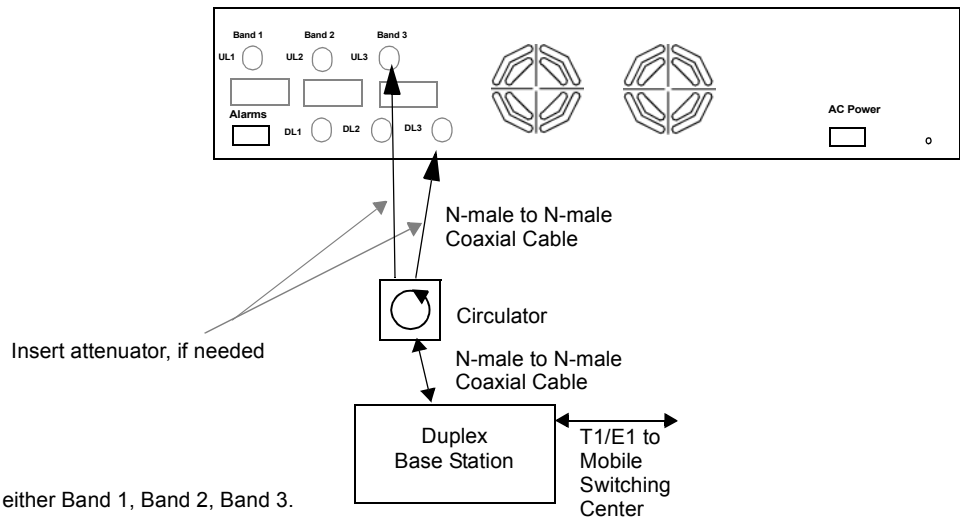
Connecting a Duplex Base Station to a Fusion Main Hub:

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

You can insert attenuators between the circulator or duplexer and Hub as needed.

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 or duplexer to a circulator.
3. Connect an N-male to N-male coaxial cable to the **DOWNLINK** connector on the Hub for Band 1, Band 2, and Band 3.
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 Hub for Band 1, Band 2, and Band 3.
6. Connect the other end of the N-male coaxial cable to the receive connector on the circulator.

Figure 7-17 Duplex Base Station to a Fusion Main Hub



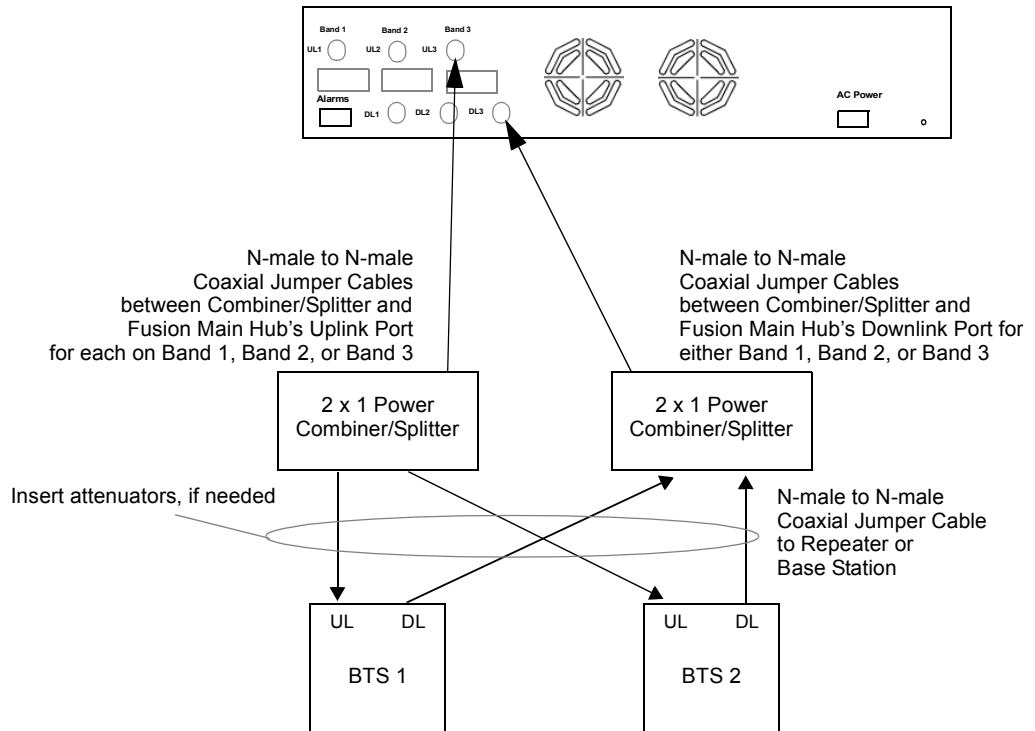
✓ **Connecting a Fusion Main Hub RF Band to Multiple BTSs**



WARNING: Only LGC personnel or LGC-authorized installation personnel should connect the Fusion Main Hub to a base station or repeater. Exceeding the maximum input power could cause failure of the Fusion Main Hub (refer to Section 5.2 on page 5-4 for maximum power specifications). If the maximum composite power is too high, attenuation is required.

You can use power combiner/splitters to connect a Fusion Main Hub RF Band to multiple base stations, as shown in Figure 7-18.

Figure 7-18 Connecting a Fusion Main Hub to Multiple Base Stations



✓ Connecting a Fusion Main Hub to a Roof-top Antenna

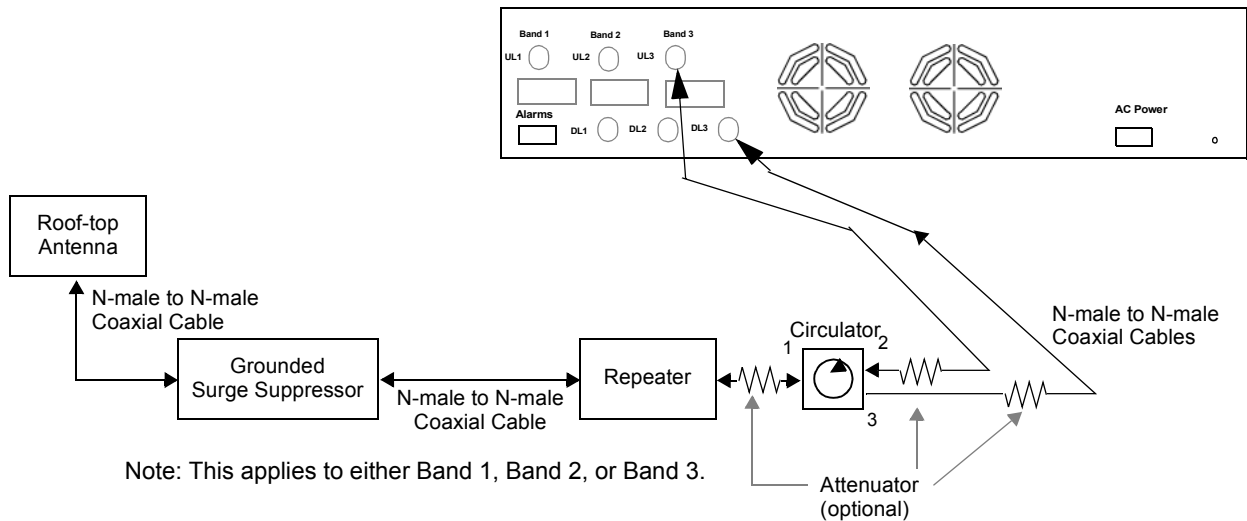
LGC Wireless recommends that you use a lightning arrestor or surge protector in a roof-top antenna configuration. Insert the lightning arrestor or surge protector between the roof-top antenna and the repeater connected to the Fusion Main Hub RF Band.

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 Hub for either Band 1, Band 2, or Band 3.

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 Hub for either Band 1, Band 2, or Band 3.

Figure 7-19 Connecting a Fusion Main Hub to a Roof-top Antenna



✓ **Connecting a Fusion Main Hub to MetroReach Focus**

Refer to the MetroReach Focus manual for information.

7.6.2 Connecting Multiple Fusion Main Hubs to an RF Source

You can use power combiner/splitters as splitters to connect multiple Fusion 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.

✓ **Connecting Multiple Fusion Main Hubs to a Simplex Repeater or BTS**



WARNING: Only LGC personnel or LGC-authorized installation personnel should connect the Fusion Main Hub to a base station or repeater. Exceeding the maximum input power could cause failure of the Fusion Main Hub (refer to Section 5.2 on page 5-4 for maximum power specifications). If the maximum composite power is too high, attenuation is required.

Considerations:

- 2 hybrid power combiner/splitters; one for uplink and one for downlink (2x1 for two Fusion Main Hubs, 3x1 for three, 4x1 for four, and so on.)
- 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 Fusion Main Hub RF Band (either Band 1 or Band 2)

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 **UPLINK**
 - b. From the second power combiner/splitter to the repeater or base station **DOWNLINK**
2. Connect the power combiner/splitters to the Hubs:
 - a. From the first Hub's **UPLINK** port (Band 1, Band 2, or Band 3) to the first power combiner/splitter
 - b. From the first Hub's **DOWNLINK** port (Band 1, Band 2, or Band 3) to the second power combiner/splitter
 - c. From the second Hub's **UPLINK** port (Band 1, Band 2, or Band 3) to the first power combiner/splitter
 - d. From the second Hub's **DOWNLINK** port (Band 1, Band 2, or Band 3) to the second power combiner/splitter

NOTE: Connections should not cross Bands. For example, all Band 1 connections should be made to the same hybrid power combiner/splitter connected to the repeater BTS that matches the Band 1 frequency.

3. Check Hub LEDs.

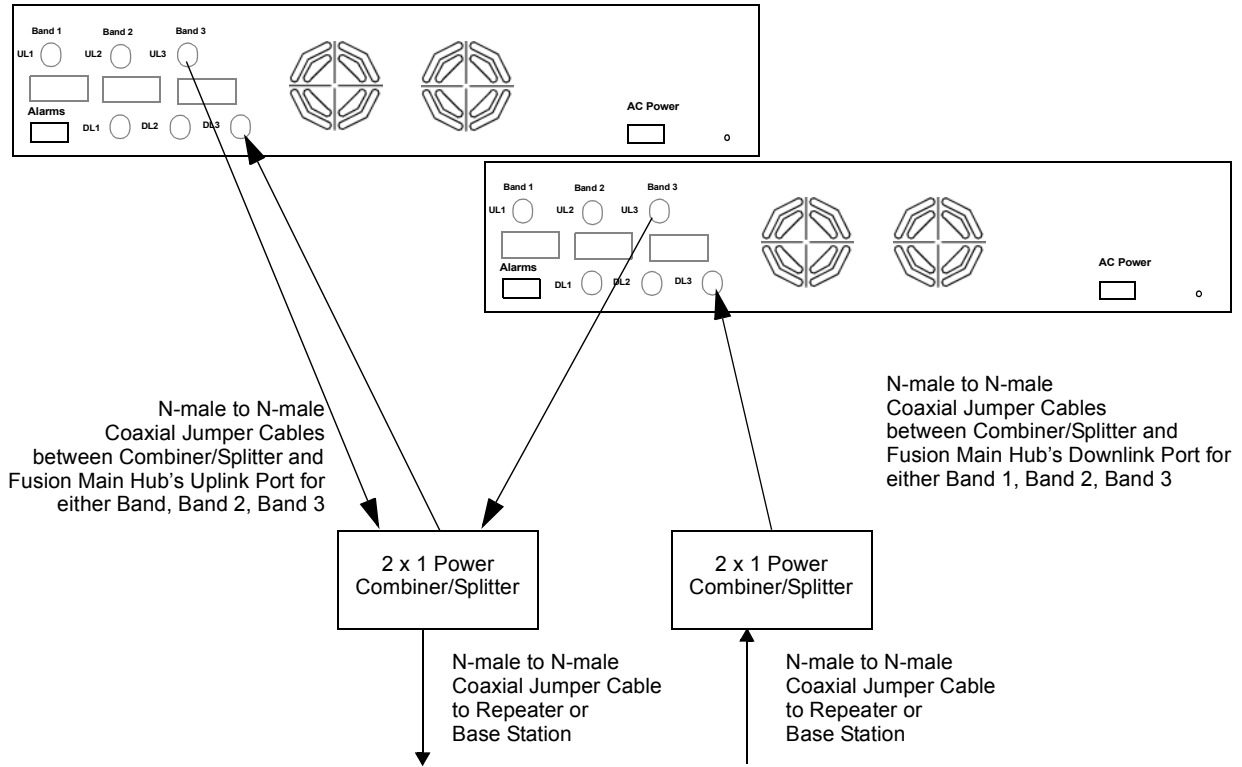
After connecting and powering on the Hub, check all LEDs to ensure that the system is operating properly.

Make sure the Hub is grounded. The warranty does not cover damage caused when an ungrounded Hub is powered on.

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

Figure 7-20 shows how to connect two Main Hubs to a simplex repeater or base station. Connecting two Hubs increases the total number of supportable RAUs from 8 to 16.

Figure 7-20 Connecting Two Fusion Main Hub's RF Band Ports to a Simplex Repeater or Base Station



✓ **Connecting Multiple Fusion Main Hubs to a Duplex Repeater or BTS**



WARNING: Only LGC personnel or LGC-authorized installation personnel should connect the Fusion Main Hub to a base station or repeater. Exceeding the maximum input power could cause failure of the Fusion Main Hub (refer to Section 5.2 on page 5-4 for maximum power specifications). If the maximum composite power is too high, attenuation is required.

Considerations:

- 2 hybrid power combiner/splitters; one for uplink and one for downlink (2x1 for two Fusion Main Hubs, 3x1 for three, 4x1 for four, and so.)
- 2 N-male to N-male coaxial jumper cables to connect each Fusion Main Hub's RF Band 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 cable between each circulator and power combiner/splitter

Procedure:

1. Connect the circulator 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 per combiner/splitter.
3. Connect the power combiner/splitter to the Hubs using N-male to N-male coaxial jumper cable:
 - a. From the first Hub's **UPLINK** (Band 1, Band 2, or Band 3) port to the first power combiner/splitter
 - b. From the first Hub's **DOWNLINK** (Band 1, Band 2, or Band 3) port to the second power combiner/splitter
 - c. From the second Hub's **UPLINK** (Band 1, Band 2, or Band 3) port to the first power combiner/splitter
 - d. From the second Hub's **DOWNLINK** (Band 1, Band 2, or Band 3) port to the second power combiner/splitter

NOTE: Connections should not cross Bands. For example, all Band 1 connections should be made to the same hybrid power combiner/splitter connected to the repeater BTS that matches the Band 1 frequency.

4. Check Hub LEDs.

Interfacing the Fusion Main Hub to an RF Source

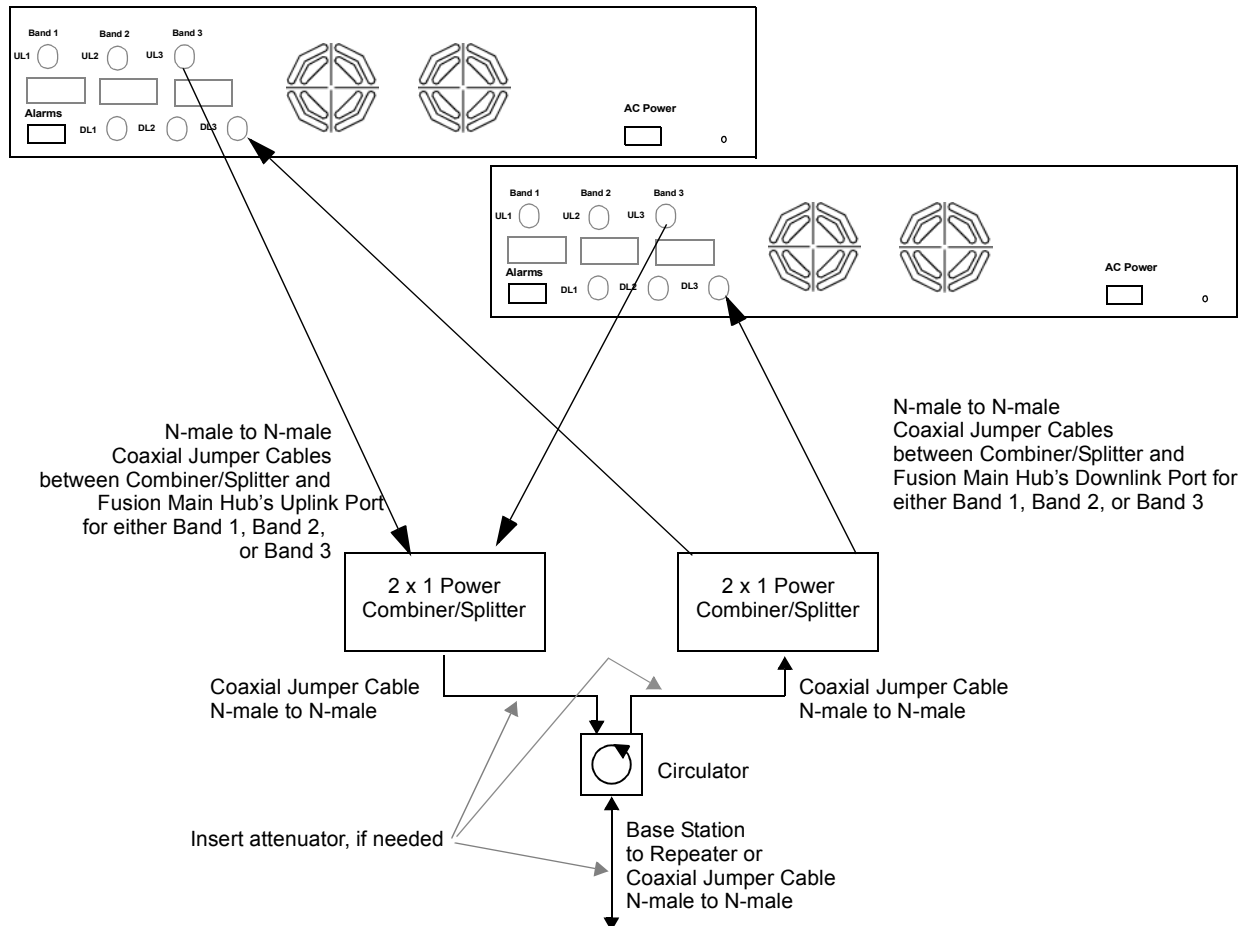
After connecting and powering on the Hub, check all LEDs to ensure that the system is operating properly.

