Appendix A

Instruction Book

LC-800 Operations Manual

Lightwave microCell System for 800 MHz Cellular Mobile Radio

PRE-RELEASE

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Installation Checklist — *LC-800 Lightwave microCell*

NOTE: *Only qualified personnel should install or service this equipment. See cross references for detailed instructions.*

_____ 1. Mount antennas and associated equipment (antenna feeders, backup power supply equipment, and so on) as required.

_____ 2. Mount the unit, leaving room for cable access.

_____ 3. Connect the Master and Remote antennas (and any additional equipment) to an external ground.

_____ 4. Connect the Master and Remote Units to their respective power sources. ***Do not activate power.*** See:

⇒ **Master Power Wiring—AC Mains on page 4-11**

⇒ **Remote Power Wiring—AC Mains on page 4-16**

_____ 5. Connect any external alarm outputs for the Master or Remote units. See:

⇒ **Alarm and Control Wiring—Master on page 4-12**

⇒ **Alarm and Control Wiring—Remote on page 4-18**

_____ 6. Review and record the fiber loss in the Forward and Reverse directions. The fiber loss should be within the parameters set forth in this manual.

⇒ **Sample Loss Calculations on page 4-3**

_____ 7. Connect all fiber optic cables and antenna feeders.

_____ 8. After verifying that all of the cabling and power wiring is connected properly, activate system power. See:

⇒ **Master Power Up on page 5-15**

⇒ **Remote Power Up on page 5-15**

_____ 9. After successfully activating system power, setup the Forward and Reverse systems. See:

⇒ **Setting/Changing Forward RF Power Levels on page 5-15**

⇒ **Setting and Changing Reverse Channel Gain on page 5-16**

_____ 10. After calculating the system setup, configure the Master and Remote fiber optic transceiver controller boards. See:

⇒ **Controller Board—Master and Remote on page 5-9**

_____ 11. Test the operation of all inputs and outputs connected to external equipment. See **Chapter 5. System Operation and Testing.**

Contents

Figures

Tables

Chapter 1 . Introduction and System Overview

Figures

Introduction

The **LC-800 Lightwave microCell** is designed for expansion and improved coverage of cellular telephone systems. This manual describes the function, installation, operation, testing, and maintenance of the LC-800, as well as several options associated with this system.

How to Use this Manual

This manual is divided into nine chapters, four appendixes, and a glossary. If you are installing this equipment for the first time, you should read each chapter. If you are familiar with this equipment, you can begin with **Chapter 4. Installation Instructions**.

The chapters of this manual are as follows:

Chapter 1. Introduction and System Overview on page 1-1
Describes the scope of this document, suggests the most effective way of using this manual, and provides a broad overview of the product along with the technical specifications and configuration options.

Chapter 2. Technical Description on page 2-1
Provides a system description and functional description of the LC-800 system, including a description of the components of the Master and Remote Units, and a discussion of the Forward and Reverse direction signal flow.

Chapter 3. Ordering Information on page 3-1
Explains various equipment configurations, spare part number information, and the procedure used to order additional equipment.

Chapter 4. Installation Instructions on page 4-1
Outlines the procedures used to install the equipment, as well as installation guidelines.

Chapter 5. System Operation and Testing on page 5-1
Explains the alignment, testing and operation of the system.

Chapter 6. Fault Identification on page 6-1
Describes how to identify and replace faulty units using the LC-800 onboard Alarm System.

Chapter 7. Maintenance on page 7-1
Explains the routine maintenance tasks needed to ensure proper operation.

Chapter 8. Controller on page 8-1
Describes the software interface with the LC-800.

Chapter 9. Customer-Specific Documentation on page 9-1
Includes customer specific installation and operational requirements.

Appendixes and Glossary
See the Contents.

General Product Description

The LC-800 is an optical, fiber-linked microCell system that overlays capacity and provides remote coverage within a Cellular Communication System.

As shown in this figure, the LC-800 provides interconnect to the host base station and RF interface to optical fiber, and provides the remote equipment to support up to 100 RF carriers.