Make sure the Main Hub is grounded. The warranty does not cover damage caused when an ungrounded Hub is powered on.

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

Figure 7-21 shows how to connect two Hubs to a duplex repeater or base station. You need to use one circulator and one more coaxial jumper cable, as shown.

Figure 7-21 Connecting Two Fusion Main Hub's RF Band Ports to a Duplex Repeater or Base Station



7.7 Connecting Contact Alarms to a Fusion System

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

- **Alarm Source (refer to Section 7.7.1 on page 7-50)**

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

NOTE: The contact can be changed to normally-open (NO) with Admin-Browser. This is not recommended since no alarm would be sent if power to the Fusion Main Hub fails.

- Fault is activated when any faults or disconnects are detected.
- Warning is activated when any warning conditions are detected except lockout or when the end-to-end system test is not valid.

- **Alarm Sense (refer to Section 7.7.2 on page 7-53)**

The Fusion Main Hub can monitor 3 external alarm contacts. Each port can be configured for normally-open (NO) or normally-closed (NC) contacts. The interface expects a set of floating contacts, and an external voltage source is not required for this interface. Use AdminBrowser to monitor the port status.

Table 7-8 lists the alarm types, equipment to which the Fusion Main Hub is connected, cable(s) used, and the faults and warnings that are detected.

Table 7-8 Alarm Types

Alarm Type	Fusion Connected to	Cable(s) Used	Errors Detected
Source	MetroReach	5-port Alarm Daisy-Chain Cable	Faults
Source	BTS	5-port Alarm Daisy-Chain Cable	Faults and Warnings
		In addition, a custom daisy-chain cable-to-BTS interface cable is required. Make this interface cable to the desired length and with the appropriate pin placement.	
Sense	Unison	5-port Alarm Daisy-Chain Cable and the Alarm Sense Adapter Cable	Faults

Note that Unison and MetroReach Focus support only faults (major errors).

Do not mix Unison and Fusion Main Hubs in the same daisy-chain. You can daisy-chain multiple Unison Hubs together and use the Alarm Sense Adapter Cable to connect the chain to a Fusion Main Hub, which will act as an alarm sensor.

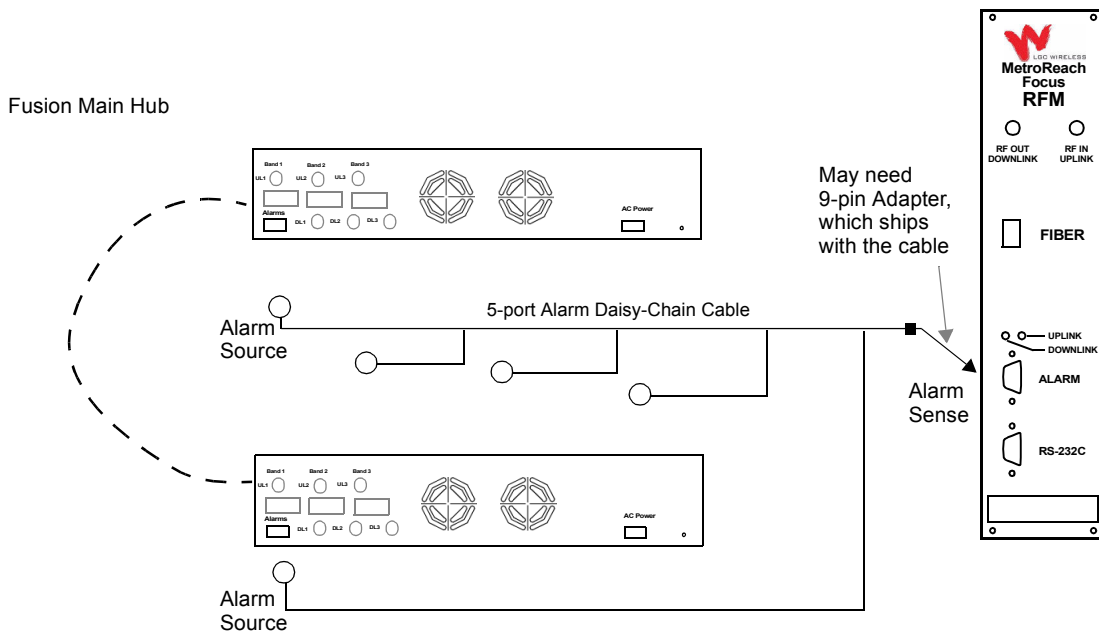
7.7.1 Alarm Source

Fusion always acts as an alarm source, no matter what type of equipment you are connecting to. Refer to Section 7.7.2 on page 7-53 if you want Fusion to sense Unison contact closures or other external alarms.

Using MetroReach Focus to Monitor Fusion

When you connect MetroReach Focus to the Fusion, the Fusion Main Hub is the output of the alarms (alarm source) and Focus is the input (alarm sense), as shown in Figure 7-22. Focus supports only faults (major errors).

Figure 7-22 Connecting MetroReach to Fusion

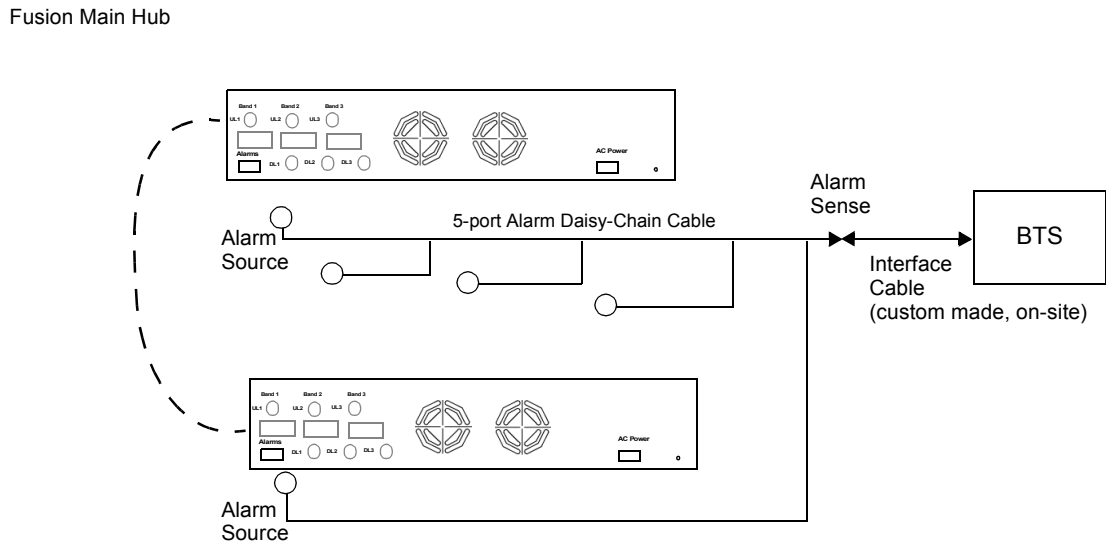


Using a Base Station to Monitor Fusion

NOTE: The BTS must be configured, by the carrier, for contact closure monitoring prior to connecting a Fusion Main Hub to it.

When you connect a BTS to Fusion, the Fusion Main Hub is the output of the alarms (alarm source) and the BTS is the input (alarm sense), as shown in Figure 7-23. An interface cable is required between the daisy-chain cable and the BTS. Because BTS alarm interface pinouts and Fusion-to-BTS distances vary, this cable is often custom and wired on-site. Refer to Section 3.2.1 for Alarm Contact details (Normally Closed).

Figure 7-23 Using a BTS to Monitor Fusion



NOTE: For normally open contacts, the fault and warning contacts need to be wired in parallel with other Main Hubs.

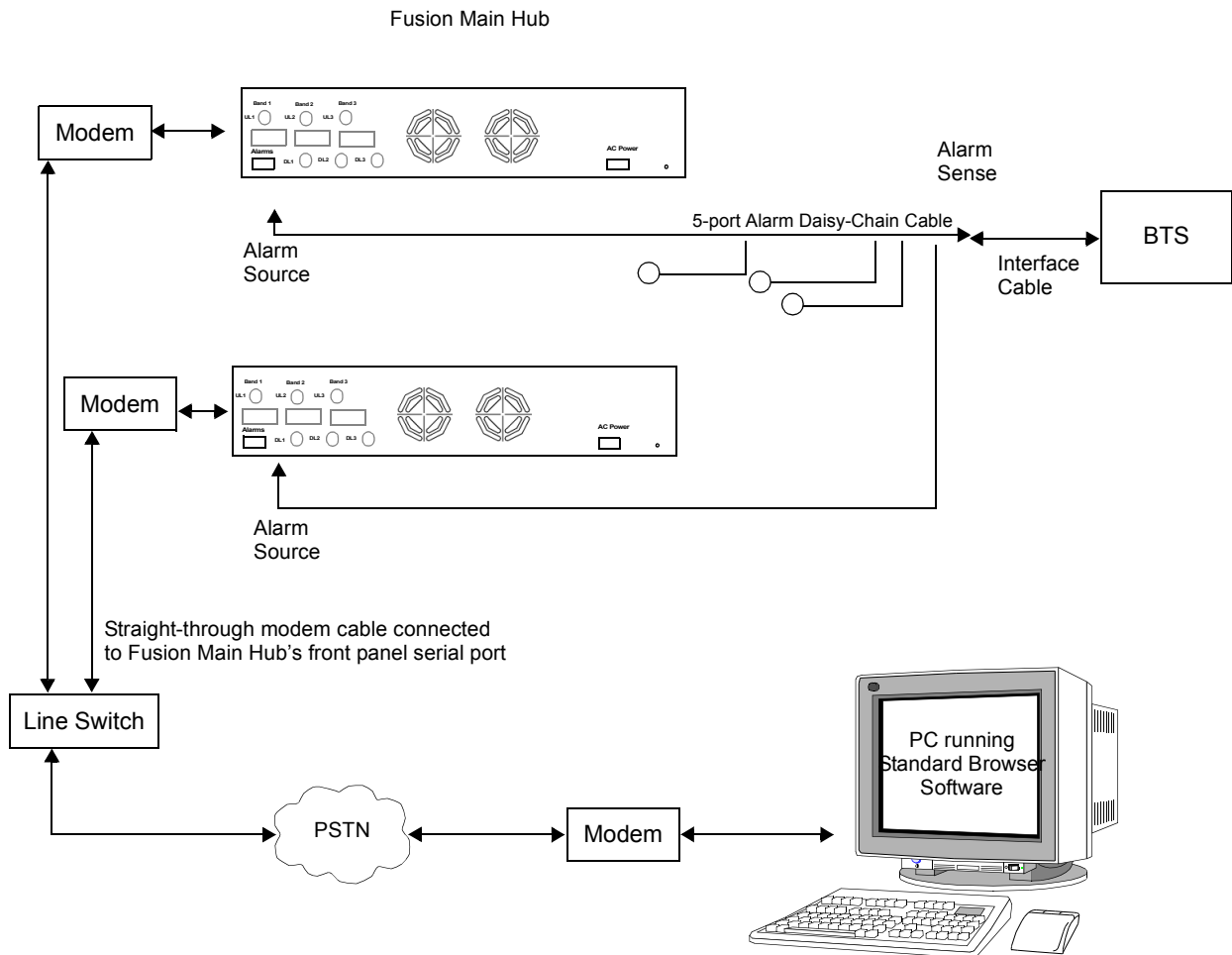
NOTE: LGC Wireless does not recommend using normally open contacts.

Using a Base Station and AdminBrowser to Monitor Fusion

NOTE: The BTS must be configured, by the carrier, for contact closure monitoring prior to connecting a Fusion Main Hub to it.

In order to take full advantage of Fusion's OA&M capabilities you can use LGC Wireless' AdminBrowser software in addition to a BTS to monitor the system, as shown in Figure 7-24. Refer to Section 7.8.6 for SNMP optional feature capabilities.

Figure 7-24 Using a BTS and AdminBrowser to Monitor Fusion



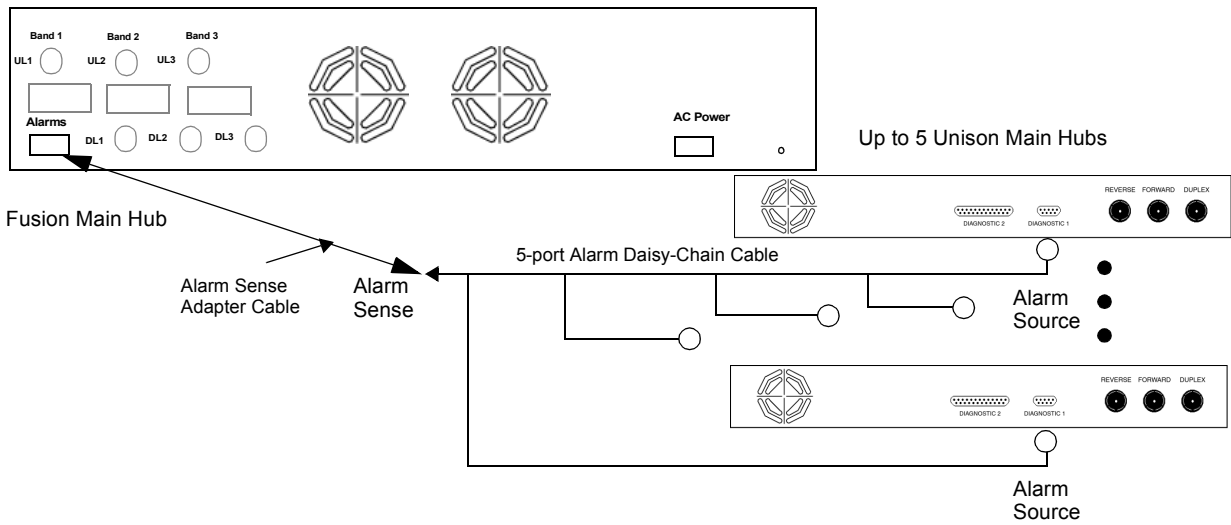
7.7.2 Alarm Sense

Use AdminBrowser to enable the Fusion system for “alarm sense” when connecting to the contact closure of Unison Main Hubs or other external alarms (refer to Set Contact Sense Properties in the *AdminBrowser User Manual*).

Using Fusion to Monitor Unison

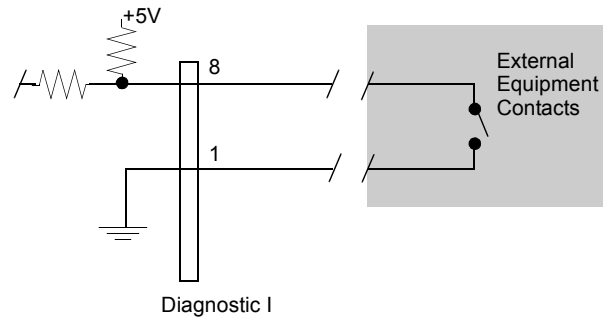
When you connect Unison to Fusion, the Fusion Main Hub is the input of the alarms (alarm sense) and the Unison is the output (alarm source), as shown in Figure 7-25. The input alarm sense needs to be set to normally closed (NC).

Figure 7-25 Using Fusion to Monitor Unison



Unison supports only faults. You must use the Alarm Sense Adapter Cable (refer to page 7-56) to interface the daisy-chain cable to Fusion. The adapter cable is required because it translates the Unison fault pinout to the sense input pins on the Fusion Main Hub.

Figure 7-26 Alarm Sense Contacts

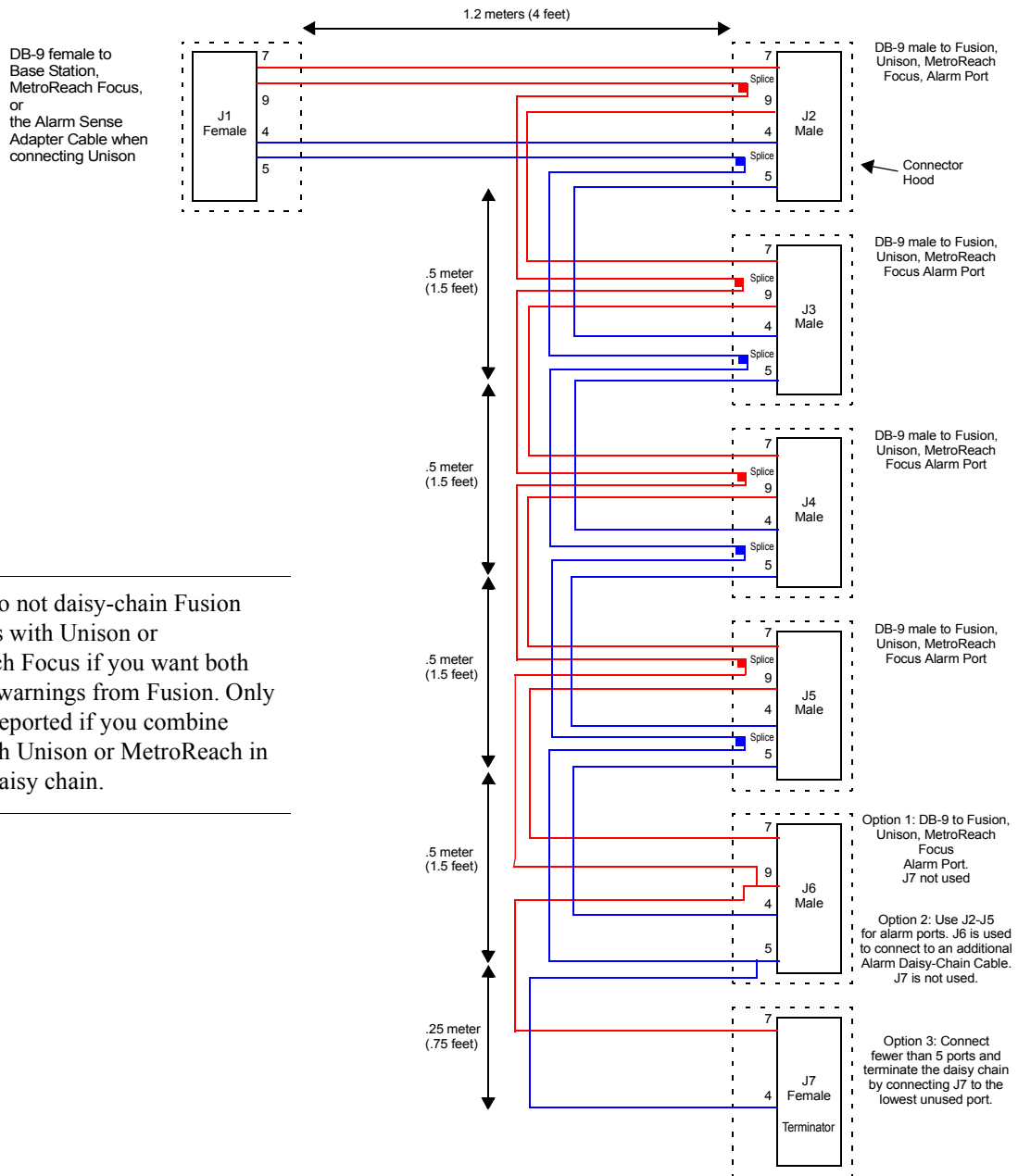


7.7.3 Alarm Cables

5-port Alarm Daisy-Chain Cable

Figure 7-27 shows the 5-port Alarm Daisy-Chain Cable (PN 4024-3), which supports fault and warning conditions.

Figure 7-27 5-port Alarm Daisy-Chain Cable



NOTE: Do not daisy-chain Fusion Main Hubs with Unison or MetroReach Focus if you want both faults and warnings from Fusion. Only faults are reported if you combine Fusion with Unison or MetroReach in the same daisy chain.

Alarm Sense Adapter Cable

The alarm sense adapter cable (PN 4025-1) translates the Unison fault pinout to the sense input pins on the Fusion Main Hub. You must use this adapter cable, illustrated in Figure 7-28, with the 5-port Alarm Daisy-Chain Cable when connecting Unison to Fusion.

Figure 7-28 Alarm Sense Adapter Cable



7.8 Alarm Monitoring Connectivity Options

The following connectivity options are described:

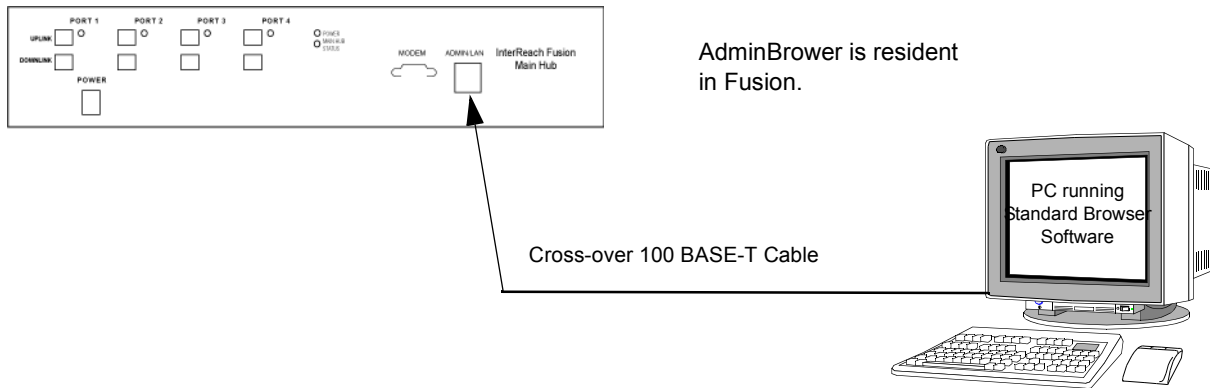
- Section 7.8.1 Direct Connection 7-57
- Section 7.8.2 Modem Connection 7-58
- Section 7.8.3 100 BASE-T Port Expander Connection 7-67
- Section 7.8.4 POTS Line Sharing Switch Connection 7-68
- Section 7.8.5 Ethernet LAN Connection 7-70
- Section 7.8.6 SNMP Interface 7-71

Note that the only accessory available through LGC Wireless is the Ethernet cross-over 100 BASE-T cable, which is provided with AdminBrowser.

7.8.1 Direct Connection

In this configuration, the PC connects directly to the **RJ-45 100 BASE-T** port on the Fusion Main Hub's front panel using a cross-over cable.

Figure 7-29 OA&M Direct Connection

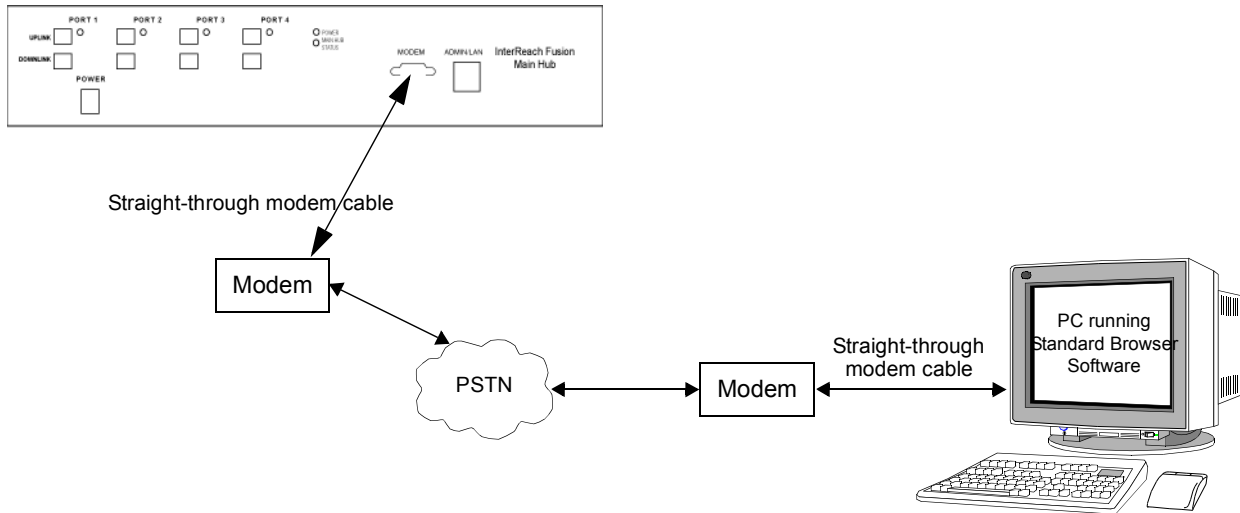


NOTE: The cross-over cable provided with the Fusion Main Hub supports full hardware handshaking, which is required. Refer to Appendix A.4 on page A-8 for cable wiring information.

7.8.2 Modem Connection

In this configuration, the PC and the Fusion Main Hub connect to modems and communicate using a standard dial-up telephone connection.

Figure 7-30 OA&M Modem Connection



NOTE: Refer to Appendix A.3 on page A-7 for the modem cable wiring information.

Modem switch settings are as follows for US Robotics modem:

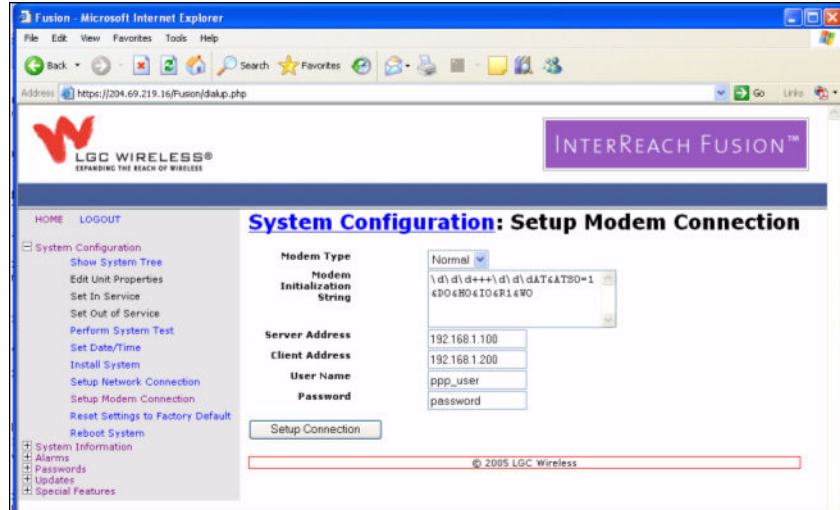
- PC-side: 3, 4 and 8 Down (“ON” position)
- Fusion Hub-side: 1, 4, 5 and 8 Down (“ON” position)

7.8.2.1 Setting Up Fusion Modem Using AdminBrowser

Use the following steps to set up a PPP Dial-In on Fusion:

1. Start AdminBrowser as explained in the AdminBrowser manual.
2. Select **System Configuration**.
3. Select **Setup Modem Connection**. The window shown in Figure 7-31 appears.

Figure 7-31 Default Dial-in Settings (Fusion Hub)



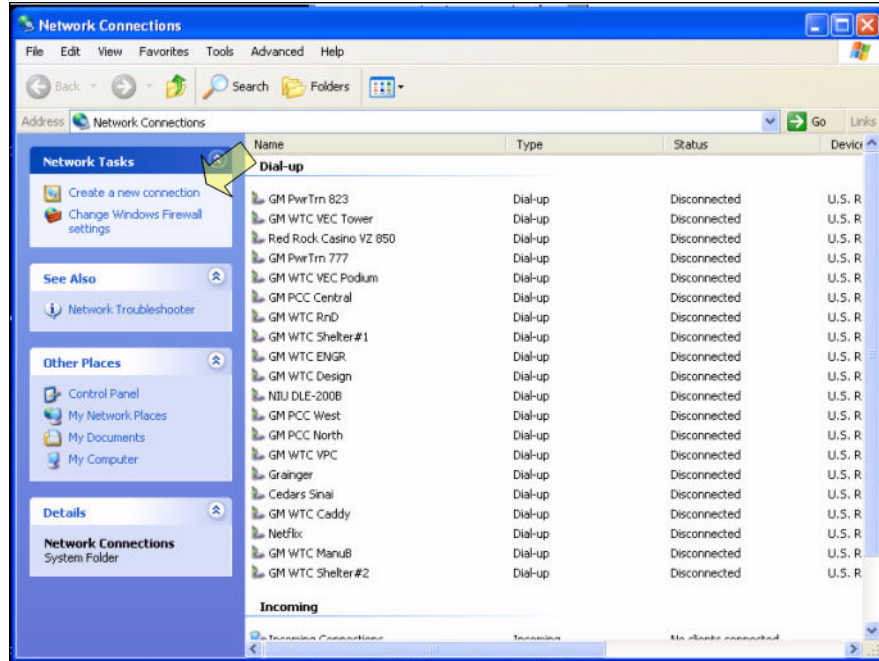
4. Make the desired changes.
5. Click **Setup Connection**.

7.8.2.2 Setting Up a PC Modem Using Windows

Use the following sets to set up a dial-up connection on your PC:

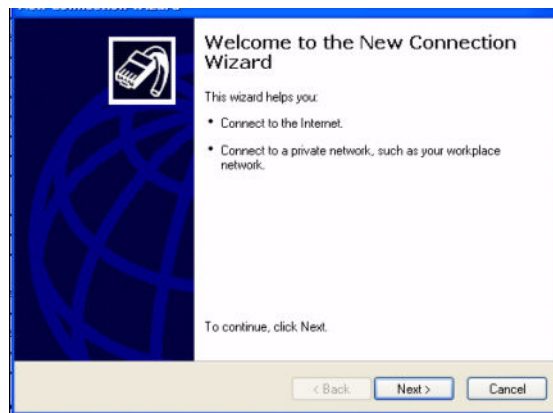
1. Click **Start, Settings, Network Connections**. The window shown in Figure 7-32 appears.

Figure 7-32 Network Connections Window



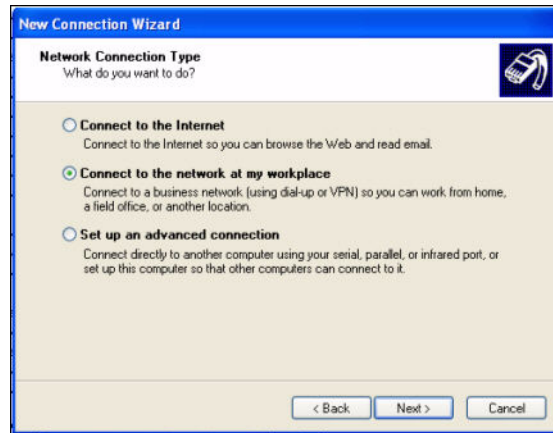
2. Click **Create a new connection**. The window shown in Figure 7-33 appears.

Figure 7-33 New Connection Wizard - Welcome Window



3. Click **Next**. The window shown in Figure 7-34 appears.

Figure 7-34 New Connection Wizard - Network Connection Type Window



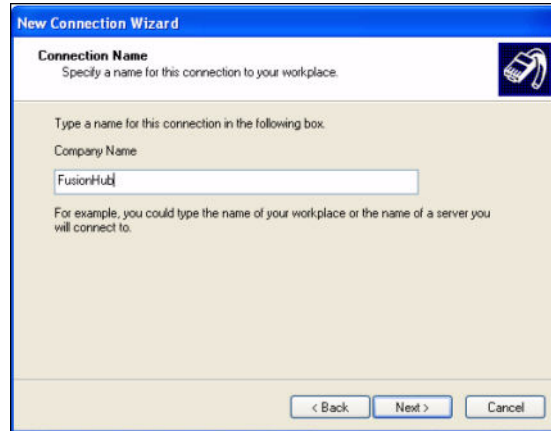
4. Select **Connect to the network at my workplace** and click **Next**. The window shown in Figure 7-35 appears.

Figure 7-35 New Connection Wizard - Network Connection Window



5. Select **Dial-up connection** and click **Next**. The window shown in Figure 7-36 appears.

Figure 7-36 New Connection Wizard - Connection Name Window



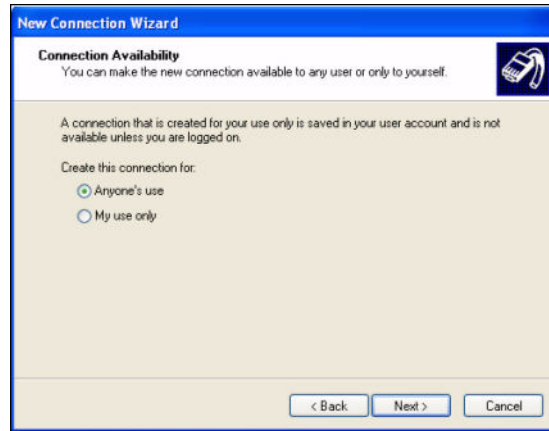
6. Type a name for this connection and click **Next**. The window shown in Figure 7-37 appears.

Figure 7-37 New Connection Wizard - Phone Number to Dial Window



7. Type the desired dial in phone number and click **Next**. The window shown in Figure 7-38 appears.

Figure 7-38 New Connection Wizard - Connection Availability Window



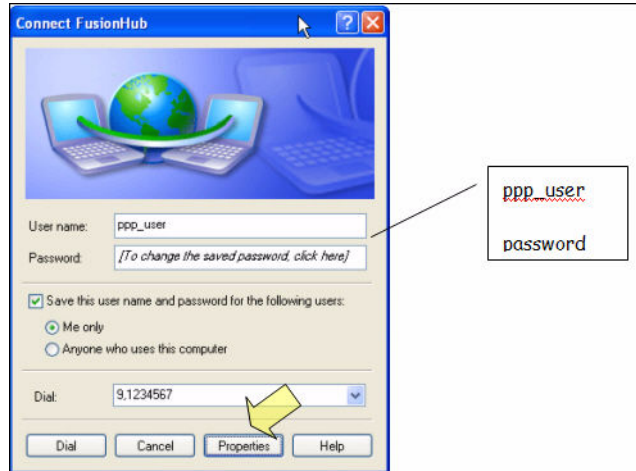
8. Select **Anyone's use** and click **Next**. The window shown in Figure 7-39 appears.

Figure 7-39 New Connection Wizard - Completing New Connection Window



9. Click **Finish**. The window shown in Figure 7-40 appears.

Figure 7-40 Connect Fusion Hub Window

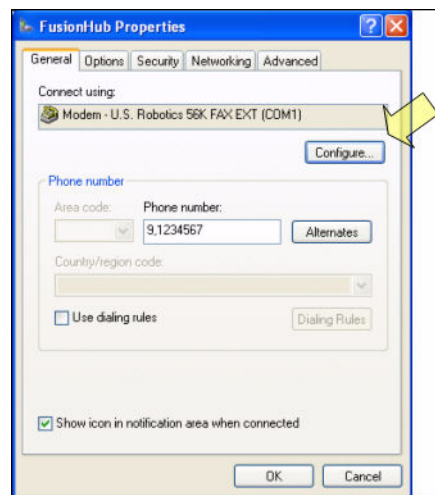


10. Type a password as indicated and click **Properties**. The window shown in Figure 7-41 appears.

The default parameters are as follows:

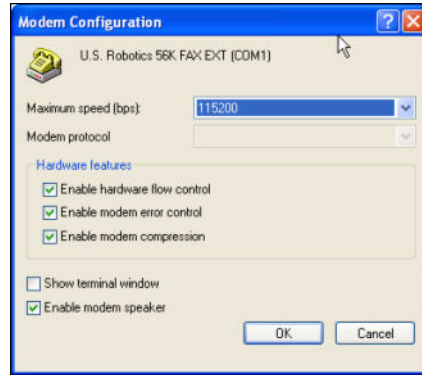
- User name: **pppuser**
- Password (one word, all lower case): **password**

Figure 7-41 Fusion Hub Properties Window



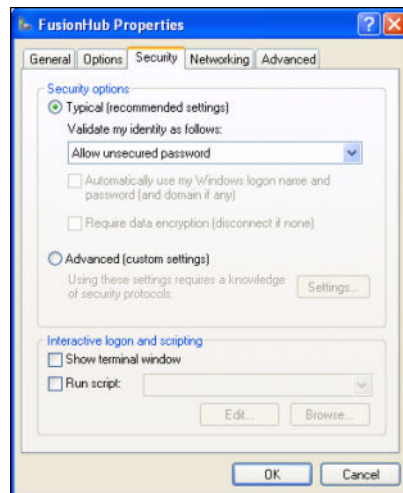
11. Click **Configure...** The window shown in Figure 7-42 appears.