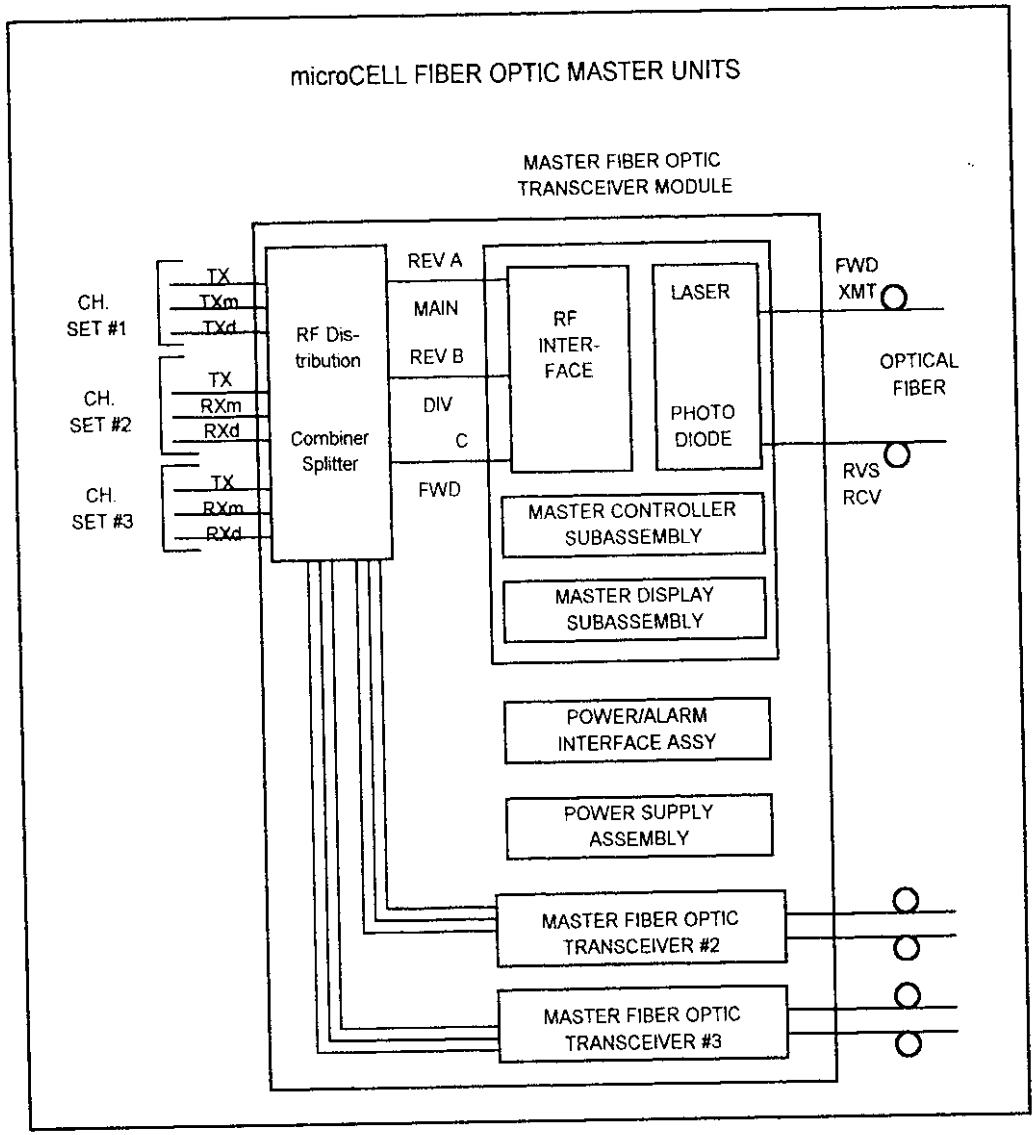


Figure 1-1. LC-800 Block Diagram: Master Unit

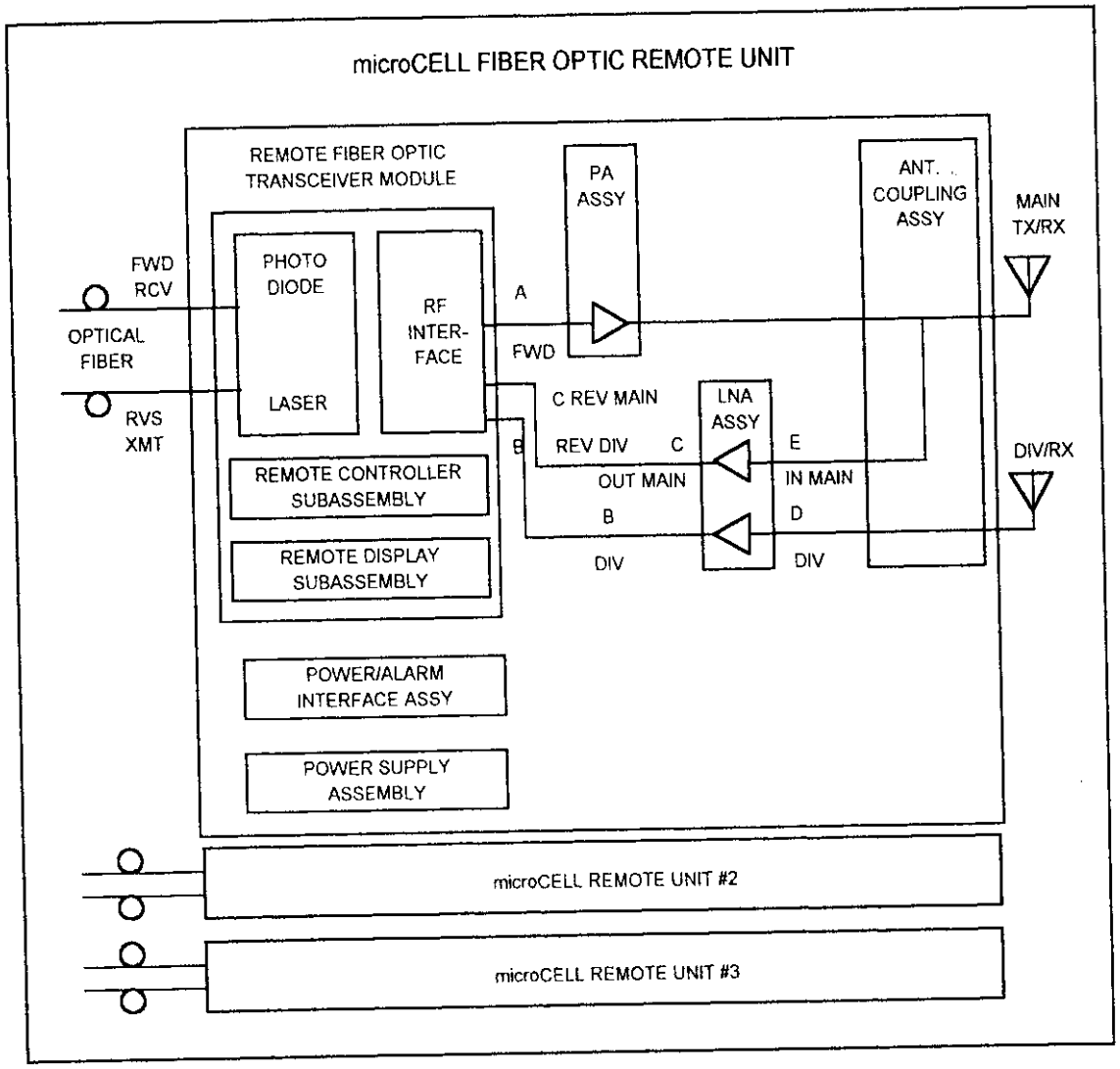


Figure 1-2. LC-800 Block Diagram: Remote Unit

The microCell has been designed to provide an economical alternative to a full-size base station in a mature cellular system in which the architecture of the system now dictates the placement of a Radio Base Station (RBS) one to two kilometers apart. The microCell can be implemented with either omni-panel or directional-panel antennas.

The LC-800 can be configured to transport a *dedicated* channel set (including the locate and set-up channel) into a specific area or it can be connected in a *simulcast* mode.

In either of these configurations, mobile hand-offs and hand-ins between sectors or RBSs are handled in the same manner as if the microCells were not there. Therefore, the microCell is not apparent to either the sector or the Mobile Telephone Switching Office (MTSO), allowing the system to operate normally.

Functionally, the microCell is a low-power base station with a dedicated block of channels. It offers an economical solution to capacity or coverage problems associated with airports, tunnels, subways, inside buildings, convention centers, sports arenas, and densely populated areas. The result of installing an LC-800 for these applications is an improvement in subscriber services.

The LC-800 is compatible with all manufacturers' analog base station equipment as well as the newer TDMA and CDMA technologies.

System Overview

The Master Unit can serve up to three remote units regardless of system configuration. Each Master Card Cage can host up to three Fiber Optic Master Transceiver Modules. Each transceiver module serves one remote unit.

The fundamental difference in the one-to-one and the one-to-three system configurations is that one-to-one channel sets and microCells are independent, while one-to-three channel sets and microCells are shared.

A typical one-to-one configuration consists of a microCell Fiber Optic Master Assembly containing three separate channel sets, each serving one Fiber Optic Transceiver Module and up to three microCell Fiber Optic Remote Assemblies—see the following figure.

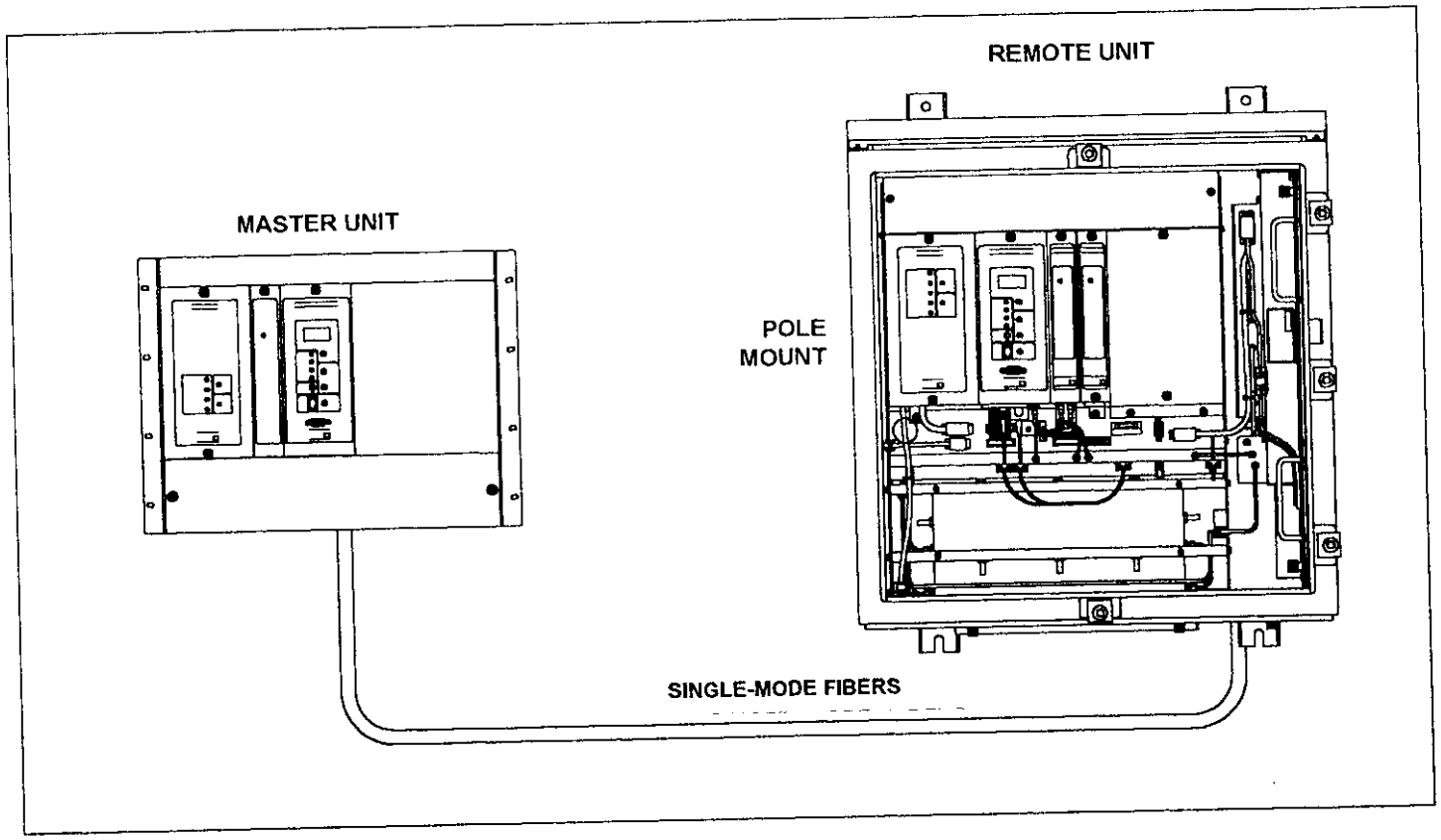


Figure 1-3. System Overview of 1-to-1 Configuration

A one-to-three configuration consists of a microCell Fiber Optic Master Assembly containing one channel set that is shared with up to three Fiber Optic Transceiver Modules and three separately located microCell Fiber Optic Remote Assemblies (see the following figure).

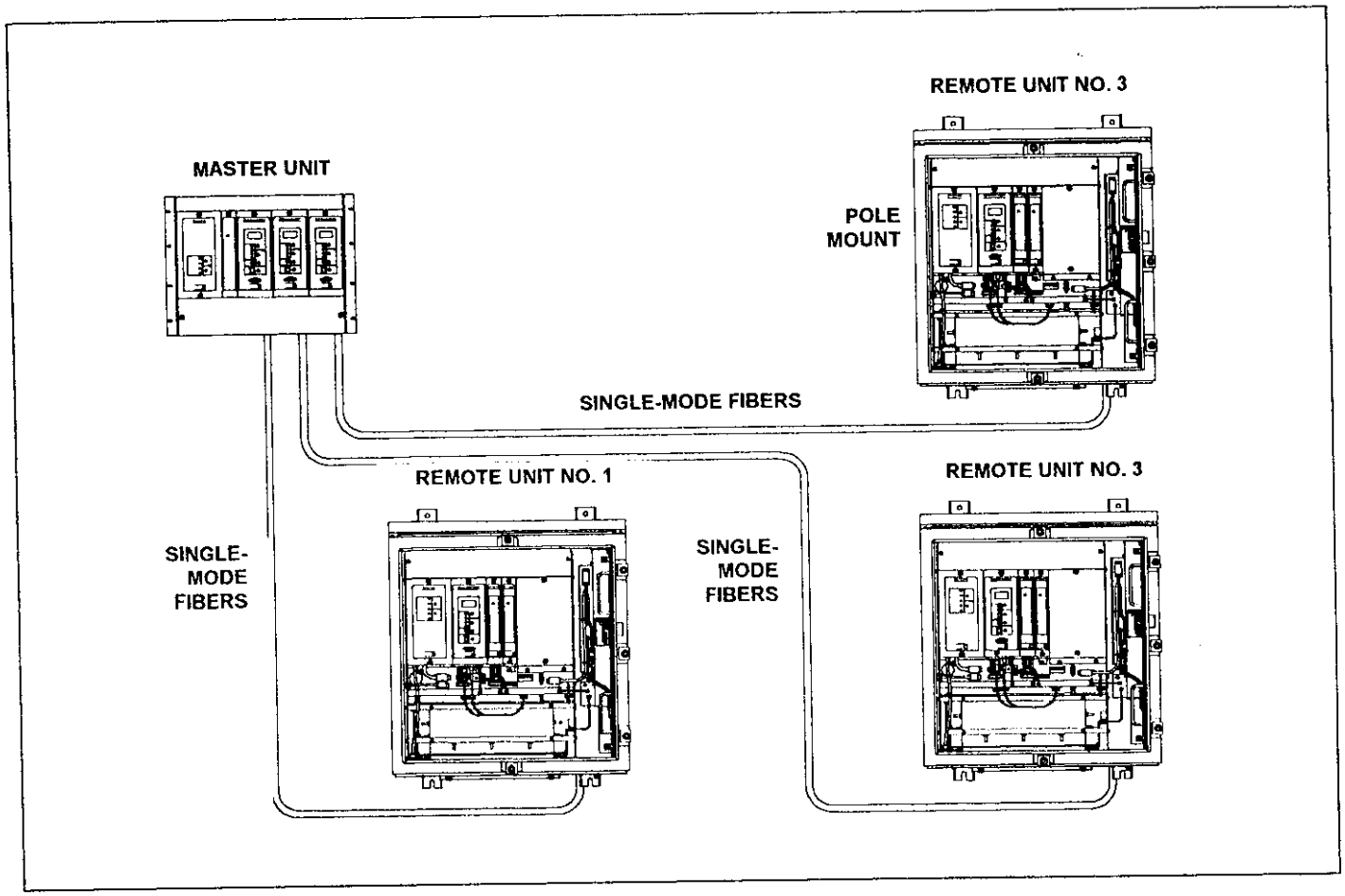


Figure 1-4. System Overview of 1-to-3 Configuration

In the forward direction (downlink):

⇒ The Master site microCell is connected to the RF output of the existing cell site equipment.

⇒ The signal is transmitted through the fiber to the Remote microCell where the signal is power amplified and transmitted to the user.

In the reverse direction (uplink):

⇒ The remote receives the RF signal.

⇒ It converts the RF signal to a fiber signal.

⇒ It transmits the signal back to the Master, where the reverse signal is converted back to RF for transmission to the cell site.

System Components—Master

The Master Unit consists of a single 19-inch (48.3 cm) EIA Rack-Mounted Card Cage, which can contain up to three Fiber Optic Master Units.

Each microCell Fiber Optic Master Assembly consists of:

⇒ Power Supply Assemblies

⇒ Combiner/Splitter Interface providing a 1-to-1 or a 1-to-3 configuration

⇒ Fiber Optic Splicing Panel

⇒ Fiber Optic Master Units (up to three)—each consisting of:

- ◊ A Master RF Subassembly, Master Controller Subassembly, and Master Display Subassembly
- ◊ Power and Alarm Interface Assembly
- ◊ Blower Assembly

System Components—Remote

The Remote Unit, housed in a weathertight aluminum cabinet, consists of the following subassemblies:

⇒ Fiber Optic Remote Unit, consisting of:

- ◊ An RF Subassembly
- ◊ A Remote Controller Subassembly
- ◊ A Remote Display Subassembly

⇒ Power Amplifier Subassembly

⇒ LNA Subassembly

⇒ Antenna Coupling Subassembly

⇒ Power Supply Subassembly

⇒ Power and Alarm Interface Assembly

⇒ Fiber Optic Splicing Panel

⇒ Blower Assembly

System Configuration Options

The LC-800 can be configured such that each Master Card Cage contains from one to three Fiber Optic Transceiver Modules in a single card cage regardless of the system configuration—see the following figure.

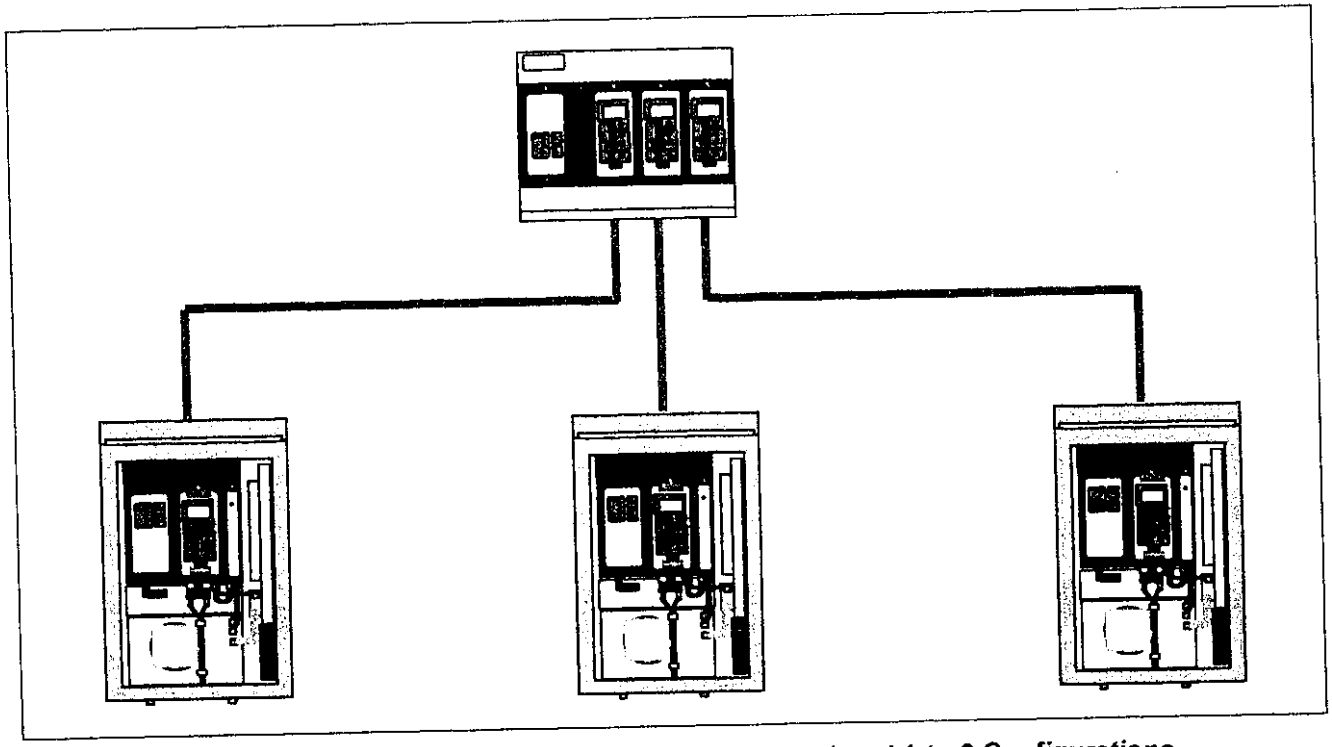


Figure 1-5. Card Cage Wiring Options for 1-to-1 and 1-to-3 Configurations

Each Fiber Optic Transceiver Module is connected through fiber to one of three microCell Fiber Optic Remotes in diverse areas.

There are two options for wiring the Combiner/Splitter interface to the Master Card Cage. In both cases, the one-to-one and the one-to-three configurations can have either one, two, or three transceivers connected to the Master:

One-to-One RF Distribution

In this configuration, the Combiner/Splitter interface connects one input or output of the shelf to one input or output of the Fiber Optic Transceiver (labeled RF IN, MAIN RF OUT, and DIV RF OUT). In this case, each transceiver is connected to a single input/output set. There are three RF inputs and six RF outputs per shelf.

One-to-Three RF Distribution

In this configuration, the Combiner/Splitter interface connects one input from the cell site and splits the forward direction three ways. You can combine three sets of signals inside the shelf for the reverse direction and split the forward direction three ways. There are one forward input and up to two reverse outputs per shelf (Main and Diversity outputs).