Figure 7-42 Modem Configuration Window



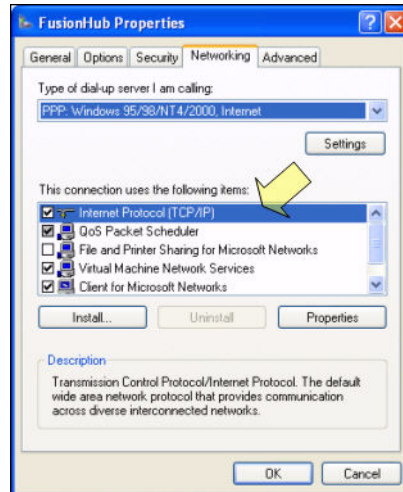
12. Select the modem speed and other parameters for your modem as desired and click **OK**.
13. Select the **Security** tab. The window shown in Figure 7-43 appears.

Figure 7-43 Fusion Hub Properties - Security Tab Window



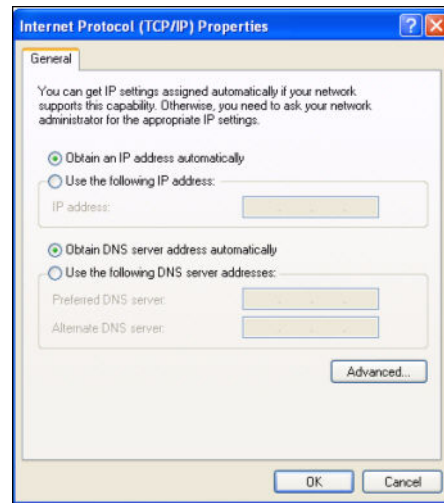
14. Select **Typical** and then click the **Networking** tab. The window shown in Figure 7-44 appears.

Figure 7-44 Fusion Hub Properties - Networking Tab Window



15. Select **Internet Protocol (TCP/IP)** as shown and click **Properties**. The window shown in Figure 7-45 appears.

Figure 7-45 Internet Protocol Properties Window

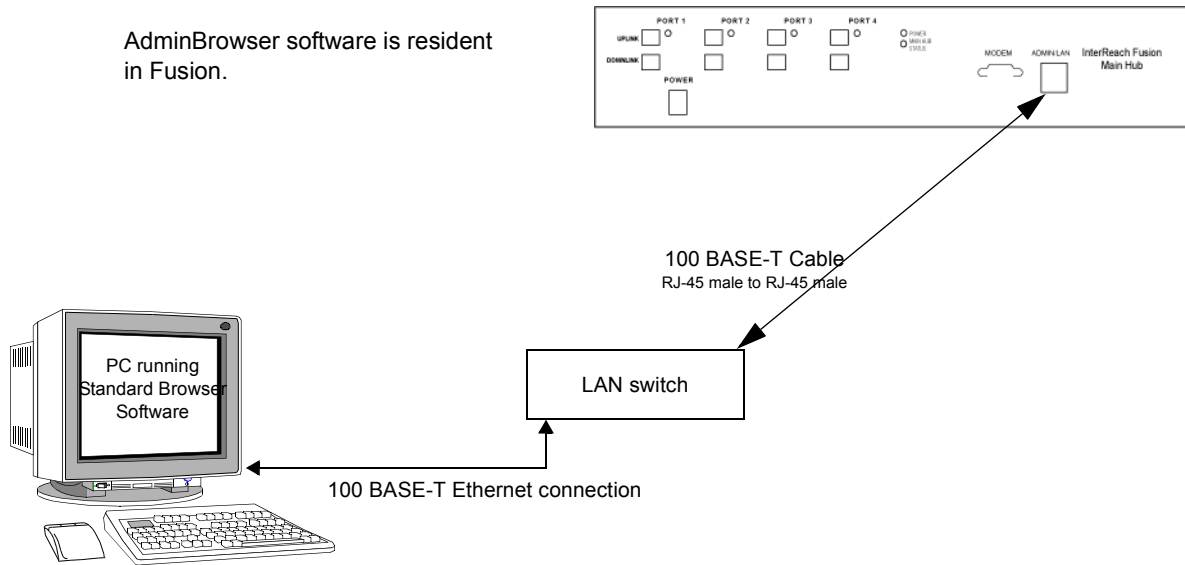


16. Select **Obtain an IP address automatically** and **Obtain DNS server address automatically** and click **OK**.
17. To connect to the Fusion Hub over the Dial-up connection, start your web browser and type the server IP address configured in Section 7.8.2.1 in the address bar.

7.8.3 100 BASE-T Port Expander Connection

In this configuration a LAN switch is used to allow the connection of multiple devices to a single PC with a 100 BASE-T port. Testing was performed with a Linksys 4-port switch. A standard RJ-45 Ethernet cable must be made to connect the LAN switch to the Fusion Main Hub.

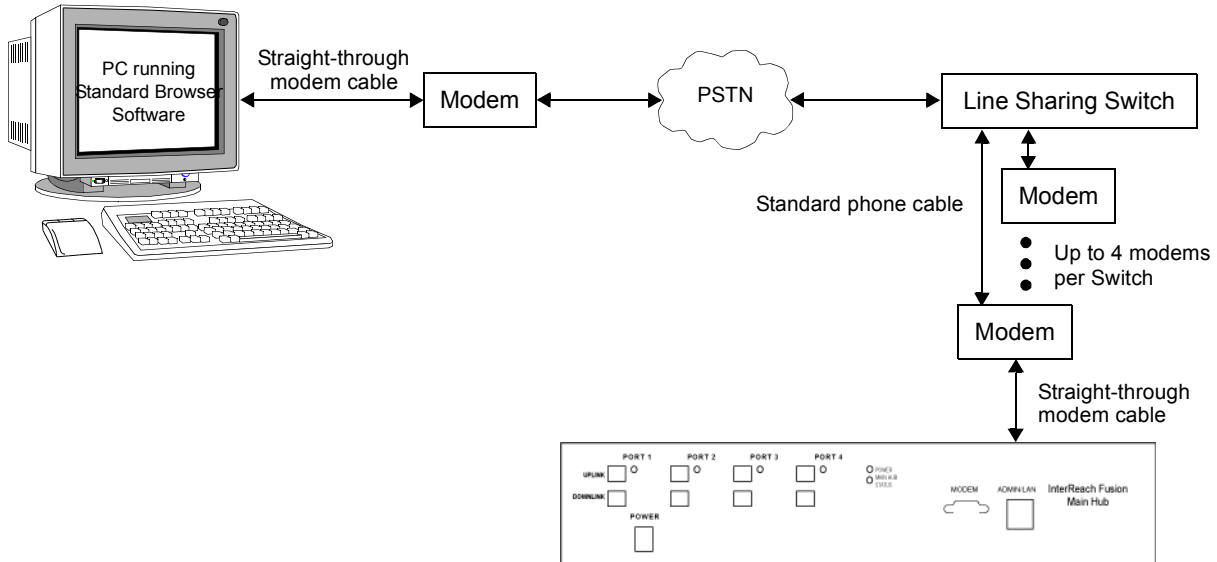
Figure 7-46 OA&M Connection using a 232 Port Expander



7.8.4 POTS Line Sharing Switch Connection

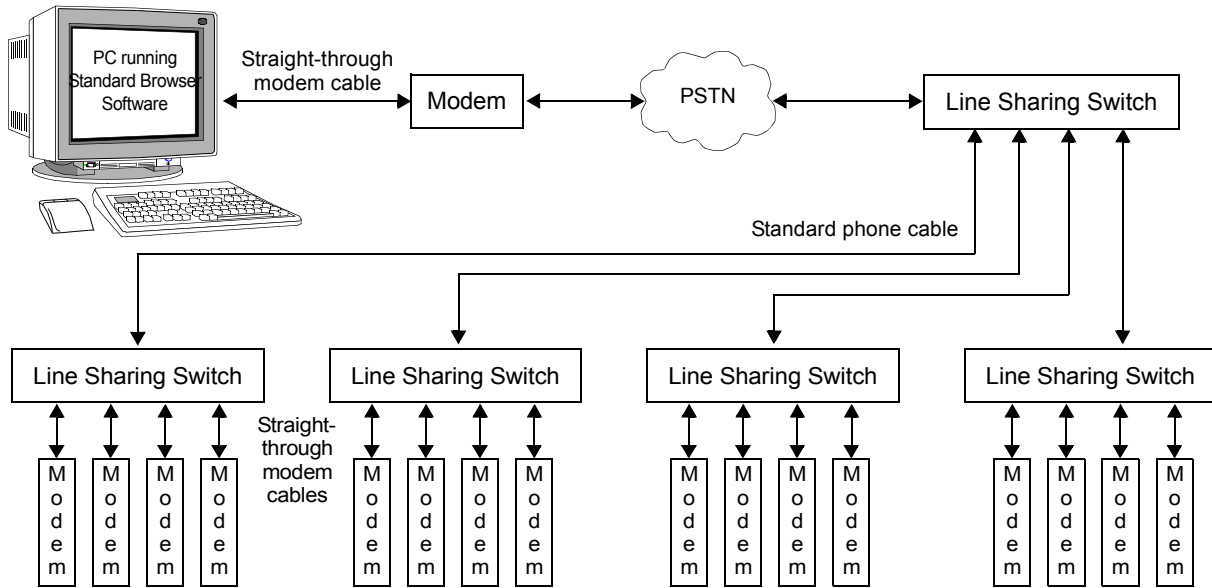
Using a line sharing switch, you can connect up to four modems to a single telephone line. Testing was performed with a Teltone Line Sharing Switch, model number M-394-B-01.

Figure 7-47 OA&M Connection Using a POTS Line Sharing Switch



Up to 16 modems can be monitored using a single telephone line by cascading line sharing switches, as shown in Figure 7-48.

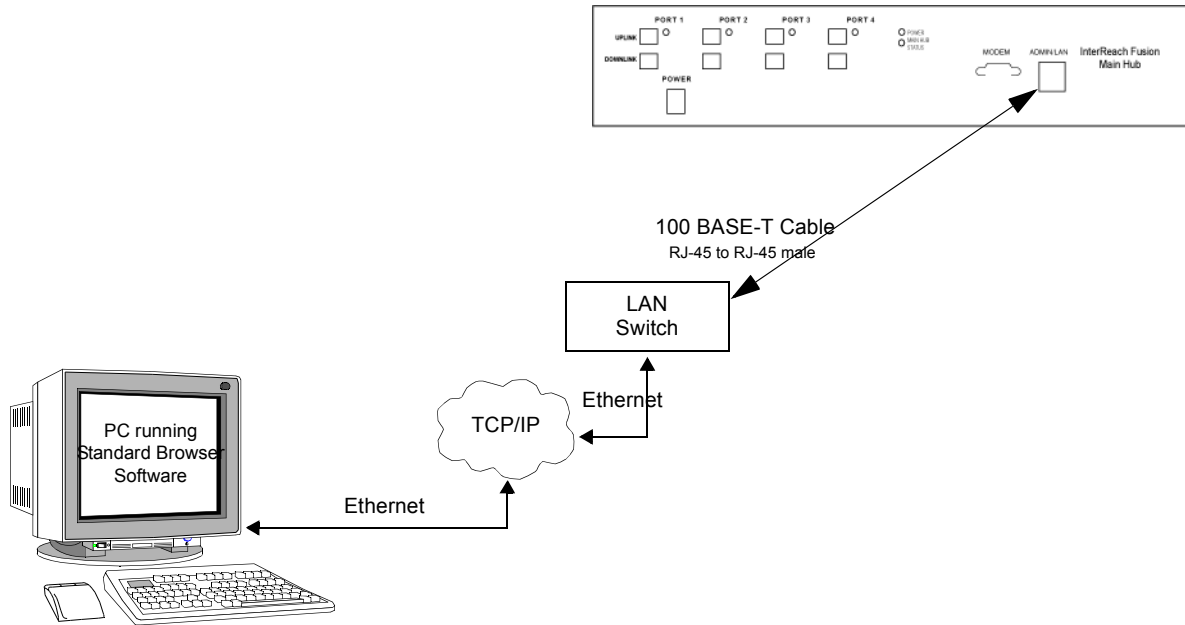
Figure 7-48 Cascading Line Sharing Switches



7.8.5 Ethernet LAN Connection

An Ethernet LAN connection can be used to communicate between the PC and Fusion. Testing was performed with an Linksys 4-port LAN switch.

Figure 7-49 OA&M Connection Using Ethernet and ENET/232 Serial Hub

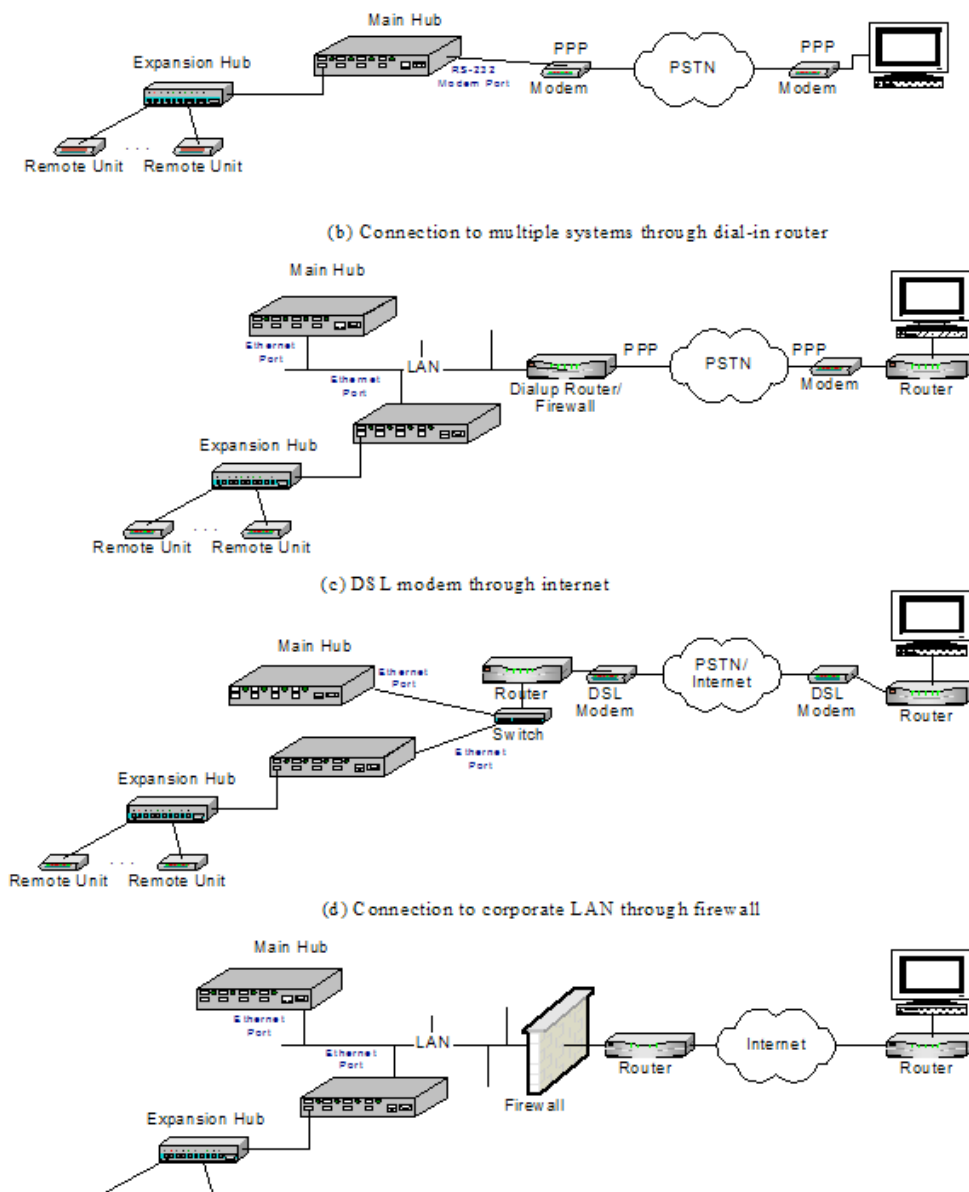


7.8.6 SNMP Interface

Faults and warnings can also be diagnosed with SNMP using a standard (NMS) network management system (optional). SNMP resident software in Fusion provides SNMP interactions for Traps and Notification.

The Fusion SNMP includes a MIB for integrating into the Network Management System (NMS) and supports SNMPv1 and SNMPv2c.

Figure 7-50 Fusion SNMP Configuration Options



Alarm Monitoring Connectivity Options

Replacing Fusion Components

This section contains the following subsections:

- Section 8.1 Replacing an RAU 8-1
- Section 8.2 Replacing a Fusion Expansion Hub 8-3
- Section 8.3 Replacing a Fusion Main Hub 8-4

8.1 Replacing an RAU

Be aware that the new RAU must support the same bands as the one you are replacing. If the RAU is of the wrong band combination, it will not operate properly in the system.

Replacing an RAU

1. Using AdminBrowser, log in and click SYSTEM INFORMATION.
2. Click SHOW SYSTEM TREE, select Fusion Main Hub, and click GET SYSTEM INFORMATION.