NOTE: *RF test connectors are included on the Combiner/Splitter for the 1-to-3 configuration only.*

Prior to installation and operation of this equipment, the following requirements must be observed:

- ⇒ Regulations for operation of RF and fiber optic equipment
- ⇒ Local ordinances and building codes relating to the installation of antennas and radio equipment
- ⇒ All necessary permits and licenses

Technical Specifications

The following technical specifications are presented in this section:

- ⇒ Frequency Range
- ⇒ Receiver
- ⇒ Transmitter
- ⇒ Optical Link
- ⇒ Physical
- ⇒ Power Option
- ⇒ Environmental
- ⇒ Alarm

Frequency Range Specifications

Mobile to RBS	824 to 849 MHz
RBS to Mobile	869 to 894 MHz

Receiver (Mobile To Base Station—Reverse Direction, Uplink)

Frequency Range

A-Band	824–835, 845–846.5 MHz
B-Band	835–845, 846.5–849 MHz

RF Selectivity (2 options)

	-3 dB passband	**-60 dB passband**
A-Band	26 MHz	60 MHz
B-Band	19 MHz	48 MHz

Diversity Receiver
Standard

Dynamic Range
65 dB, instantaneous; 100 dB, sliding

Signal levels at antenna connection
-15 to -115 dBm; -25 to -115 dBm for Level 5

Reverse Channel Gain
30 dB nominal; 0 to 24 dB for Level 5

Transmitter (Base Station to Mobile—Forward Direction, Downlink)

Frequency Range

A-Band	869 to 880 MHz, 890 to 891.5 MHz
B-Band	880 to 890 MHz, 891.5 to 894 MHz

Frequency Stability
0 Hz Error From Cell Site

Carriers	(dBm)	(dBm)	(dBm)
2	+27.0	+30.0	30.5
4	+22.0	+27.0	29.5
8	+18.5.0	+23.5	28.5
16	+15.0	+20.0	27.5
20	+14.0	+19.0	26.5
32	+12.0	+17.0	24.5
IMD= -40 dBc and ≤13 dBm (FCC Regulatory Limit) Average IM Power			

Signal Levels (Forward)—0 to -30 dBm per carrier

Optical Link

Link Loss Budget	10 dB full performance, 15 dB degraded performance
Transmitter	DFB laser at 1310 nanometers
Receiver	Photo Diode
Optical Fiber	Single Mode
Optical Connector	FC/PC and Fusion Splice

Physical

	Master Unit	Remote Unit
Housing	Weathertight Aluminum	Weathertight Aluminum
Height	14 inches/35.5 cm	26 inches/66.0 cm
Width	19 inches/48.3 cm EIA Rack Mount	24 inches/61.0 cm
Depth	12 inches/30.5 cm	14 inches/35.6 cm
Weight	30 lbs./13.5 kg	125 pounds/56.3 kg
Color	White	White

Maximum at Full RF Power	24 VDC @ 12.0 Amps; no DC version available for Level 5
Master Unit E/W One Fiber Optic Transceiver	120 VAC @ .6 Amps 230 VAC @ .3 Amps 24 VDC @ 2.0 Amps
Master Unit E/W Three Fiber Optic Transceivers	120 VAC @ 1.3 Amps 230 VAC @ .7 Amps 24 VDC @ 5.2 Amps

Environmental

Temperature		Relative Humidity	
Master	-20° to +50° C	Cell Site Equipment	90%
Remote	-30° to +50° C	Remote Unit	100%
		Altitude	4,600 meters / 15,000 feet max.

Alarms

Local	LCD Readout
Remote	Summary and Detailed Equipment
Orderwire	Digital Orderwire to All Remotes

Figures

Introduction

This section includes a system description of both forward and reverse signal directions and a technical description of the components and functions of the Master and Remote Units.

System Description

The system description provides a discussion of the Forward and Reverse direction signal activity in the LC-800. See the list of Figures for the location of block diagrams of each unit.

Master To Remote—Forward Direction

At the Master site, locate the Transmit Input Connector. This is a 50 ohm, Type N connector that accepts the 800 MHz RF signal host cell site transmit to be sent remotely over the microCell system.

From the input, the signal is fed through an input attenuator (labeled FWRD IN) and on to a Distributed Feedback (DFB) Laser. The laser transmits 0 to +3 dBm of output power on 1.3 µm single mode optical fiber.

The fiber signal is received at the Remote site by a Photo Diode Detector, then applied to a Low Noise Amplifier. Then, the signal is power-amplified and sent to the Remote transmit antenna, from which the signal is transmitted to the mobile cellular user.

The forward gain is set up with the FWRD IN attenuator and the Power Amplifier step attenuator.

⇒ The FWRD IN attenuator is located prior to the Optical transmitter at the Master Fiber Optic Module.

⇒ The PA attenuator is located within the PA Assembly

Both attenuators are programmable through DIP Switch settings on the Controller Board. The maximum transmit power depends upon the number of channels being transmitted and the level of signals at the Combiner/Splitter Input.