All system settings for Hubs and RAUs will be displayed. Write down or save the Uplink and Downlink Attenuation setting so you can set the new RAU with the same settings.

3. Click CANCEL to close the window.
4. Verify that the new RAU is of the same frequency bands as the one replaced.
5. Disconnect the CATV cable and antenna cable from the unit to be replaced.
6. Install the new RAU.
7. Connect the antenna cable and then the CATV cable to the new RAU.
8. Click SYSTEM CONFIGURATION.
9. Click SHOW SYSTEM TREE.
10. Select the Fusion RAU replaced and click EDIT UNIT PROPERTIES.

11. Set the attenuation of each band as the old RAU was programmed and click **SAVE PROPERTIES**.

Perform System Test

When convenient, perform System Test to optimize performance.

During System Test, the entire system is temporarily off-line and no RF is being transmitted.

Checking the RAU's LEDs

1. The RAU's **LINK** and **ALARM** LEDs should blink (green/red) on power up.
 - If the LEDs do not blink on power up, replace the RAU.
2. After several seconds both LEDs should change to green, which indicates that the unit has been successfully replaced, there is communication with the Hub, and the RAU band is correct.
 - a. If the **LINK** LED remains green and the **ALARM** LED remains red, verify that the RAU model is correct for the intended frequency band.
 - Disconnect the cable and then reconnect it once; doing this more than once will not change the result.
 - b. If both LEDs still don't change to green, use AdminBrowser to determine the exact nature of the fault and see a recommendation of how to correct it.
 - c. If both LEDs turn red (after 90 seconds), the Hub has terminated communications.

8.2 Replacing a Fusion Expansion Hub

✓ Replacing a Fusion Expansion Hub

1. Turn off the power to the Expansion Hub.
2. Disconnect all CATV cables, both fiber cables, and the AC power cord.
3. Replace the Expansion Hub with a new one.
4. Connect the AC power cord, all CATV cables, and both fiber cables – remembering to clean and correctly connect the uplink and downlink fiber.
5. Turn on the power to the Expansion Hub.

✓ AdminBrowser Tasks

- The Main Hub automatically issues the band setting.
- When convenient, use AdminBrowser to perform System Test in order to optimize performance.

During System Test, the entire system is temporarily off-line and no RF is being transmitted. For a fully loaded system (one Main Hub, four Expansion Hubs, and 32 RAUs), it can take up to 1.5 minutes to complete the test.

✓ Checking the Expansion Hub's LEDs

- The LEDs should blink through all states on power up.
 - If the LEDs do not blink on power up, replace the Expansion Hub.
 - If the LEDs do not illuminate at all, make sure the AC power cable is connected.
- The **UL STATUS** and **DL STATUS** LEDs should be green.
- The **E-HUB STATUS** and **POWER** LEDs should be green.
- For each CATV port that has an RAU connected the LEDs should be green.
It can take several seconds for each CATV connection for the LEDs to display properly.

NOTE: Refer to Section 9 for troubleshooting using the LEDs.

8.3 Replacing a Fusion Main Hub

You must record the system configuration settings from the old Fusion Main Hub's memory before replacing the unit. You will program the new Main Hub with this information. If the Main Hub is programmed incorrectly, the system will not work. If the Hub to be replaced is not functioning and you cannot use AdminBrowser, get the configuration settings from the As-Built Document that was created as part of the original installation.

✓ Replacing a Fusion Main Hub

1. Using AdminBrowser, log in, click SYSTEM INFORMATION, click SHOW SYSTEM TREE, select Fusion Hub, click GET SYSTEM INFORMATION.
2. Turn off the power to the Fusion Main Hub.
3. Disconnect all cables and the AC power cord.
4. Replace the Main Hub with a new one.
5. Connect the AC power cord and all cables.
6. Connect the crossover Ethernet cable to the PC and then to the Main Hub's front panel 100Base-T connector. ADMIN/LAN port)
7. Start the standard browser on the PC to communicate with AdminBrowser software.
8. Turn on the power to the Main Hub.
9. Observe the LEDs after turning on the power.

All the LEDs blink during the initial power up sequence. All LEDs should turn green after the power on sequence is complete. Power up sequence takes between 1 and 2 minutes depending on the number of RAUs.

✓ Configure the New Fusion Main Hub

1. Using AdminBrowser and log in to the Main Hub.
2. Click SYSTEM CONFIGURATION.
3. Click SET DATE/TIME and enter the current date and time.
4. Click SET DATE/TIME.
5. Follow the instructions to eventually reboot the system to set the date and time.
6. Using AdminBrowser, log in and click SYSTEM CONFIGURATION.
7. Click INSTALL SYSTEM.
8. Set the new Main Hub parameters from the old Main Hub and click INSTALL SYSTEM (that is, uplink and downlink gain, system labels, and so on).
9. Follow the instructions to perform a System Test.

10. Click SYSTEM CONFIGURATION and click on SETUP NETWORK CONNECTION OR MODEM CONNECTION if the Main Hub has Network or Modem equipment connected to it.

During System Test, the entire system is temporarily off-line and no RF is being transmitted.

Checking the Main Hub's LEDs

- The LEDs should blink through a 5-second test on power up.
 - If the LEDs do not blink on power up, replace the Main Hub.
 - If the LEDs do not illuminate at all, make sure the AC power cable is connected.
- For each fiber optic port that has a connected Expansion Hub, which has been programmed with a band, the **PORT** LED should be green.
- Refer to Section 9.3, "Troubleshooting," on page 9-3 for more LED states.

NOTE: If there is no communication between the Main Hub and the Expansion Hubs, use the AdminBrowser to isolate system problems.

Maintenance, Troubleshooting, and Technical Assistance

This section contains the following subsections:

- Section 9.1 Service 9-1
- Section 9.2 Maintenance 9-2
- Section 9.3 Troubleshooting 9-3
- Section 9.4 Troubleshooting CATV 9-10
- Section 9.5 Technical Assistance 9-10

9.1 Service

There are no user-serviceable parts in any of the Fusion components. Faulty or failed components are fully replaceable through LGC Wireless. All units should be replaced and returned to the factory for service if needed.

Address	2540 Junction Avenue San Jose, California 95134-1902 USA
Phone	1-408-952-2400
Fax	1-408-952-2410
Help Hot Line	1-800-530-9960 (U.S. only) +1-408-952-2400 (International)
Web Address	http://www.lgcwireless.com
e-mail	lgccustomersupport@lgcwireless.com

9.2 Maintenance

Keep the fiber ports clean and free of dust. No other periodic maintenance of the Fusion equipment is required.

To clean the fiber ports:

You can clean the Hub's fiber ports using canned compressed air or isopropyl alcohol and cotton swabs.

Considerations:

- If you use compressed air:
 - The air must be free of dust, water, and oil.
 - Hold the can level during use.
- If using isopropyl alcohol and foam-tipped swab:
 - Use only 98% pure or more alcohol.

Procedure using compressed air:

1. Remove the connector's dust cap.
2. Spray the compressed air away from the unit for a few seconds to clean out the nozzle and then blow dust particles out of each fiber port.

Procedure using isopropyl alcohol:

1. Remove the connector's dust cap.
2. Dip a 2.5mm lint-free, foam-tipped swab in isopropyl alcohol and slowly insert the tip into the connector.
3. Gently twist the swab to clean the connector.
4. Insert a dry swab to dry the connector.

Additionally, you can use compressed air after the alcohol has completely evaporated.

9.3 Troubleshooting

NOTE: Fusion has no user-serviceable parts. Faulty or failed units are fully replaceable through LGC Wireless.

Sources of potential problems include:

- Faulty cabling/connector
 - Malfunction of one or more Fusion components
 - Antenna, base station, or repeater problem
 - External RF interface
 - Tripped circuit breaker
 - Equipment is not grounded
 - Using an Ethernet crossover cable that does not support full hardware handshaking when using AdminBrowser
-

NOTE: Faulty cabling is the cause of a vast majority of problems. All CATV 75 Ohm cable should be tested to TIA-570-B specifications. **The RAU will be damaged if the cable connector is not installed properly.**

You must use AdminBrowser for troubleshooting the system, use the LEDs only as backup or for confirmation.

If you cannot determine the cause of a problem after following the recommended procedures, call LGC Wireless customer help hot line:

1-800-530-9960 (U.S. only)
+1-408-952-2400 (International)

Or, email us at lgccustomersupport@lgcwireless.com.

Please provide the following information:

- Serial number of the unit
- Description of the problem
- Using AdminBrowser 1.00, access Special Features, then the Get Service Information window. Save and email this file to LGC Wireless.
- What is the length of the CATV cable? What type is it (for example RG-6)?
- Status of the LEDs on the unit
- Was the unit power cycled?

9.3.1 Troubleshooting Using AdminBrowser

Use AdminBrowser software to determine the current faults and warnings for all of the units in the system. To troubleshoot, start with the Fusion Main Hub's faults AND warnings, then proceed to each of the Expansion Hubs, finishing with each of the RAUs.



NOTE: AdminBrowser v1.00 displays events (faults, warnings, or status messages) depending on your view preference. To change your view preference, refer to Section 3.3.2, "View Preference," on page 3-10.

System Troubleshooting

Using AdminBrowser, click SYSTEM INFORMATION, then click GET FAULTS, WARNINGS AND STATUSES. This gives the present status of the system, depending upon View Preferences for all components.

Faults usually impact service; warnings may impact service; status messages contain information that should not be ignored, but indicate conditions that do not generally impact service.

NOTE: System commands can take longer to execute compared to component commands.

NOTE: This RAU icon  indicates there is fault on the RAU. This icon  indicates a disconnected device. You cannot request status on a disconnected device.

9.3.1.1 Troubleshooting Recommendations

Some actions that you can take, depending on the device fault or warning include, are as follows:

- a. Hardware faults on Expansion Hub.
 - Try swapping fiber with another Expansion Hub at the Main Hub.
 - Try cleaning the fiber and the fiber ports with alcohol foam tip swab and compressed air. See Section , "To clean the fiber ports:," on page -2.
 - Power cycle the Expansion Hub.
- b. Under Alarms, click CLEAR ALL DISCONNECTS at the Fusion Main Hub.

- c. Power cycle the Fusion Main Hub.
- d. RAU hardware faults. Try moving a working CATV to the suspect port and verifying that the RAU comes up OK.
- e. Try isolating the system components:
 - Check to see if the whole system is effected or a portion of the system.
 - If the whole system is effected, disconnect the DAS system from the RF source and see if the RF source is working.
 - Continue to isolate by disabling portions of the system. Under System Configuration, click SHOW SYSTEM TREE and select a component. Then click SET OUT OF SERVICE/SET IN SERVICE.

9.3.1.2 Fault/Warning/Status Indications

Once all of the units are powered on and the cable connections are made, the faults from each unit can be requested using AdminBrowser. Start with the Fusion Main Hub and work downstream.

Resolve all faults first and then check the warnings. Take appropriate action to resolve the faults, as indicated in the following tables. In cases where there is more than one possible cause, they are listed from the “most likely” to the “least likely” cause. Actions are listed in the order that they should be performed; not all actions may need to be done.

NOTE: If you have a red **STATUS** LED without a fault message, it probably indicates that the unit is locked out.

Refer to Appendix C for tables containing Fault, Warning, and Status messages and their meanings.

9.3.2 Troubleshooting Using LEDs

The following troubleshooting guide is from the perspective that all Fusion equipment is installed, their cables are connected, and they are powered on; it is assumed that the system was operating normally before the problem to be diagnosed occurred.

Always use AdminBrowser, if possible, to troubleshoot the system. The Fusion Main Hub and Expansion Hub LEDs are for backup troubleshooting. The RAU LEDs probably will not provide additional information for troubleshooting.

9.3.2.1 Troubleshooting Main Hub LEDs During Normal Operation

All of the Main Hub’s LEDs should be green during normal operation. If any LEDs are red, get status using AdminBrowser to determine the exact cause and recommendations.

Table 9-1 Troubleshooting Main Hub Port LEDs During Normal Operation

During Normal Operation	Main Hub Port LEDs	State	Action	Impact
Expansion Hub Not Connected	PORT	Red	<p>If the Expansion Hub was disconnected accidentally, re-connect the cables. The LEDs should change to Green/Red (then Green/Green, after 20 seconds, if the Main Hub band has been programmed).</p> <p>When the Expansion Hub is to be removed from service permanently, use AdminBrowser’s ‘Clear All Disconnect Status’ command to clear all disconnect states to no connect states.</p>	<p>The Expansion Hub was previously connected, but it is not currently connected; the Expansion Hub uplink cable disconnected.</p> <p>AdminBrowser clears all disconnects caused by installation as part of the clean-up process. After installation, power cycle the Main Hub or use AdminBrowser’s “Clear All Disconnect Status” command.</p> <p>Changes the Main Hub’s port LEDs to Off/Off.</p>
Expansion Hub Connected	PORT	Red 60 ppm)	Use AdminBrowser to determine the exact cause of the Main Hub’s faults.	<p>Lost communication with Expansion Hub; could be Expansion Hub problem or fiber cable problem.</p> <p>The Expansion Hub communication problems delay MH responses to AdminBrowser commands, resulting in command time-outs. You can disconnect the offending Expansion Hub initially to obtain status from the rest of the system, then connect the Expansion Hub and resolve the communication problem.</p>
	PORT	Red	The Expansion Hub or connected RAU reports a fault condition; use AdminBrowser to determine the exact cause of the Expansion Hub and RAU’s faults.	<p>Degraded performance or unit may be off-line.</p> <p>Depends on fault condition.</p>

Table 9-2 Troubleshooting Main Hub Status LEDs During Normal Operation

During Normal Operation	Main Hub Status LEDs	State	Action	Impact
At Any Time	MAIN HUB STATUS	Red	Use AdminBrowser to determine the exact cause of the fault. Power cycle one time. If the fault remains, replace the Main Hub.	Internal Main Hub fault.
			Use AdminBrowser to check if the Main Hub is commanded Out-of-Service (every Expansion Hub port status LED will be red as well). A power cycle will not clear a commanded Out-of-Service, you must use AdminBrowser to clear this state.	The Main Hub and all downstream units are off-line.
	MAIN HUB STATUS	Flashing Red (60ppm)	Reduce input signal power.	Signal compression.
At Any Time	POWER	Red	Replace the Main Hub.	One or more power supplies are out of specification.

9.3.2.2 Troubleshooting Expansion Hub LEDs During Normal Operation

- All of the Expansion Hub **LINK** and **E-HUB/RAU** LEDs that have RAUs connected should be Green/Green, indicating that the RAU is powered on, communication is established, and operation is normal.
- The **POWER**, **EHUB STATUS**, **DL STATUS**, and **UL STATUS** LEDs should all be Green.

Table 9-3 Troubleshooting Expansion Hub Port LEDs During Normal Operation

During Normal Operation	Expansion Hub Port LEDs	State	Action	Impact
RAU is not connected	PORT	Off	If the RAU was disconnected accidentally, re-connect the CATV cable. The Expansion Hub’s port LEDs should change to Green/Red (then Green/Green, after 20 seconds, if the Main Hub is connected, powered on, and has band programmed). Use AdminBrowser’s “Clear All Disconnect Status” command if you are permanently removing the RAU from service. The Expansion Hub’s port LEDs should change to Off/Off.	The RAU was previously connected, but it is not currently connected; the RAU cable is disconnected.
RAU is connected	PORT	Red	Disconnect/reconnect the CATV cable to force power-on reset to the RAU. If the port LEDs remain Red check for the exact cause of Expansion Hub faults using AdminBrowser.	Lost communications with the RAU. The RAU could have powered down due to over current; cable could have been damaged.
	PORT	Flashing Red (60 ppm)	The RAU reports a fault condition; check for the exact cause of Expansion Hub and RAU faults using AdminBrowser.	Depends on the fault condition.
	PORT	Flashing Red (60 ppm)	The Expansion Hub reports no connection, cable shorts, or a current port trap condition.	Expansion Hub communications with the RAU. The Expansion Hub is at fault. The cable could have been damaged. The cable leads may be shorted.

Table 9-4 Troubleshooting Expansion Hub Status LEDs During Normal Operation





During Normal Operation	Expansion Hub Status LEDs	State	Action	Impact
At Any Time	UL STATUS	Red	Check uplink fiber for optical loss. Power cycle Expansion Hub one time to check uplink laser.	No communications between the Main Hub and the Expansion Hub. Uplink laser failure.
	DL STATUS	Red	Check the downlink fiber for optical loss	No communications with the Main Hub.
	E-H STATUS	Red	If either the UL STATUS or the DL STATUS are also red, see above. Cycle power on the Expansion Hub. If fault remains, replace the Expansion Hub.	Internal Expansion Hub fault (including either of the above UL STATUS or DL STATUS states).

9.4 Troubleshooting CATV

The following table summarizes CATV problems, as reported by AdminBrowser if a cable is cut or miswired.

NOTE: Recommended minimum and maximum CATV cable lengths vary depending upon the type of CATV cable used. Refer to Section 6.1.2, “Cable and Connector Requirements,” on page 6-2.

Table 9-5 Summary of CATV Cable Wiring Problems

Problem Type	Message	Icon	Impact
Loose connector, shorted conductor or improper connection to the shield.	None		High phase noise, degraded signal on both Downlink and Uplink (high bit error rate)
	• No communication with RAUn		RAU unable to communicate with Hub, degraded performance or RAU off-line
	• Portn UL RF path loss is too high		Increased ripple in the uplink path, decreased UL gain, or no UL gain
	• The DL RF path loss is too high		Increased ripple in the downlink path, RAU off-line
	• RAUn over current or port short		RAU will not power on.