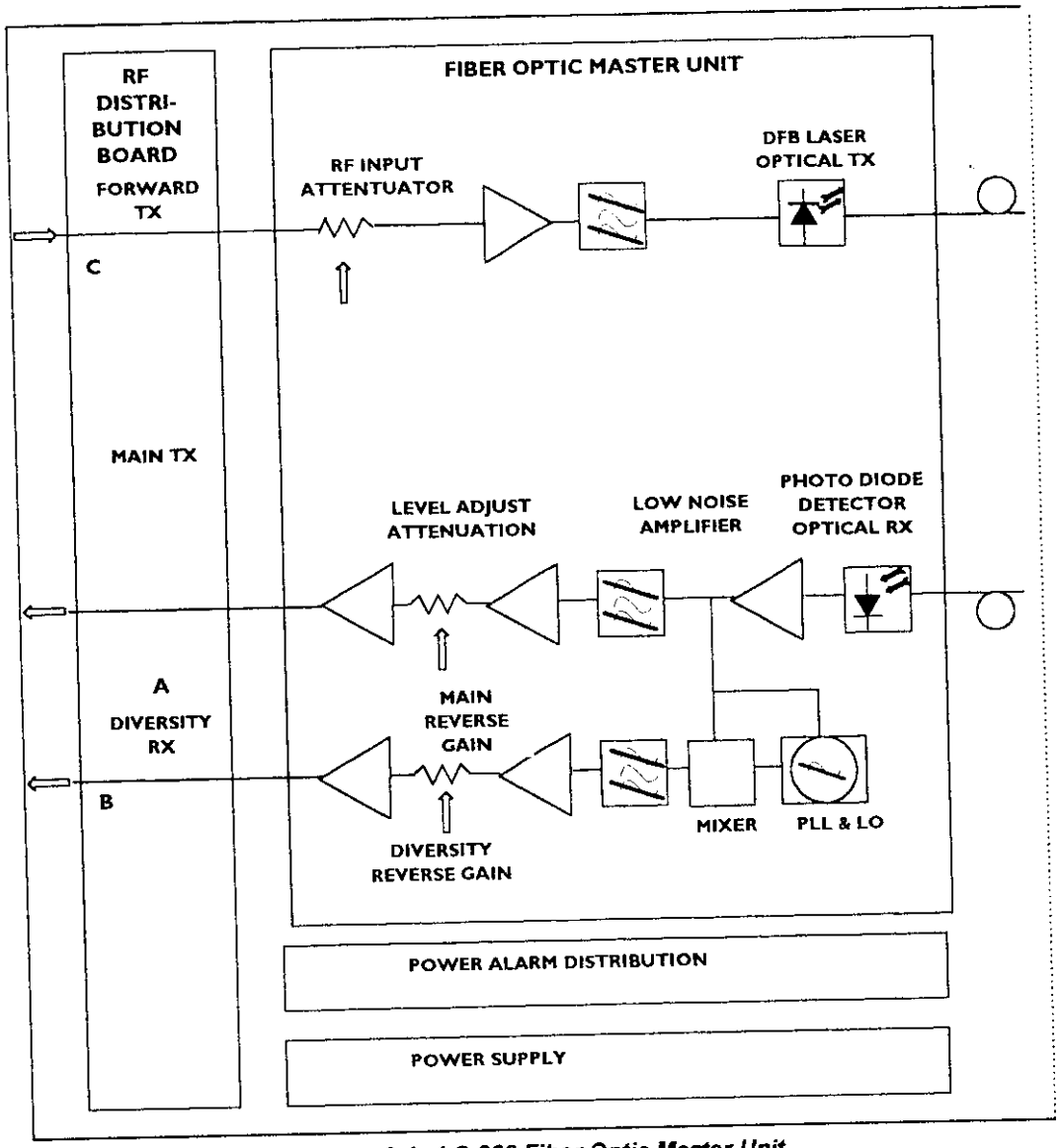


Figure 2-1. LC-800 Fiber Optic Master Unit

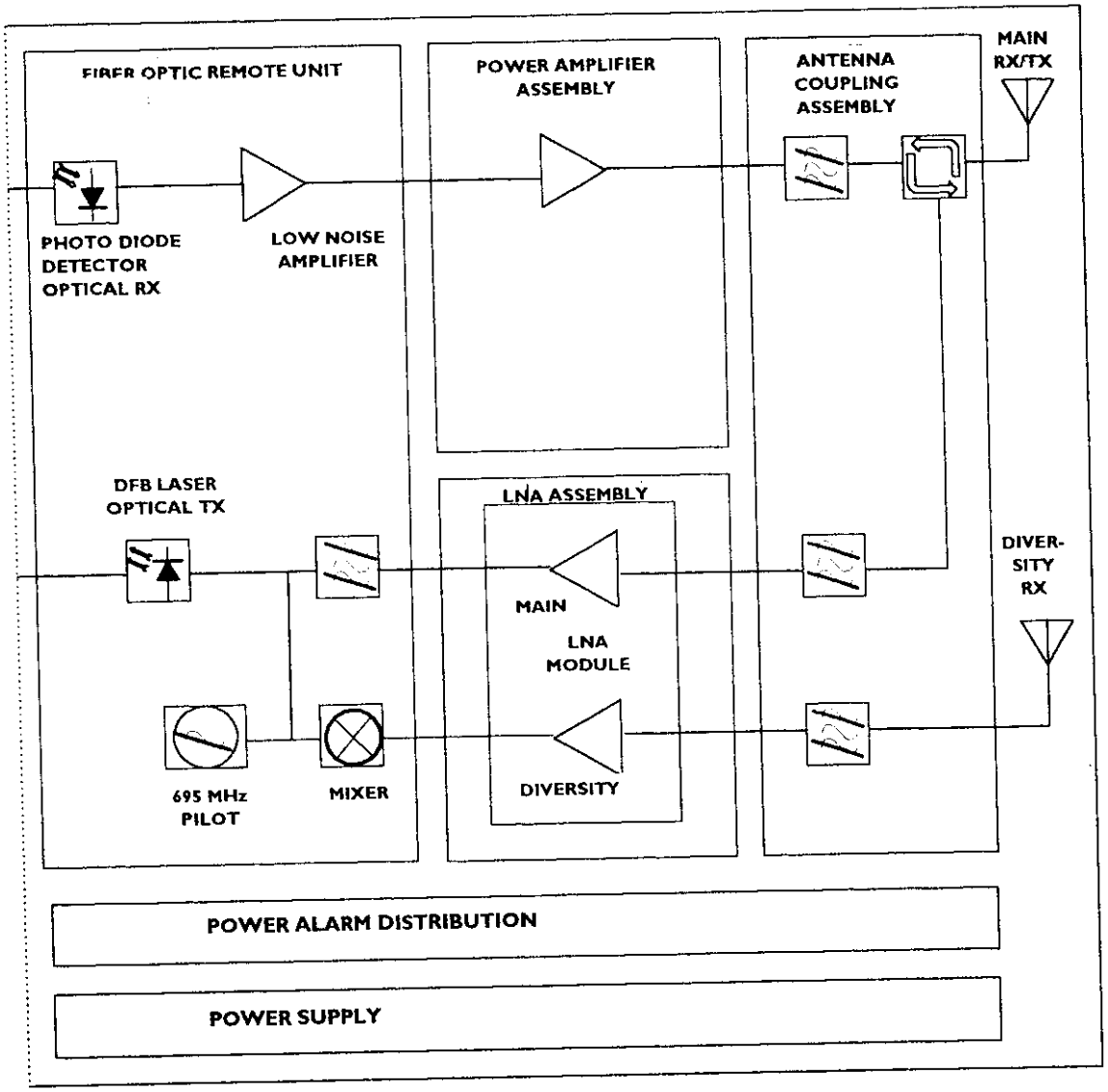


Figure 2-2. LC-800 Fiber Optic Remote Assembly

Remote to Master—Reverse Direction

See **Figure 2-2** on the previous page and locate the Main and Diversity RF antennas at the Remote site. This is the point where the RF signal is received from the mobile cellular user.

The Main receive antenna (which doubles as the Main transmit antenna) and the Diversity antenna (if so equipped) receive the RF signal from the mobile cellular user and are routed through couplers to Filter/Circulator assemblies. The Main and Diversity signals are then fed through the Low Noise Amplifier Module. The Diversity signal is frequency translated to allow frequency multiplexing over fiber. Both signals are used to modulate a DFB laser for fiber optic transmission to the Master site.

At the Master site, the signal is received by a Photo-Diode Detector and a Low Noise Amplifier, and is then bandpass-filtered before going through a set of level-adjustable attenuators. The desired RF frequency is produced for demodulation and processing by the cell site transmitter.

The Reverse gain is defined as the gain that occurs between the antenna input at the Remote site (with a nominal level of -55 dBm) and the combiner output of the Master Unit. Reverse gain is set up using an attenuator, with values between 0 and 24 dB. Note that, in order to minimize the noise contribution of the LC-800 in the Reverse direction, a minimum amount of gain is required.

NOTE: *Lightwave microCells equipped with a 1-to-3 distribution board experience a 10 dB loss in both Forward and Reverse signal directions. The losses are due to the Combiner/Splitter circuitry.*

microCell Fiber Optic Master Assembly

The microCell Fiber Optic Master Assembly consists of the following subassemblies:

- ⇒ Master Card Cage Assembly
- ⇒ Power Supply Assembly
- ⇒ RF Distribution Assembly
- ⇒ Fiber Optic Master Unit
- ⇒ Blower Assembly

For an illustration of the Master Assembly and Remote Assembly components, see the following two figures.