9.5 Technical Assistance

Call our help hot line for technical assistance:

1-800-530-9960 (U.S. only)
 +1-408-952-2400 (International)
lgccustomersupport@lgcwireless.com

Leave your name and phone number and an LGC Wireless customer service representative will return your call within an hour. Be prepared to provide the following information when you receive the return call:

- Company name
- End user name
- Type of system, model number, frequency
- Approximate time in service (warranty), sales order number
- Description of problem
- LED status
- AdminBrowser faults, warnings, and status messages

Cables and Connectors

A.1 75 Ohm CATV Cable

- Connects the Expansion Hub to the RAU(s)
- Transmits multiband (downlink) and receives (uplink) IF signals
- Delivers DC electrical power to the RAUs. The Fusion Hub's DC voltage output is 54V DC nominal. A current limiting circuit is used to protect the Hub if it reaches its current limit
- Carries configuration and status information
- Use 75 Ohm type-F connectors with captive centerpins
- Lengths:
 - RG-59:
 - Minimum: 0 meters (0 ft.)
 - Maximum: 150 meters (492 ft.)
 - RG-6:
 - Minimum: 0 meters (0 ft.)
 - Maximum: 170 meters (558 ft.)
 - RG-11:
 - Minimum: 0 meters (0 ft.)
 - Maximum: 275 meters (902 ft.)

Recommended minimum and maximum CATV cable lengths vary depending upon which CATV cable you use.

Be sure to test cable termination before installing the cable.

CommScope CATV cable or equivalent is required:

CommScope 20655V for RG-59. This cable is illustrated in Figure A-1.

CommScope 2279V for RG-6. This cable is illustrated in Figure A-2.

CommScope 2293K for RG-11. This cable is illustrated in Figure A-3.

Figure A-1 CommScope 2065V for RG-59

CONSTRUCTION:

CENTER CONDUCTOR:
20 AWG Solid Copper (.0320" +/- .0003")

DIELECTRIC:
Foamed Fluorinated Ethylene Propylene (FFEP)
Dia. Over Dielectric: 0.135" +/- 0.004" Nom.

SHIELD:
Foil: Aluminum/Poly Tape
Braid: 34 AWG 7 End Tin/Copper
96% Coverage
Nom. Dia. 0.170"

JACKET:
Flame Retardant Polyvinylchloride (PVC) (2065V)
Kynar (2065K)
Dia. Over Jacket: 0.207" +/- 0.002"
Min. Avg. Jkt. Thickness: 0.016"
Min. Spot: 0.012"



ELECTRICAL PROPERTIES:

SPARKER TEST: 2500 VAC

DIELECTRIC STRENGTH: Conductor to Shield – 3 Sec. @ 2500 VDC

CAPACITANCE: 16.1 pF/ft. Nom.

IMPEDANCE: 75.0 +/- 3 Ohms

VELOCITY OF PROPAGATION: 84.0% Nom.

DCR: Cond: 10.34 Ohms/1000 Ft. Nom.
Shield: 2.7 Ohms/1000 Ft. Nom.

SRL: 23 dB (5 to 450 MHz) 100% Swept Tested
15 dB (451 – 2400 MHz) 100% Swept Tested

ATTENUATION:

dB/100 Ft. (Nom.)	@ Frequency MHz
.30 dB	1 MHz
.54 dB	3.6 MHz
0.88 dB	10 MHz
2.16 dB	71.5 MHz
2.90 dB	135 MHz
4.16 dB	270 MHz
4.98 dB	360 MHz
7.61 dB	720 MHz

MECHANICAL PROPERTIES:

MINIMUM BEND TEST:
Loaded: 20 Times Cable OD
Unloaded: 10 Times Cable OD

JACKET TEMP. RATING:
Temp: 60°C (2065V)
125°C (2065K)

Figure A-2 CommScope 2279V for RG-6

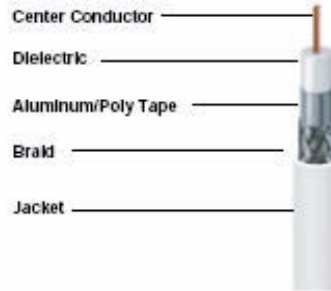
CONSTRUCTION:

CENTER CONDUCTOR:
18 AWG Solid Copper

DIELECTRIC:
Foamed Fluorinated Ethylene Propylene (FFEP)
Dia. Over Dielectric: 0.170" +/- 0.004" Nom.

SHIELD:
Foil: Aluminum/Poly Tape
Braid: 34 AWG Tinned Copper
95% Coverage
Nom. Dia. 0.205"

JACKET:
Plenum Polyvinylchloride (PL-PVC)
Dia. Over Jacket: 0.237" +/- 0.004"
Max. Avg. Jkt. Thickness: 0.016"
Min. Spot: 0.013"



ELECTRICAL PROPERTIES:

SPARKER TEST: 4000 VAC

DIELECTRIC STRENGTH: Conductor to Shield – 3 Sec. @ 2500 VDC

CAPACITANCE: 16.0 pF/ft.

IMPEDANCE: 76.0 +/- 2 Ohms

VELOCITY OF PROPAGATION: 84.0% Nom.

DCR: 6.5 Ohms/1000 ft.

SRL: 23 dB (1 to 450 MHz) 100% Swept Tested
15 dB (451 – 2400 MHz) 100% Swept Tested

ATTENUATION:

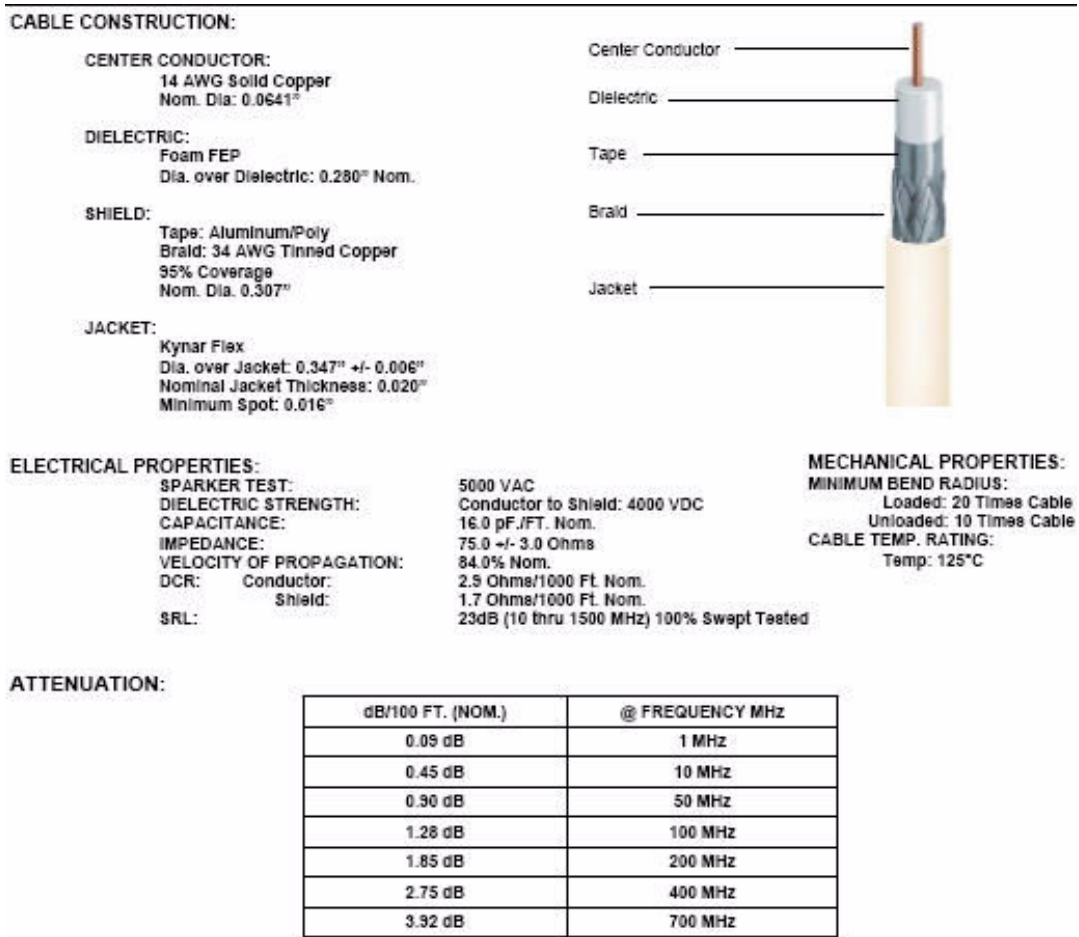
dB/100 Ft. (Nom.)	@ Frequency MHz
.26 dB	1 MHz
.47 dB	3.6 MHz
.70 dB	10 MHz
1.65 dB	71.5 MHz
2.39 dB	135 MHz
3.40 dB	270 MHz
4.08 dB	360 MHz
6.05 dB	720 MHz

MECHANICAL PROPERTIES:

MINIMUM BEND TEST:
Loaded: 20 Times Cable OD
Unloaded: 10 Times Cable OD

JACKET TEMP. RATING:
Temp: 60°C

Figure A-3 CommScope 2293K for RG-11



NOTE: LGC Wireless requires solid copper center conductor CATV cable for proper DC voltage to the RAU and maximum distances.

Use the following connectors and tools to prepare the cable ends:

CommScope cable part number: 2065V

Canare part number: F connector FP-C4F

Crimp Tool TC-1, Crimp Die TCD-4C, Cable Strip preparation tool TS100E

CommScope cable part number: 2279V

Canare part number: F connector FP-C55A

Crimp Tool TC-1, Crimp Die TCD-35CA, Cable Strip preparation tool TS100E

CommScope cable part number: 2293V

Canare part number: F connector FP-C71A

Crimp Tool TC-1, Crimp Die TCD-7CA, Cable Strip preparation tool TS100E

If the maximum distance is not required, then copper-clad over steel-center conductor cable may be used to reduce cable costs.

Table A-2 shows CommScope cable choices of plenum, non-plenum, solid copper conductor, and copper-clad over-steel conductor cable with their part numbers and maximum distances.

Table A-1 System Gain (Loss) Relative to CATV Cable Length (All RAUs except 800/900/1900)

Cable Type	Comm-Scope Part Number	Plenum Rated	Solid Copper Conductor	Copper Clad Conductor	Zero-loss RF Maximum Length (meters)	Distance Where RF is 10dB Below Input RF (meters)
RG-59						
	2065V	Yes	X		150	210
	2022V	Yes		X	120	120*
	5572R	No		X	110	110*
	5565	No	X		150	210
RG-6						
	2279V	Yes	X		170	230
	2275V	Yes		X	170	175*
	5726	No		X	170	170*
	5765	No	X		170	230
RG-11						
	2293K	Yes	X		275	375
	2285K	Yes		X	275	370*
	5913	No		X	275	370*

* Exceeding the distance of copper-clad cable will result in the attached RAU becoming non-functional. If the distance of a cable run is at its maximum and is of concern, LGC recommends the use of solid copper cable to ensure successful operation.

Table A-2 System Gain (Loss) Relative to CATV Cable Length for 800/900/1900 RAUs

Cable Type	Comm-Scope Part Number	Plenum Rated	Solid Copper Conductor	Copper Clad Conductor	Zero-loss RF Maximum Length (meters)	Distance Where RF is 10dB Below Input RF (meters)
RG-59						
	2065V	Yes	X		150	210
	2022V	Yes		X	80	80*
	5572R	No		X	70	70*
	5565	No	X		150	210
RG-6						
	2279V	Yes	X		170	230
	2275V	Yes		X	115	115*
	5726	No		X	110	110*
	5765	No	X		170	230
RG-11						
	2293K	Yes	X		275	375
	2285K	Yes		X	240	240*
	5913	No		X	240	240*

* Exceeding the distance of copper-clad cable will result in the attached RAU becoming non-functional. If the distance of a cable run is at its maximum and is of concern, LGC recommends the use of solid copper cable to ensure successful operation.

A.2 Fiber Optical Cables

- Connects the Main Hub to Expansion Hub(s)
- Transmits (downlink) and receives (uplink) optical signals
- Carries configuration and status information
- Use industry-standard 62.5 μ m/125 μ m MMF or Corning SMF-28 fiber, or equivalent.
- SC/APC (angle-polished) connectors are required throughout the fiber network (port-to-port), including fiber distribution panels
- Distances:
 - Multi-mode Fiber: up to 500 m (1,640 ft) – 3 dB optical loss maximum
 - Single-mode Fiber: up to 6 km (19,685 ft) – 3 dB optical loss maximum

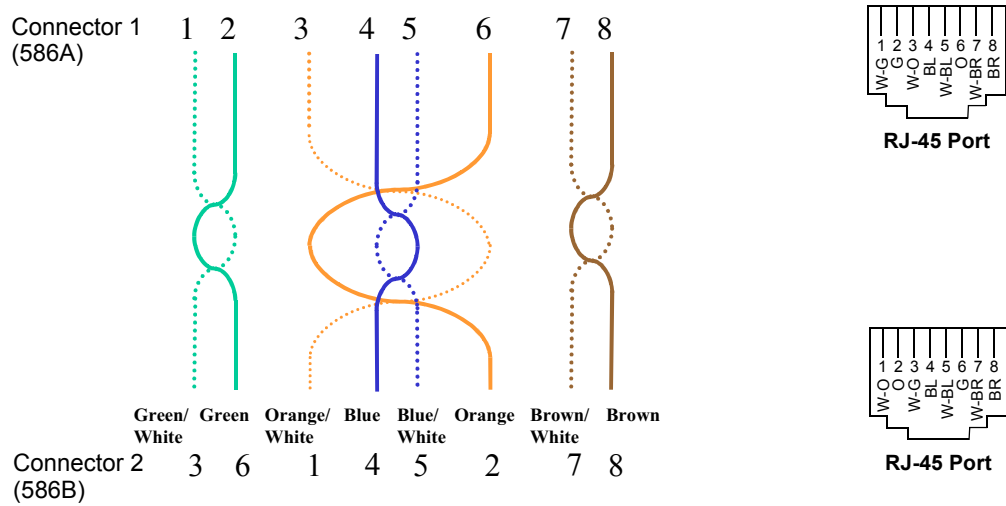
A.3 Coaxial Cable

- Connects a Fusion Hub to a repeater or base station (N-type connectors)
- Connects an RAU to a passive antenna (N-type connectors)

A.5 TCP/IP Cross-over Cable

A TCP/IP cross-over cable (PN 4069-ADB) is used to connect a standard browser PC to the AdminBrowser with a Fusion Hub. A cable is included with the Fusion Hub. The pinouts for this cable are illustrated in Figure A-2.

Figure A-2 Wiring Map for TCP/IP Cable



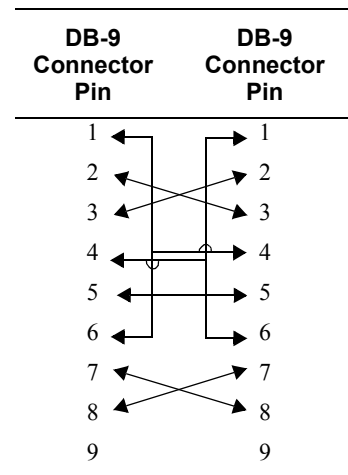
A.6 DB-25 to DB-9 Null Modem Cable

Use a DB-9 female to DB-9 female null modem cable to connect the craft person's PC/Laptop to the RS-232 port on the front of the Fusion Hub for IP address configuration. Table A-3 lists the cable pinout and Figure A-3 shows a diagram of its wiring.

Table A-3 DB-9 Female to DB-9 Female Null Modem Cable Pinout

From	Signal	To	Signal
P1-4	DTR	P2-6, P2-1	DSR, DCD
P1-6	DSR	P1-1, P2-4	DCD, DTR
P1-3	TXD	P2-2	RXD
P1-2	RXD	P2-3	TXD
P1-5	GND	P2-5	GND
P1-7	RTS	P2-8	CTS
P1-8	CTS	P2-7	RTS
P1-9	N/C	N/C	N/C

Figure A-3 DB-9 Female to DB-9 Female Null Modem Cable Diagram



Note that for each DB-9 connector, pins 1 and 6 are tied together and sent to pin 4 of the opposite connector, providing the required handshake signals.

B.1 Fusion System Approval Status

InterReach Fusion has been approved as shown below.

800 SMR/iDEN Products

- Safety: UL 60950, 3rd Edition
- EMC: FCC part 15 class A
- Radio: FCC Part90

850 Cellular Products

- Safety: CB scheme evaluation to IEC 60950, 3rd Edition with all national deviations.
- EMC: FCC part 15 class A
- Radio: FCC Part 22

900 Paging/SMR/iDEN Products

- Safety: UL 60950, 3rd Edition
- EMC: FCC part 15 class A
- Radio: FCC Part 90

1800 DCS Products-Pending

- Safety: CB scheme evaluation to IEC 60950, 3rd Edition with all national deviations.
- EMC: EN 301 489-8 V.1.2.1 (2002-08)
- Radio: EN 502 V.8.1.2 (2001-07)

900 GSM/EGSM Products-Pending

- Safety: CB scheme evaluation to IEC 60950, 3rd Edition with all national deviations.
- Radio: EN 301 502 V.8.1.2 (2001-07)
- EMC: EN 301 489-8 V.1.2.1 (2002-08)

1900 PCS Products

- Safety: CB scheme evaluation to IEC 60950, 3rd Edition with all national deviations.
- EMC: FCC part 15 class A
- Radio: FCC part 24

2100 UMTS Products-Pending

- Safety: CB scheme evaluation to IEC 60950, 3rd Edition with all national deviations.
- EMC: ETSI TS 125 113 125 113 (2005-12)
- Radio: EN 301 908-11 V2.3.1 (2004-10)

InterReach Fusion Main Hub and Expansion Hub

- Safety: CB scheme evaluation to IEC 60950-1, First Edition with all national deviations.
- EMC: FCC part 15 class A
- Radio: EN 301 502 V.8.1.2 (2001-07)
- EMC: EN 301 489-8 V.1.2.
- EMC: ETSI TS 125 113 125 113 (2005-12)
- Radio: FCC Part 22H
- Radio: FCC part 24
- Radio: EN 301 908-11 V2.3.1 (2004-10)
- EMC: CISPR 22A
- EMC: CISPR 24

NOTE: for Canadian customers, the Manufacturer's rated output power¹ of this equipment is for single carrier operation. For situations when multiple carrier signals are present, the rating would have to be reduced by 3.5 dB, especially where the output signal is re-radiated and can cause interference

to adjacent band users. This power reduction is to be by means of input power or gain reduction and not by an attenuator at the output of the device.

NOTE: This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

B.2 Human Exposure to RF

The U.S. Federal Communications Commission (FCC) has developed guidelines for evaluation of human exposure to RF emissions. The guidelines incorporate limits for Maximum Permissible Exposure (MPE) for power density of transmitters operating at frequencies between 300 kHz and 100 GHz. Limits have been set for portable, mobile, and fixed equipment. LGC products fall in the category of fixed equipment; products intended to be permanently secured and exposures are evaluated for distances greater than 20cm (7 7/8”). Portable devices fall into exposures of less than 20cm, are SAR evaluations are used.

Antenna gain is restricted to 1.5 W ERP (2.49 W EIRP) in order to satisfy RF exposure compliance requirements. If higher than 1.5 W ERP, routine MPE evaluation is needed. The antennas should be installed to provide at least 20 cm from all persons to satisfy MPE requirements of FCC Part 2, 2.1091.

Basic MPE evaluation is performed by taking the maximum power output of the equipment, the gain of the antenna to be used, and distance from the antenna, referenced in FCC OET Bulletin 65 “*Evaluation Compliance with FCC Guidelines for Human Exposure to Radio Frequency for Electric Fields*”.

LGC products transmit well below the FCC power density limits. FCC defines power output limits

at 20cm distance for various frequency ranges:

- Over 300 MHz to 1.5 GHz the limit is determined by frequency/1500
- Above 1.5 GHz the limit is 1mW/cm²

The basic equation for determining power density is:

$$S = PG / 4\pi R^2$$

1. “Manufacturer’s rated output power” refers to Fusion’s downlink P1dB. The power per carrier tables take into account this power reduction for multiple carriers.

Where **S** is power density in mW/cm²

PG, the transmitted power from the antenna identified as EIRP (Equivalent Isotropically Radiated Power), is the product of power output of device and antenna gain, in mW.

R is the distance of interest from the antenna.

Typical Installation Example:

Assuming an antenna is placed on a 10 foot ceiling, for a person 6 feet tall, the distance from antenna to body is 4 feet (112 cm).

For a PCS 1900 or Cell 850 remote unit, the maximum power output, according to the power table in Section 6.3 Maximum Output Power per Carrier on page 6-4, is 16.5 dB.

Assuming a 7 dBi antenna is used, PG in the equation is equal to 23.5 dB (224 mW) EIRP.

Using $S = PG/4\pi R^2$

$$S = 224/(4 \times 3.14) \times (112)^2 = 0.001 \text{ mW/cm}^2$$

Also, assuming a minimum distance of 20 cm according to FCC regulations"

$$S = 224/(4 \times 3.14) \times (20)^2 = 0.04 \text{ mW/cm}^2$$

Faults, Warnings, Status Tables

This appendix contains the following sections:

- Section C.1 Faults Reported by Fusion Main/SingleStar Hubs A-1
- Section C.2 Faults Reported for System CPU A-5
- Section C.3 Faults for Fusion Expansion Hubs A-6
- Section C.4 Faults for RAUs A-9
- Section C.5 Warning/Status Messages for Fusion Main/SingleStar Hubs A-10
- Section C.6 Warning/Status Messages for System CPUs A-15
- Section C.7 Warning/Status Messages for Fusion Expansion Hubs A-16
- Section C.8 Warning /Status Messages for RAUs A-19

The following tables contain messages for all versions of firmware, but all messages are not displayed by a given firmware version.

C.1 Faults Reported by Fusion Main/SingleStar Hubs

Faults indicate service-impacting conditions and should be given immediate attention.

Once all of the units are powered on and the cable connections are made, the faults from each unit can be requested using AdminBrowser. Start with the Fusion Main Hub and work downstream.

Resolve all faults first and then check the warnings. Take appropriate action to resolve the faults, as indicated in the following tables. In cases where there is more than one possible cause, they are listed from the “most likely” to the “least likely” cause. Actions are listed in the order that they should be performed; not all actions may need to be done.

NOTE: If you have a red **STATUS** LED without a fault message, it probably indicates that the unit is locked out.

Table C-1 Fault Messages for Fusion Main/SingleStar Hubs

Message Number	Description	Reason/Action
{MF01}	Software error occurred and recovered.	If this happens repeatedly, replace the Hub.
{MF02}	Software error occurred and recovered.	If this happens repeatedly, replace the Hub.
{MF03}	Software error occurred and recovered.	If this happens repeatedly, replace the Hub.
{MF04}	Software reset occurred and recovered, or firmware download.	If this happens repeatedly, replace the Hub.
{MF05}	Software error occurred and recovered.	If this happens repeatedly, replace the Hub.
{MF06}	Problem detected in the Hub. Internal communication reset.	Contact LGC Wireless Support for more information.
{MF07}	Hub power cycle.	Hub power cycle.
{MF08}	Internal communications failure.	No internal communications in preceding 15 minutes.
{MF09}	Hardware Reset.	Commanded hardware power on reset
{MF10}	Band not programmed.	Use AdminBrowser to program the band.
{MF11}	Hardware failure (DL Pilot PLL).	Cycle power once. If fault persists, replace the Hub
{MF12}	Hardware failure (DL Pilot Too High).	Cycle power once. If fault persists, replace the Hub.
{MF13}	Hardware failure (DL Pilot Too Low).	Cycle power once. If fault persists, replace the Hub.
{MF14}	Hardware failure (54 VDC).	54 VDC power supply is out of range, replace the Hub
{MF15}	Hardware failure (RF VDC Power).	Loss of DC power to RF circuits, replace the Hub.
{MF16}	Self Lockout (All Bands).	Hub has shutdown the system due to an internal fault. System is offline.
{MF17}	Hardware failure (DL PLL Band 1).	Cycle power once. If fault persists, replace the Hub.
{MF18}	Hardware failure (UL PLL Band 1).	Cycle power once. If fault persists, replace the Hub
{MF19}	Commanded Out-of-service (Band 1).	Band 1 commanded out-of-service by User.
{MF20}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF21}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF22}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF23}	Problem detected in the Hub	Contact LGC Wireless Support for more information.
{MF24}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF25}	Hardware failure (DL PLL Band 2).	Cycle power once. If fault persists, replace the Hub.
{MF26}	Hardware failure (UL PLL Band 2).	Cycle power once. If fault persists, replace the Hub.
{MF27}	Commanded Out-of-service (Band 2).	Band 2 commanded out-of-service by User.
{MF28}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF29}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF30}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF31}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF32}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF33}	Hardware failure (DL PLL Band 3).	Cycle power once. If fault persists, replace the Hub.

Table C-1 Fault Messages for Fusion Main/SingleStar Hubs (continued)

Message Number	Description	Reason/Action
{MF34}	Hardware failure (UL PLL Band 3).	Cycle power once. If fault persists, replace the Hub.
{MF35}	Commanded Out-of-service (Band 3).	Band 3 commanded out-of-service by User.
{MF36}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF37}	Problem detected in the Hub	Contact LGC Wireless Support for more information.
{MF38}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF39}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF40}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF41}	Hardware failure (Optical Power Out).	Cycle power once. If the fault persists, replace the Hub.
{MF42}	Problem detected in the Hub	Contact LGC Wireless Support for more information.
{MF43}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF44}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF45}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF46}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF47}	Problem detected in the Hub	Contact LGC Wireless Support for more information.
{MF48}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MD129}	Port 1 Disconnected.	Unit is disconnected.
{MD130}	Port 2 Disconnected.	Unit is disconnected.
{MD131}	Port 3 Disconnected.	Unit is disconnected.
{MD132}	Port 4 Disconnected.	Unit is disconnected.
{MD133}	Port 5 Disconnected.	Unit is disconnected.
{MD134}	Port 6 Disconnected.	Unit is disconnected.
{MD135}	Port 7 Disconnected.	Unit is disconnected.
{MD136}	Port 8 Disconnected.	Unit is disconnected.
{MC137}	Port 1 No Communications.	No communications with remote unit.
{MC138}	Port 2 No Communications.	No communications with remote unit.
{MC139}	Port 3 No Communications.	No communications with remote unit.
{MC140}	Port 4 No Communications.	No communications with remote unit.
{MC141}	Port 5 No Communications.	No communications with remote unit.
{MC142}	Port 6 No Communications.	No communications with remote unit.
{MC143}	Port 7 No Communications.	No communications with remote unit.
{MC144}	Port 8 No Communications.	No communications with remote unit.
{MT145}	Port 1 Cable Fault.	Possible electrical short in the coax cable, or RAU problem.
{MT146}	Port 2 Cable Fault.	Possible electrical short in the coax cable, or RAU problem.
{MT147}	Port 3 Cable Fault.	Possible electrical short in the coax cable, or RAU problem.
{MT148}	Port 4 Cable Fault.	Possible electrical short in the coax cable, or RAU problem.
{MT149}	Port 5 Cable Fault.	Possible electrical short in the coax cable, or RAU problem.

Table C-1 Fault Messages for Fusion Main/SingleStar Hubs (continued)

Message Number	Description	Reason/Action
{MT150}	Port 6 Cable Fault.	Possible electrical short in the coax cable, or RAU problem.
{MT151}	Port 7 Cable Fault.	Possible electrical short in the coax cable, or RAU problem.
{MT152}	Port 8 Cable Fault.	Possible electrical short in the coax cable, or RAU problem.
{MT153}	Port 1 Trip.	Remote Unit is drawing too much current.
{MT154}	Port 2 Trip.	Remote Unit is drawing too much current.
{MT155}	Port 3 Trip.	Remote Unit is drawing too much current.
{MT156}	Port 4 Trip.	Remote Unit is drawing too much current.
{MT157}	Port 5 Trip.	Remote Unit is drawing too much current.
{MT158}	Port 6 Trip.	Remote Unit is drawing too much current.
{MT159}	Port 7 Trip.	Remote Unit is drawing too much current.
{MT160}	Port 8 Trip.	Remote Unit is drawing too much current.
{MF161}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF162}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF163}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF164}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF165}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF166}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF167}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF168}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF169}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF170}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF171}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF172}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF173}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF174}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF175}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
{MF176}	Problem detected in the Hub.	Contact LGC Wireless Support for more information.

C.2 Faults Reported for System CPU

Table C-2 Faults for System CPU

Message Number	Description	Reason/Action
{SF01}	No internal communications.	No internal communications in preceding 2 minutes. Power cycle to clear.
{SF02}	Problem detected in the system CPU.	System CPU performed self reboot to clear.
{SF03}	Problem detected in the system CPU.	System CPU performed self reboot to clear.
{SF04}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF05}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF06}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF07}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF08}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF09}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF10}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF11}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF12}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF13}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF14}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF15}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF16}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF17}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF18}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF19}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF20}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF21}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF22}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF23}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF24}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF25}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF26}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF27}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF28}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF29}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF30}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF31}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
{SF32}	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.

C.3 Faults for Fusion Expansion Hubs

Table C-3 Fault Messages for Fusion Expansion Hubs

Message Number	Description	Reason/Action
{EF01}	Software error occurred and recovered.	If this happens repeatedly, replace the Hub.
{EF02}	Software reset occurred and recovered, or firm-ware download.	If this happens repeatedly, replace the Hub.
{EF03}	Software reset occurred and recovered.	If this happens repeatedly, replace the Hub.
{EF04}	Software reset occurred and recovered.	If this happens repeatedly, replace the Hub.
{EF05}	Software error occurred and recovered.	If this happens repeatedly, replace the Hub.
{EF06}	Firmware download.	Firmware download.
{EF07}	Hub power cycle.	Hub power cycle.
{EF08}	MH communications fail-ure.	No communications from MH in THE preceding 90 seconds.
{EF09}	MH communications fail-ure.	EH uplink messages not getting to the MH.
{EF10}	Hardware failure (PLL).	Cycle power once. If the fault persists, replace the Hub.
{EF11}	Hardware failure (54 VDC).	54 VDC power supply is out of range, replace the Hub.
{EF12}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF13}	Band not programmed.	Cycle power once. If the fault persists, replace the Hub.
{EF14}	Low optical input power.	Check downlink fiber connections.
{EF15}	Hardware failure (Optical Output Power).	Cycle power once. If the fault persists, replace the Hub.
{EF16}	Self Lockout (All Bands).	The Hub has shutdown the system due to an internal fault. The sys-tem is offline.
{EF17}	Commanded Out-of-ser-vice (Band 1).	Band 1 commanded out-of-service by the user.
{EF18}	Fault lockout (Band 1).	Band 1 out-of-service due to an MH fault.
{EF19}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF20}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF21}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF22}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF23}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF24}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF25}	Commanded Out-of-ser-vice (Band 2).	Band 2 commanded out-of-service by the user.

Table C-3 Fault Messages for Fusion Expansion Hubs (continued)

Message Number	Description	Reason/Action
{EF26}	Fault lockout (Band 2).	Band 2 out-of-service due to MH fault.
{EF27}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF28}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF29}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF30}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF31}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF32}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF33}	Commanded Out-of-service (Band 3).	Band 3 commanded out-of-service by the user.
{EF34}	Fault lockout (Band 3).	Band 3 out-of-service due to an MH fault.
{EF35}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF36}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF37}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF38}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF39}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{EF40}	Problem detected in the EH.	Contact LGC Wireless Support for more information.
{ED129}	Port 1 Disconnected.	Unit is disconnected.
{ED130}	Port 2 Disconnected.	Unit is disconnected.
{ED131}	Port 3 Disconnected.	Unit is disconnected.
{ED132}	Port 4 Disconnected.	Unit is disconnected.
{ED133}	Port 5 Disconnected.	Unit is disconnected.
{ED134}	Port 6 Disconnected.	Unit is disconnected.
{ED135}	Port 7 Disconnected.	Unit is disconnected.
{ED136}	Port 8 Disconnected.	Unit is disconnected.
{EC137}	Port 1 No Communications.	No communications with remote unit.
{EC138}	Port 2 No Communications.	No communications with remote unit.
{EC139}	Port 3 No Communications.	No communications with remote unit.
{EC140}	Port 4 No Communications.	No communications with remote unit.
{EC141}	Port 5 No Communications.	No communications with remote unit.
{EC142}	Port 6 No Communications.	No communications with remote unit.

Table C-3 Fault Messages for Fusion Expansion Hubs (continued)

Message Number	Description	Reason/Action
{EC143}	Port 7 No Communications.	No communications with remote unit.
{EC144}	Port 8 No Communications.	No communications with remote unit.
{ET145}	Port 1 Cable Fault.	Possible electrical short in the coaxial cable, or an RAU problem.
{ET146}	Port 2 Cable Fault.	Possible electrical short in the coaxial cable, or an RAU problem.
{ET147}	Port 3 Cable Fault.	Possible electrical short in the coaxial cable, or an RAU problem.
{ET148}	Port 4 Cable Fault.	Possible electrical short in the coaxial cable, or an RAU problem.
{ET149}	Port 5 Cable Fault.	Possible electrical short in the coaxial cable, or an RAU problem.
{ET150}	Port 6 Cable Fault.	Possible electrical short in the coaxial cable, or an RAU problem.
{ET151}	Port 7 Cable Fault.	Possible electrical short in the coaxial cable, or an RAU problem.
{ET152}	Port 8 Cable Fault.	Possible electrical short in the coaxial cable, or an RAU problem.
{ET153}	Port 1 Trip.	The Remote Unit is drawing too much current.
{ET154}	Port 2 Trip.	The Remote Unit is drawing too much current.
{ET155}	Port 3 Trip.	The Remote Unit is drawing too much current.
{ET156}	Port 4 Trip.	The Remote Unit is drawing too much current.
{ET157}	Port 5 Trip.	The Remote Unit is drawing too much current.
{ET158}	Port 6 Trip.	The Remote Unit is drawing too much current.
{ET159}	Port 7 Trip.	The Remote Unit is drawing too much current.
{ET160}	Port 8 Trip.	The Remote Unit is drawing too much current.

C.4 Faults for RAUs

Table C-4 Faults for RAUs

Message Number	Description	Reason/Action
{RF01}	Software error occurred and recovered.	If this happens repeatedly, replace the RAU.
{RF02}	Software error occurred and recovered.	If this happens repeatedly, replace the RAU.
{RF03}	Software error occurred and recovered.	If this happens repeatedly, replace the RAU.
{RF04}	Software reset occurred and recovered, or firmware download.	If this happens repeatedly, replace the RAU.
{RF05}	Software error occurred and recovered.	If this happens repeatedly, replace the RAU.
{RF06}	Problem detected in the RAU.	Contact LGC Wireless Support for more information.
{RF07}	RAU power cycle.	RAU power cycle.
{RF08}	Problem detected in the RAU.	Contact LGC Wireless Support for more information.
{RF09}	Invalid band.	The RAU doesn't support programmed band. Check the RAU type against the band programmed in the hub.
{RF10}	Low input DC voltage.	Check the coaxial cable for high RF loss. Try another Hub port. If the fault persists, replace the RAU. If the fault clears, mark the Hub port as unusable and replace the Hub when possible.
{RF11}	Hardware Failure (DL PLL Band 1).	Cycle power once. If the fault persists, replace the RAU.
{RF12}	Hardware Failure (DL PLL Band 2).	Cycle power once. If the fault persists, replace the RAU.
{RF13}	Hardware Failure (DL PLL Band 3).	Cycle power once. If the fault persists, replace the RAU.
{RF14}	Hardware Failure (UL PLL Band 1).	Cycle power once. If the fault persists, replace the RAU.
{RF15}	Hardware Failure (UL PLL Band 2).	Cycle power once. If the fault persists, replace the RAU.
{RF16}	Hardware Failure (UL PLL Band 3).	Cycle power once. If the fault persists, replace the RAU.
{RF17}	Hardware Failure (PA Band 1).	Cycle power once. If the fault persists, replace the RAU.
{RF18}	Hardware Failure (PA Band 2).	Cycle power once. If the fault persists, replace the RAU.
{RF19}	Hardware Failure (PA Band 3).	Cycle power once. If the fault persists, replace the RAU.
{RF20}	Hardware Failure (UL Pilot).	Cycle power once. If the fault persists, replace the RAU.
{RL21}	Commanded Out-of-service (Band 1).	Band 1 commanded out-of-service by User. Command In-Service on Band 1 to restore service.
{RL22}	Commanded Out-of-service (Band 2).	Band 2 commanded out-of-service by User. Command In-Service on Band 2 to restore service.
{RL23}	Commanded Out-of-service (Band 3).	Band 3 commanded out-of-service by User. Command In-Service on Band 3 to restore service.
{RF24}	Problem detected in the RAU.	Contact LGC Wireless Support for more information.
{RX25}	Commanded shutdown (Band 1).	Check the status of hub to which the RAU is connected.
{RX26}	Commanded shutdown (Band 2).	Check the status of hub to which the RAU is connected.
{RX27}	Commanded shutdown (Band 3).	Check the status of the hub to which the RAU is connected.
{RF28}	Internal shutdown (Band 1).	RAU Fault condition in band 1 path (or common path).
{RF29}	Internal shutdown (Band 2).	RAU Fault condition in band 2 path (or common path).
{RF30}	Internal shutdown (Band 3).	RAU Fault condition in band 3 path (or common path).
{RF31}	Problem detected in the system.	Contact LGC Wireless Support for more information.
{RF32}	Problem detected in the RAU.	Contact LGC Wireless Support for more information.