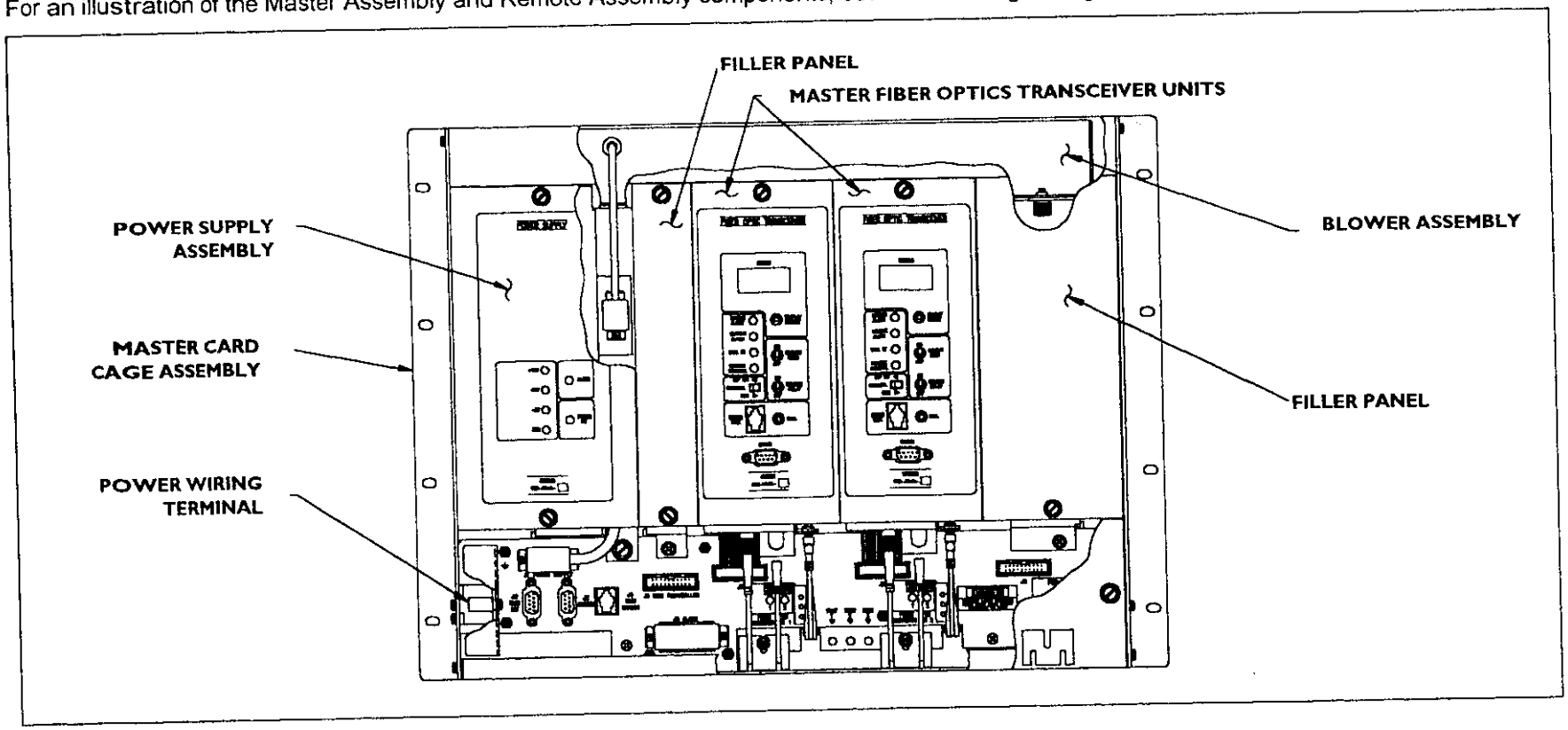


Figure 2-3. Physical Description—Lightwave microCell, Master

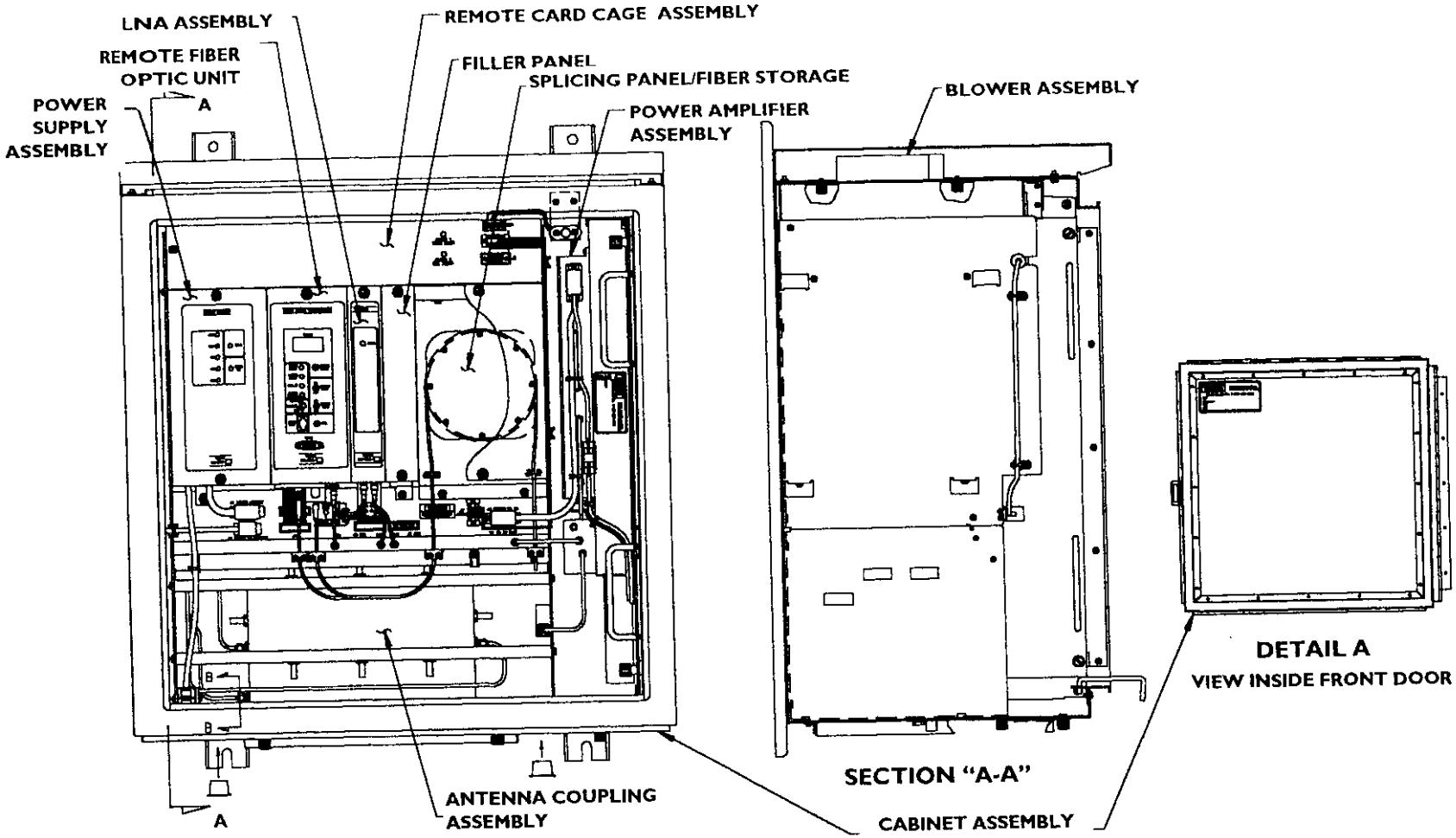


Figure 2-4. Physical Description—Lightwave microCell, Remote

Master Card Cage Assembly

The Master Card Cage Assembly consists of the 19-inch EIA Rack-Mounted Card Cage and the Power/Alarm Interface Subassembly. The cage has slots for a Power Supply Assembly, up to three Fiber Optic Transceiver Modules, and a Filler Panel.

The Power/Alarm Interface Subassembly contains the connection that provides for external monitoring of alarms at the Master site. For more information, see **Alarm and Control Wiring** on page 4-12.

Power Supply Assembly

The Power Supply Assembly is mounted in the left side of the Master Card Cage. The Power Supply can be specified for 115 VAC or 230 VAC, or 24 VDC or 48 VDC at the inputs. There are three output voltages: +12, +5, and -5 VDC.

An Alarm Subassembly is included that gives PA alarms to the System Controller. There are three test points on the front of the unit that you can use to test actual voltage output.

RF Distribution Assembly

The RF Distribution Assembly consists of the Combiner/Splitter interface, which allows a 1:1 or 1:3 configuration. In a 1:3 configuration, a 1:3 Distribution Subassembly is included. For a further description of the RF Distribution Assembly refer to **System Configuration on page 5-15**, and **RF Cable Installation on page 4-13**.

Fiber Optic Master Unit

The Fiber Optic Master Unit consists of these subassemblies:

⇒ Master RF Subassembly

⇒ Controller Subassembly

⇒ Display Subassembly

⇒ Diversity RF Subassembly (optional)

Master RF Subassembly

Forward Direction, RBS to Mobile—The RF signal input arrives at a 50 ohm, Type SMB connector located at the bottom of each Fiber Optic Master, labeled C. For a 2-channel system, nominal signal input is from -20 dBm to 0 dBm per channel.

The signal is fed through an adjustable (0 to 20 dB) input attenuator, then bandpass- filtered to allow an 869 to 894 MHz bandwidth signal. The signal passes a power detector, which lets you monitor the RF signal.

A zero dB reference point is displayed here. The recommended per-channel operating composite power in order to avoid intermodulation product is -3 dBm. For more information on intermodulation product and Carrier Loading considerations, see **RF Engineering Guidelines** on page 4-3.

A 1039 MHz pilot is added to the RF signal, which then optically modulates the DFB laser. The optical signals are routed through an FC/PC connection labeled FWD XMIT and RVS RCV (located at the bottom of the unit) to the Remote site through optical fiber. The splicing panel and FC/PC connection are accessible through the back panel.

Reverse Direction, Mobile to RBS—The optically modulated signal is received from the Remote site by a Photo Diode Detector. The signal is fed through a Low Noise Amplifier and then bandpass-filtered. The signal passes through a set of level adjustable attenuators, then feeds the output attenuators before routing to the RF connections. The two RF out connections are labeled A/Main RF Out and B/Div RF Out.

Controller Subassembly

Located on the backside of the Master RF Board, this Microprocessor Control Board houses the Controller Display (the circuitry handling the communication link and data transfer

between the Master and Remote sites) and consists of interface hardware which allows computer interface—through an RS232 connector and orderwire interface throug an RJ11 connector—for diagnostics and Remote monitoring.

The Controller Board houses seven sets of configurable DIP Switches and four Jumper Sockets; for more information see **Controller Board—Master and Remote on page 5-9**.

Display Subassembly

The Master Display consists of an LCD Display of configuration status, four LEDs for alarms and control indications, and a set of five switches that control communication between the local and Remote Modules. See **Chapter 5. System Operation and Testing** for a complete description of the Master Display.

Diversity RF Assembly

The optional Diversity RF Assembly contains the circuitry that allows the processing of a Diversity signal in the Reverse direction. The Diversity Assembly is mounted between the RF and Controller Boards of the Fiber Optic Master Unit.

Blower Assembly

The Blower Assembly on the Master is mounted on the inside top panel of the unit, fastened by four hand-removable screws. This assembly contains two fans that provide cooling for the Master Assembly.

microCell Fiber Optic Remote Assembly

The microCell Fiber Optic Remote Assembly consists of the following assemblies:

- ⇒ Cabinet
- ⇒ Remote Card Cage
- ⇒ Fiber Optic Remote Unit
- ⇒ Blower
- ⇒ LNA
- ⇒ Power Amplifier
- ⇒ Antenna Coupling
- ⇒ Power Supply

Cabinet Assembly

The Cabinet Assembly is fabricated from weathertight aluminum. This assembly houses the Remote Unit electronic equipment and provides environmental protection. Openings are provided on the unit for conduit and cable routing. Rack mounting points are provided for wall mounting or pole mounting.

Remote Card Cage Assembly

The Remote Card Cage Assembly consists of the Power/Alarm Interface Subassembly. The cage has slots for a Power Supply Assembly, a Fiber Optic Transceiver Module, a Low Noise Amplifier Module, a Filler Panel, and a Fiber locker.

On the Compact cabinet, the Fiber Locker and the Filler Panel are not part of the Card Cage Assembly. A secondary Blower is installed directly over the Power Supply Assembly.

Power/Alarm Interface Subassembly

This subassembly contains the connection which provides for external monitoring of alarm inputs and outputs at the Remote site. For further detail, refer to **Alarm and Control Wiring—Remote on page 4-18**.

Fiber Optic Remote Unit

The Fiber Optic Remote Unit consists of three subassemblies: the Remote RF Subassembly, the Controller Subassembly, and the Display Subassembly.

Remote RF Subassembly

Forward Direction—The fiber signal comes into the Remote Unit through an FC/PC connection labeled FWD RCV located at the bottom of the Fiber Optic Remote Unit. The signal is received by a photo diode detector, which converts it to RF before going on to a 869 to 894 MHz bandpass filter. From here the signal goes on to the Power Amplifier Assembly.

Reverse Direction—The signal from the mobile cellular user is received at the Remote site Main and (if configured) Diversity antennas. The Main and Diversity signals are bandpass filtered and feed the LNA.

If configured with the optional Diversity Module:

1. The Diversity signal is frequency translated with a mixer and a 1390 MHz pilot.
2. A 695 MHz pilot is added and is sent with the Main signal to the Optical Modulator.
3. The optically modulated signal is transmitted back to the Master site over the optical fiber.

Controller Subassembly

Located on the back side of the Remote RF Board, this Microprocessor Control Board houses the controller display, the circuitry handling, the communication link, and data transfer between the Master and Remote sites. It also contains interface equipment that allows computer interface (through an RS232 connector and orderwire interface through an RJ11 connector) for diagnostics and Remote monitoring.

The Controller Board houses seven sets of configurable DIP Switches and four Jumper Sockets. For more information, see **Controller Board—Master and Remote on page 5-9**.