C.5 Warning/Status Messages for Fusion Main/SingleStar Hubs

Warning Messages

Warnings alert you to conditions that indicate possible service impact. Warnings are displayed in the Messages pane in red lettering.

Before addressing warnings, ensure that all faults are resolved. Take appropriate action to resolve the warnings, as indicated in the following tables.

NOTE: AdminBrowser v0000007 or higher displays events (faults, warnings, or status messages) depending on your view preference. To change your view preference, refer to Section 3.3.2, “View Preference,” on page 3-10.

Status Messages

Status messages alert you to conditions that are important, but generally do not impact service. Status messages alert you to conditions that are important, but generally do not impact service. Status messages are displayed in the Messages pane in blue lettering.

NOTE: AdminBrowser v0000007 or higher displays events (faults, warnings, or status messages) depending on your view preference. To change your view preference, refer to Section 3.3.2, “View Preference,” on page 3-10.

NOTE: The icons displayed in the system status tree assume that there are no other faults, warnings, or status present.

In Table C-5, the message number is in the following form:

[Mnn]/X where nn equals the message number, and X equals the default of either Status (S) or Warning (W).

Table C-5 Warnings/Status Messages for Fusion Main/SingleStar Hubs

Message Number/Default	Description	Reason/Action
[M01]/S	Fan 1 failure.	Check the fan for rotation, air flow blockage, and dust. Replace the Hub on high temperature warning.
[M02]/S	Fan 2 failure.	Check the fan for rotation, air flow blockage, and dust. Replace the Hub on high temperature warning.
[M03]/S	54 VDC Pwr Supply Fan failure.	Check the fan for rotation, air flow blockage, and dust. Replace the Hub on high temperature warning.
[M04]/W	5 VDC Monitor.	DC power out of range, replace the Hub.
[M05]/W	9 VDC Monitor.	DC power out of range, replace the Hub.
[M06]/W	54 VDC Monitor.	DC power out of range, replace the Hub.
[M07]/W	3 VDC Monitor.	DC power out of range, replace the Hub.
[M08]/W	12 VDC Monitor.	DC power out of range, replace the Hub.
[M09]/W	Temperature High.	Reduce ambient temperature, check for air flow blockage, fan rotation.
[M10]/W	-5 VDC Monitor.	DC power is out of range, replace the Hub.
[M11]/W	High laser current.	Output laser failure possible, replace the Hub when possible.
[M12]/W	DL path loss is too high	Replace the Hub.
[M13]/S	Low input optical (Port 1).	Check the uplink fiber.
[M14]/S	Low input optical (Port 2).	Check the uplink fiber.
[M15]/S	Low input optical (Port 3).	Check the uplink fiber.
[M16]/S	Low input optical (Port 4).	Check the uplink fiber.
[M17]/S	Hardware failure (Test Tone PLL Band 1).	Unable to perform DL system test.
[M18]/S	Hardware failure (Test Tone Too High Band 1).	Unable to perform DL system test.
[M19]/S	Hardware failure (Test Tone Too Low Band 1).	Unable to perform DL system test.
[M20]/W	Overdrive limiter active (Band 1).	Reduce input signal power to avoid potential component damage.
[M21]/W	CEMark limiter at maximum (Band 1).	Reduce input signal power to avoid drop in system gain.
[M22]/W	No DL test tone (Band 1).	Hub DL gain is low.
[M23]/S	No UL test tone (Band 1).	Hub UL path gain is low.
[M24]/S	Problem detected in the system.	Contact LGC Wireless Support for more information.
[M25]/S	Hardware failure (Test Tone PLL Band 2).	Unable to perform DL system test. Replace the hub when possible.
[M26]/S	Hardware failure (Test Tone Too High Band 2).	Unable to perform DL system test. Replace the hub when possible.
[M27]/S	Hardware failure (Test Tone Too Low Band 2).	Unable to perform DL system test. Replace the hub when possible.
[M28]/W	Overdrive limiter active (Band 2).	Reduce input signal power to avoid potential component damage.
[M29]/W	CEMark limiter at maximum (Band 2).	Reduce input signal power to avoid drop in system gain.

Table C-5 Warnings/Status Messages for Fusion Main/SingleStar Hubs

Message Number/Default	Description	Reason/Action
[M30]/W	No DL test tone (Band 2).	Hub DL path gain is low.
[M31]/S	No UL test tone (Band 2).	Hub UL path gain is low.
[M32]/S	Problem detected in the system.	Contact LGC Wireless Support for more information.
[M33]/S	Hardware failure (Test Tone PLL Band 3).	Unable to perform DL system test.
[M34]/S	Hardware failure (Test Tone Too High Band 3).	Unable to perform DL system test.
[M35]/S	Hardware failure (Test Tone Too Low Band 3).	Unable to perform DL system test.
[M36]/W	Overdrive limiter active (Band 3).	Reduce input signal power to avoid potential component damage.
[M37]/W	CEMark limiter at maximum (Band 3).	Reduce input signal power to avoid drop in system gain.
[M38]/W	No DL test tone (Band 3).	Hub DL path gain is low.
[M39]/S	No UL test tone (Band 3).	Hub UL path gain is low.
[M40]/S	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
[M41]/W	Port 1 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[M42]/W	Port 2 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[M43]/W	Port 3 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[M44]/W	Port 4 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[M45]/W	Port 5 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[M46]/W	Port 6 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[M47]/W	Port 7 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[M48]/W	Port 8 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[M49]/W	Port 1 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[M50]/W	Port 2 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[M51]/W	Port 3 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[M52]/W	Port 4 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[M53]/W	Port 5 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[M54]/W	Port 6 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[M55]/W	Port 7 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[M56]/W	Port 8 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[M57]/W	Port 1 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[M58]/W	Port 2 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[M59]/W	Port 3 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[M60]/W	Port 4 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[M61]/W	Port 5 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[M62]/W	Port 6 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[M63]/W	Port 7 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[M64]/W	Port 8 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[M65]/S	No UL test tone (Band 1).	Hub/Port UL path gain is low.

Table C-5 Warnings/Status Messages for Fusion Main/SingleStar Hubs

Message Number/Default	Description	Reason/Action
[M66]/S	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
[M67]/S	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
[M68]/S	No UL test tone (Port 4/Band 1).	Hub/Port UL path gain is low.
[M69]/S	No UL test tone (Band 2).	Hub/Port UL path gain is low.
[M70]/S	No UL test tone (Port 2/Band 2).	Hub/Port UL path gain is low.
[M71]/S	No UL test tone (Port 3/Band 2).	Hub/Port UL path gain is low.
[M72]/S	No UL test tone (Port 4/Band 2).	Hub/Port UL path gain is low.
[M73]/S	No UL test tone (Band 3).	Hub/Port UL path gain is low.
[M74]/S	No UL test tone (Port 2/Band 3).	Hub/Port UL path gain is low.
[M75]/S	No UL test tone (Port 3/Band 3).	Hub/Port UL path gain is low.
[M76]/S	No UL test tone (Port 4/Band 3).	Hub/Port UL path gain is low.
[M77]/S	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
[M78]/S	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
[M79]/S	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
[M80]/S	Problem detected in the Hub.	Contact LGC Wireless Support for more information.
[M81]/W	Port 1 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[M82]/W	Port 2 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[M83]/W	Port 3 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[M84]/W	Port 4 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[M85]/W	Port 5 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[M86]/W	Port 6 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[M87]/W	Port 7 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[M88]/W	Port 8 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[M89]/W	Port 1 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[M90]/W	Port 2 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[M91]/W	Port 3 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.

Table C-5 Warnings/Status Messages for Fusion Main/SingleStar Hubs

Message Number/Default	Description	Reason/Action
[M92]/W	Port 4 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[M93]/W	Port 5 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[M94]/W	Port 6 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[M95]/W	Port 7 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[M96]/W	Port 8 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[M97]/W	Port 1 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check the RAU.
[M98]/W	Port 2 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check the RAU.
[M99]/W	Port 2 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check the RAU.
[M100]/W	Port 2 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check the RAU.
[M101]/W	Port 2 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check the RAU.
[M102]/W	Port 2 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check the RAU.
[M103]/W	Port 2 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check the RAU.
[M104]/W	Port 8 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check the RAU.
[M105]/W	Port 1 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[M106]/W	Port 2 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[M107]/W	Port 3 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[M108]/W	Port 4 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[M109]/W	Port 5 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[M110]/W	Port 6 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[M111]/W	Port 7 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[M112]/W	Port 8 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.

C.6 Warning/Status Messages for System CPUs

In Table C-6, the message number is in the following form:

[Snn]/X where nn equals the message number, and X equals the default of either Status (S) or Warning (W).

Table C-6 Warning/Status Messages for System CPUs

Message Number/ Default	Description	Reason/Action
[S01]/W	Alarm Input 1.	Check equipment connected to alarm input 1.
[S02]/W	Alarm Input 2.	Check equipment connected to alarm input 2.
[S03]/W	Alarm Input 3.	Check equipment connected to alarm input 3.
[S04]/S	Problem detected in the system CPU.	Retrieve the TTL and erase.
[S05]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
[S06]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
[S07]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
[S08]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
[S09]/S	Time-tagged Log is full.	Retrieve the TTL and erase.
[S10]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
[S11]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
[S12]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
[S13]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
[S14]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
[S15]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.
[S16]/S	Problem detected in the system CPU.	Contact LGC Wireless Support for more information.

C.7 Warning/Status Messages for Fusion Expansion Hubs

Table C-7 Warning/Status Message for Fusion Expansion Hubs

Message Number /Default	Description	Reason/Action
[E01]/W	Alarm Input 1.	Check the equipment connected to alarm input 1.
[E02]/W	Alarm Input 2.	Check the equipment connected to alarm input 2.
[E03]/W	Alarm Input 3.	Check the equipment connected to alarm input 3.
[E04]/S	Problem detected in the EH.	Contact LGC Wireless Support for more information.
[E05]/W	SNMP Trap #1.	TBD.
[E06]/W	SNMP Trap #2.	TBD.
[E07]/W	SNMP Trap #3.	TBD.
[E08]/S	Problem detected in the EH.	Contact LGC Wireless Support for more information.
[E09]/S	Fan 1 failure.	Check the fan for proper rotation, air flow blockage, and dust accumulation. Replace the Hub on high temperature warning.
[E10]/S	Fan 2 failure.	Check the fan for proper rotation, air flow blockage, and dust accumulation. Replace the Hub on high temperature warning.
[E11]/W	-5 VDC Monitor.	DC power out of range, replace the Hub.
[E12]/W	5 VDC Monitor.	DC power out of range, replace the Hub.
[E13]/W	9 VDC Monitor.	DC power out of range, replace the Hub.
[E14]/W	54 VDC Pwr Supply failure.	DC port power supply out of range, replace the Hub.
[E15]/W	3 VDC Monitor.	DC power out of range, replace the Hub.
[E16]/W	12 VDC Monitor.	DC power out of range, replace the Hub.
[E17]/W	Temperature High.	Reduce the ambient temperature, check for air flow blockage, fan rotation.
[E18]/W	DL path exceeds maximum gain.	If the problem is common to more than one port, replace the MH, otherwise check the EH.
[E19]/W	DL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different MH port. If the problem is on more than one port, replace the EH, otherwise replace the RAU.
[E20]/W	Hardware Failure (High UL Pilot).	Cycle power once. If the fault persists, replace the EH.
[E21]/W	Hardware Failure (Low UL Pilot).	Cycle power once. If the fault persists, replace the EH.
[E22]/W	Low optical input power.	Check the downlink fiber connection.
[E23]/W	High laser current.	Contact LGC Wireless Support for more information.
[E24]/S	Problem detected in the EH.	Contact LGC Wireless Support for more information.
[E25]/W	Port 1 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[E26]/W	Port 2 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[E27]/W	Port 3 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[E28]/W	Port 4 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[E29]/W	Port 5 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[E30]/W	Port 6 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[E31]/W	Port 7 No DL test tone (Band 1).	Hub/Port DL path gain is low.

Table C-7 Warning/Status Message for Fusion Expansion Hubs (continued)

Message Number /Default	Description	Reason/Action
[E32]/W	Port 8 No DL test tone (Band 1).	Hub/Port DL path gain is low.
[E33]/W	Port 1 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[E34]/W	Port 2 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[E35]/W	Port 3 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[E36]/W	Port 4 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[E37]/W	Port 5 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[E38]/W	Port 6 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[E39]/W	Port 7 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[E40]/W	Port 8 No DL test tone (Band 2).	Hub/Port DL path gain is low.
[E41]/W	Port 1 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[E42]/W	Port 2 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[E43]/W	Port 3 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[E44]/W	Port 4 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[E45]/W	Port 5 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[E46]/W	Port 6 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[E47]/W	Port 7 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[E48]/W	Port 8 No DL test tone (Band 3).	Hub/Port DL path gain is low.
[E49]/W	Port 1 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[E50]/W	Port 2 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[E51]/W	Port 3 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[E52]/W	Port 4 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[E53]/W	Port 5 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[E54]/W	Port 6 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[E55]/W	Port 7 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[E56]/W	Port 8 DL path loss is high.	If the problem is on more than one port, replace the Hub. Switch the cable connection to a different hub port until the Hub can be replaced.
[E57]/W	Port 1 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[E58]/W	Port 2 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.

Table C-7 Warning/Status Message for Fusion Expansion Hubs (continued)

Message Number /Default	Description	Reason/Action
[E59]/W	Port 3 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[E60]/W	Port 4 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[E61]/W	Port 5 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[E62]/W	Port 6 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[E63]/W	Port 7 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[E64]/W	Port 8 UL path loss is high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem is on more than one port, replace the Hub, otherwise replace the RAU.
[E65]/W	Port 1 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check RAU.
[E66]/W	Port 2 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check RAU.
[E67]/W	Port 3 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check RAU.
[E68]/W	Port 4 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check RAU.
[E69]/W	Port 5 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check RAU.
[E70]/W	Port 6 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check RAU.
[E71]/W	Port 7 UL path exceeds maximum gain.	If problem is common to more than one port, replace the Hub, otherwise check RAU.
[E72]/W	Port 8 UL path exceeds maximum gain.	If the problem is common to more than one port, replace the Hub, otherwise check RAU.
[E73]/W	Port 1 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[E74]/W	Port 2 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[E75]/W	Port 3 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[E76]/W	Port 4 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[E77]/W	Port 5 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[E78]/W	Port 6 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[E79]/W	Port 7 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.
[E80]/W	Port 8 54 VDC Power Enabled.	Caution: Port 54 VDC power may be present at the output.

C.8 Warning /Status Messages for RAUs

In Table C-8, the message number is in the following form:

[Rnn]/X where nn equals the message number, and X equals the default of either Status (S) or Warning (W).

Table C-8 Warning/Status Messages for RAUs

Message Number Default	Description	Reason/Action
[R01]/W	Temperature High.	Check RAU location for excessive temperature; check for air flow blockage and/or incorrect installation. Move the RAU to a cooler environment.
[R02]/W	No communications from Hub.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem persists, replace the RAU.
[R03]/W	DL RF path loss is too high.	Check the cable for high RF loss. Switch the cable connection to a different hub port. If the problem persists, replace the RAU.
[R04]/W	DL RF path exceeds maximum gain.	Check the Hub for proper operation; switch the cable connection to a different hub port. If the problem persists, replace the RAU.
[R05]/S	DL RF path problem (Band 1).	Unable to complete the DL system end-to-end test, replace the RAU when possible.
[R06]/S	DL RF path problem (Band 2).	Unable to complete the DL system end-to-end test, replace the RAU when possible.
[R07]/S	DL RF path problem (Band 3).	Unable to complete the DL system end-to-end test, replace the RAU when possible.
[R08]/S	System test required.	Run system test.
[R09]/W	Antenna Disconnected.	Check RAU antenna connection; re-run system test.
[R10]/S	UL RF path problem (Band 1).	Unable to complete the UL system end-to-end test, replace the RAU when possible.
[R11]/S	UL RF path problem (Band 2).	Unable to complete the UL system end-to-end test, replace the RAU when possible.
[R12]/S	UL RF path problem (Band 3).	Unable to complete the UL system end-to-end test, replace the RAU when possible.
[R13]/S	Problem detected in the RAU.	Contact LGC Wireless Support for more information.
[R14]/S	Problem detected in the RAU.	Contact LGC Wireless Support for more information.
[R15]/S	Problem detected in the RAU.	Contact LGC Wireless Support for more information.
[R16]/S	Problem detected in the RAU.	Contact LGC Wireless Support for more information.