Display Subassembly

The Remote Display consists of an LCD display of configuration status, four LEDs for alarms and control indications, and a set of five switches that control communication between the local and Remote Modules. For a complete description of the Remote Display, see **Chapter 5. System Operation and Testing**.

Blower Assembly

The Blower Assembly on the Remote Unit is mounted on the inside top of the Cabinet Assembly, fastened by four hand-removable screws. Two fans provide cooling for the standard unit and the compact Level 5 Unit. The compact, standard unit is designed with a single fan.

LNA Assembly

The Low Noise Amplifier Assembly determines the system sensitivity. This assembly interfaces directly with the Antenna Coupling Assembly, with two signal paths corresponding to the Main and Diversity signal paths.

The LNA provides for controlling the amount of Reverse gain in the system in order to set the LC-800 dynamic range. There are four attenuator stages, which you can control using switch settings on the Master or Remote Controller Boards. These switches reduce the system gain in 10 dB steps. Internal signal level detectors act to reduce the Reverse gain in the presence of *hot tones*, switching nominally at input levels of approximately -45 dBm, -35 dBm, -25 dBm, and -15 dBm.

Power Amplifier Assembly

A wideband, linear Power Amplifier completes the active component line up in the forward direction. All forward signals are amplified together in this Power Amplifier to transmit power levels. Four configurations are available, designated as Level 2, Level 3, Level 4, and Level 5 (high-power).

The Power Amplifier Assembly receives the signals from the Fiber Optic Transceiver Unit by way of coaxial cable connection.

The signals are linearly amplified by approximately 70 dB before going on to the Antenna Coupling Assembly.

The Power Amplifier Assembly is a slide-in assembly that includes an integral heatsink and three blowers for forced air cooling. The Power Amplifier Assembly mounts on the right-hand side of the Remote enclosure. The Power Amplifier consists of the following stages.

Programmable Step Attenuator, 19 dB

This attenuator can be set using DIP Switch settings. The attenuator sections are 3 dB, 6 dB and 10 dB and can be used in any combination up to 19 dB; for more information see **Controller Board—Master and Remote on page 5-9**.

Preamplifier—Level 2 through Level 5

This wideband linear stage provides 40 dB of gain and 1 Watt PEP (Peak Envelope Performance) output for Level 2, Level 3, and Level 4. For Level 5 it provides 53 dB of gain and 2 Watts PEP. It is temperature compensated and includes the programmable step attenuator.

5 Watt Linear Power Amplifier—Level 2 and Level 3

This wideband stage provides 12 dB of linear gain and 5 Watts PEP output. This is a single transistor stage with active bias.

25 Watt Linear Power Amplifier—Level 2 and Level 3

Two high power stages are parallel combined to produce 25 Watts of PEP output and 8.5 dB of linear gain. This wideband stage is the final amplifier for Level 3 equipment. Level 2 equipment uses only one of the two parallel stages to produce more than 12.5 Watts of output and 9 dB gain.

Linearized Power Amplifier—Level 4

Level 4 equipment combines a pre-distortion linearizer circuit with the Class A, 25 Watts Power Amplifier line up to make a linearized Power Amplifier. The pre-distorter creates an out of phase distortion that nulls most of the distortion created in the main amplifier, thereby increasing the power per channel operating levels by 5 dB or more.

A Multi-Carrier Feed-Forward Amplifier—Level 5

Providing 30 dB of range and 18 dB of gain, this unit is capable of providing up to 25 Watts average power (at the Amplifier output), and can provide output for up to 16 carriers at 1 Watt per carrier (at the microCell output)—with IMD (Intermodulation Distortion) levels of -60 dBc or better. This amplifier uses feed-forward correction circuitry to provide better IM (Intermodulation) performance at higher power and traffic levels.

Antenna Coupling Assembly

The antenna subsystem consists of coax feedline and antennas for distribution of the cellular signals going to and coming from the mobile units.

The assembly is configured to operate with a Main Transmit/Receive antenna and the optional Diversity antenna. The Coupling Assembly contains the components that select the LC-800 operating bandwidth and separate the transmit and receive signals. Test couplers are included to provide monitor points.

Forward Direction—The transmit signals from the Power Amplifier Assembly are buffered by an isolator and then pass to a transmit bandpass filter in the 869 to 894 MHz range. Different filters are used for A and B bands. The full 12.5 MHz of either band is passed by the filter set installed. A circulator couples the transmit signals for transmission by the Main antenna. A 30 dB directional coupler in line with the signal path allows in-service signal access.

Reverse Direction—At the Main antenna, the RF signals from the cellular mobile users are received and then passed to the RF Main Input of the Antenna Coupling Assembly. Signals go through the test coupler and T/R combining circulator, then to a pre-select bandpass filter. As with the Forward Direction, different filters are used for A and B bands while passing the

entire 12.5 MHz spectrum of A or B operator. The signals then leave the assembly and are fed to the LNA Unit.

At the Diversity antenna, the RF signals from the mobile cellular users come in to the RF Diversity Input, and go through a coupler and isolator combination to a bandpass filter. The signal then feeds the LNA Assembly.

Power Supply Assembly

The Power Supply Assembly for the Remote Unit is mounted in the left side of the cabinet. The Power Supply can be specified for 115 VAC or 230 VAC, or 24 VDC or 48 VDC at the inputs. There are four output voltages provided: +26, +12, +5, and -5 VDC. An Alarm Subassembly is included that gives Power Supply Alarms to the System Controller. There are four test points on the front of the unit that can be used to test actual power output.

Sources For Additional Information

Refer to the following sources for information on microCells, cellular telecommunications, and fiber optics:

microCells: *Application And System Engineering of Repeater Technologies microCells.* E. Drucker 1992, Repeater Technologies, Inc. *(Note: available from Repeater Technologies, Inc.)*

Cellular: *Mobile Cellular Telecommunications Systems.* William C.Y. Lee 1989, McGraw Hill Company.

Fiber Optics: *Fiber Optics Handbook*, 1989, Hewlett Packard.

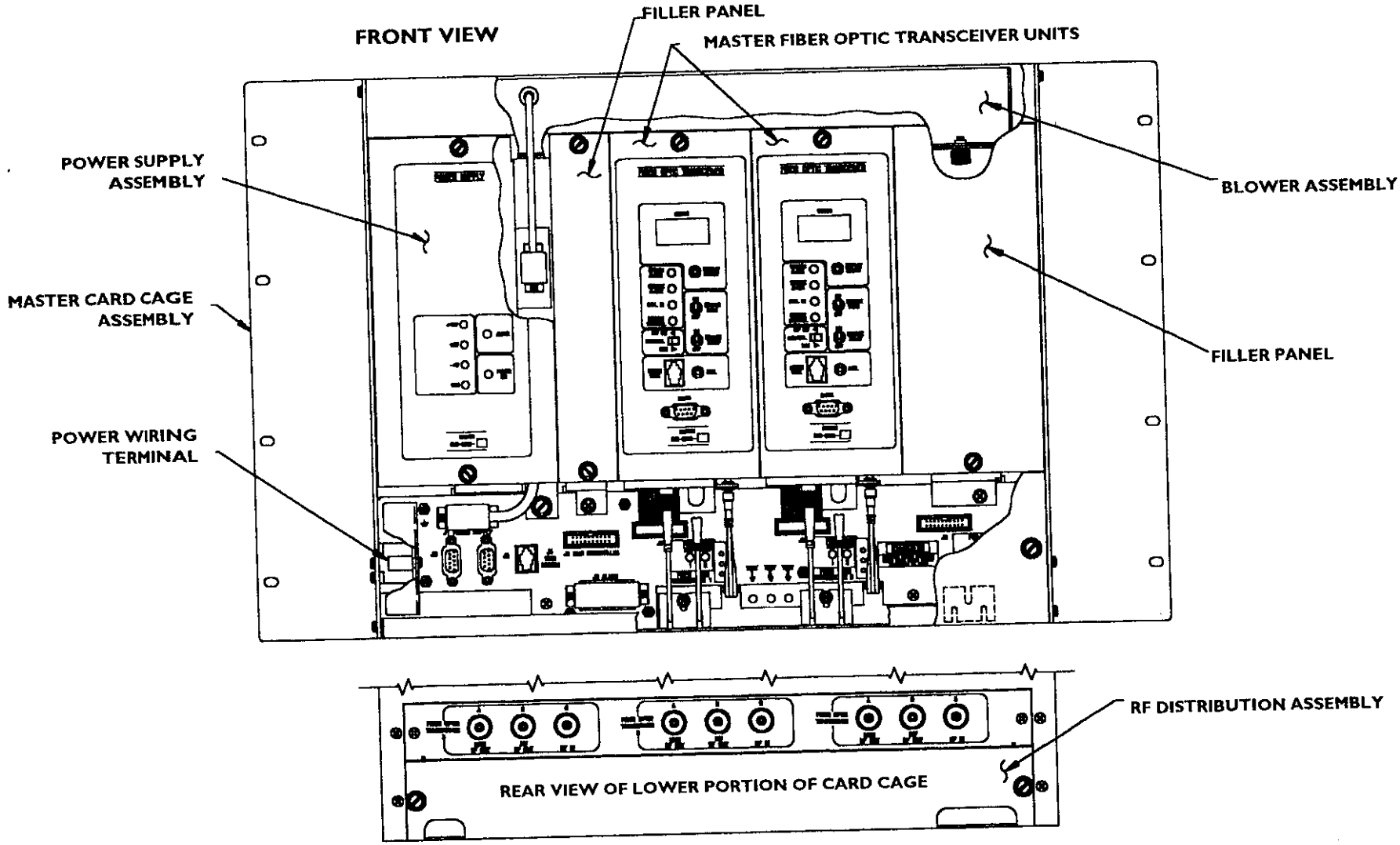


Figure 2-5. MicroCell Master with Extended Mounting Ears (for 23-inch Rack)

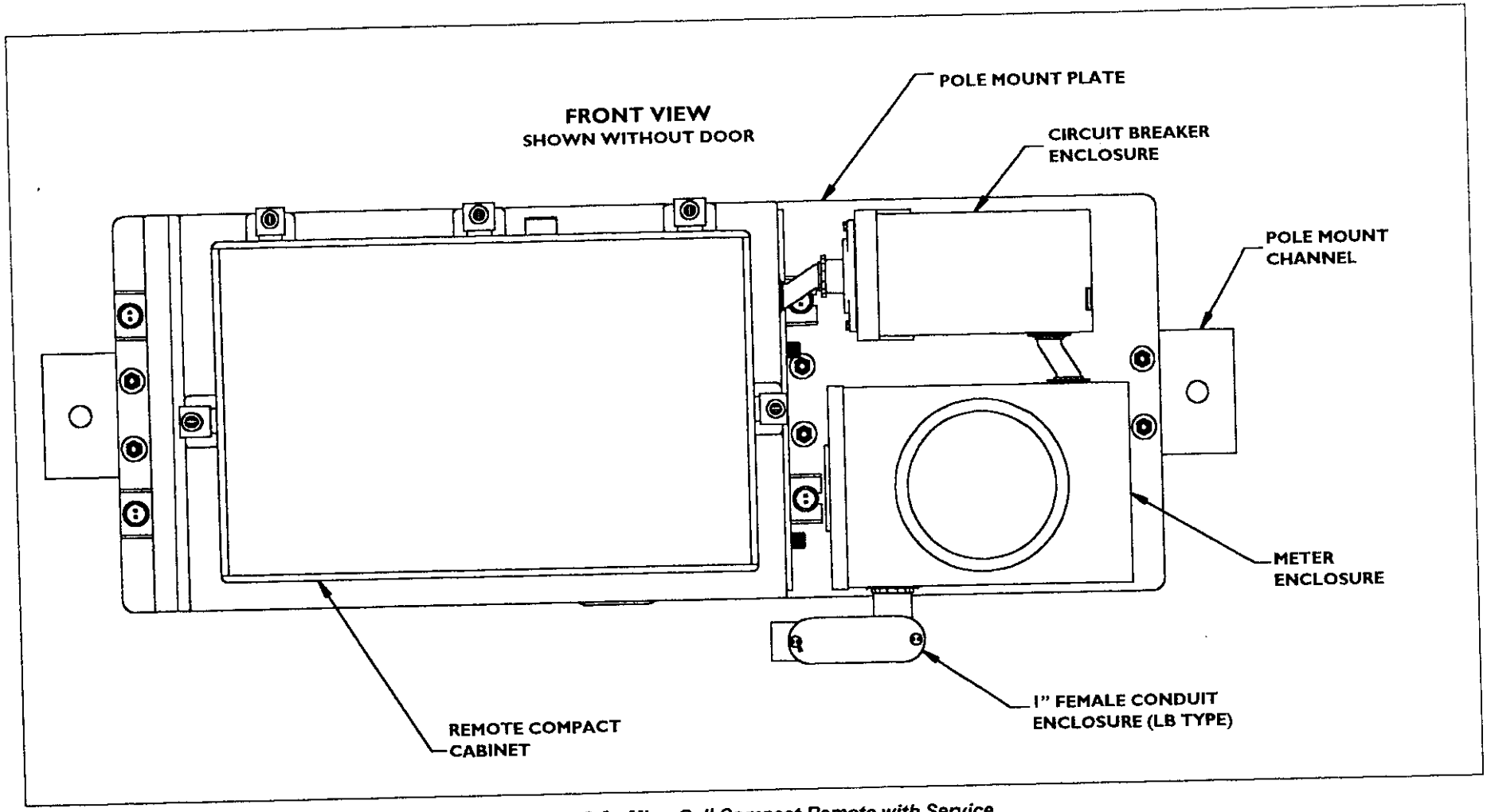


Figure 2-6. MicroCell Compact Remote with Service

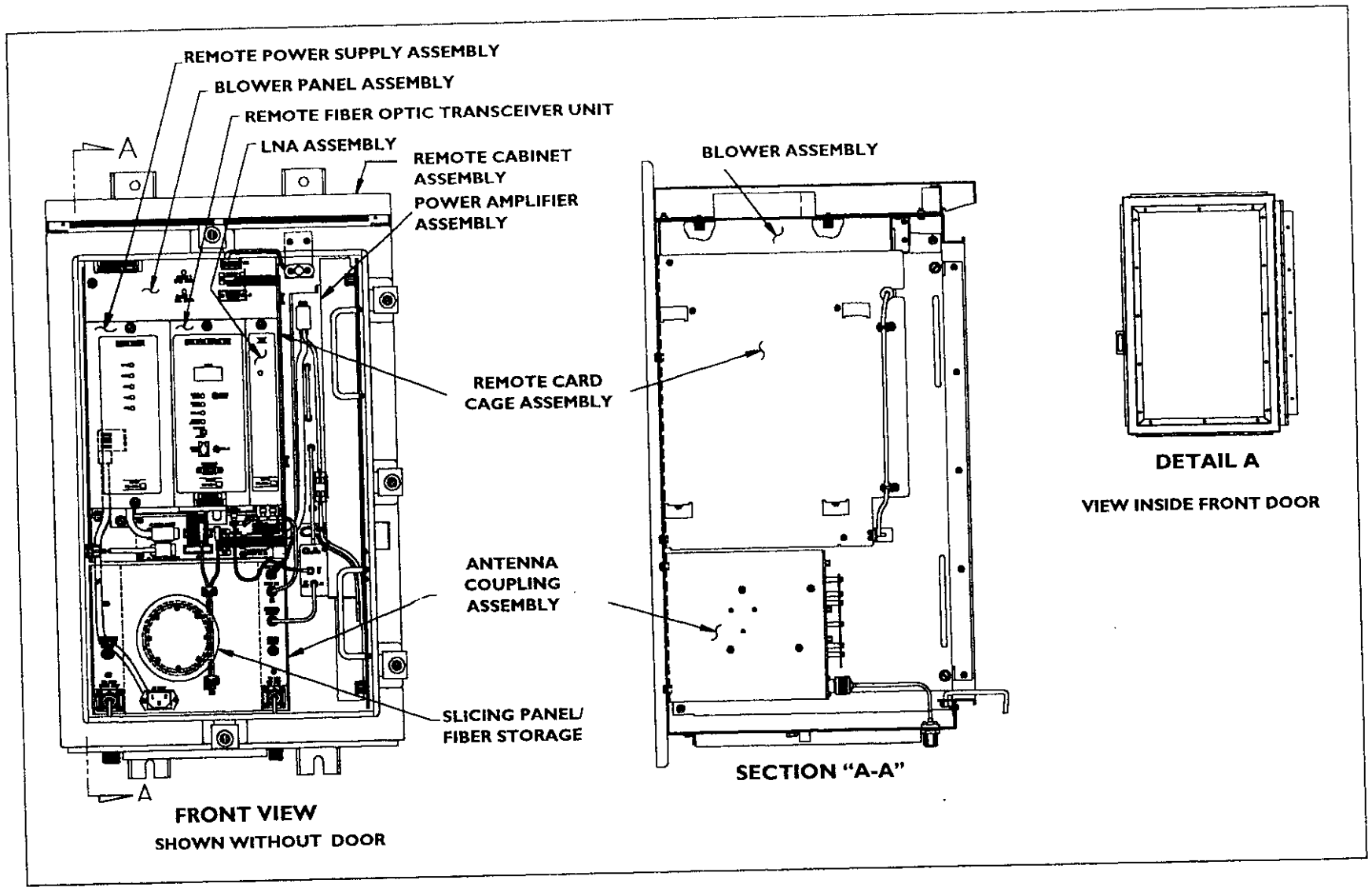


Figure 2-7. MicroCell Compact Remote

End of Chapter

Chapter 3 . Ordering Information

Tables

Introduction

This section discusses the standard configurations and part numbers of the LC-800 as it is shipped from the factory, and makes note of optional equipment and part numbers. For a list or replacement parts, see Tables 1 and 2.

Master Unit Standard Configurations

The LC-800 Master Unit includes the Card Cage, Power Supply, Blower, and RF Distribution Assemblies. The Optical Transceiver Units (one, two, or three) are specified separately. An optional Alarm Expansion Module is available.

Table 3-1. Standard Configurations and Part Numbers—Master Unit

Model No.	Description	Part No.	Ship Lbs.
LC-800MU-XX	*LC-800 Master Unit*		
LC-800MU-01	115 VAC,1:1 Distribution	900-0746-01	30
LC-800MU-02	115 VAC, 1:3 Distribution	900-0746-02	30
LC-800MU-11	230 VAC 1:1 Distribution	900-0746-11	30
LC-800MU-12	230 VAC 1:3 Distribution	900-0746-12	30
LC-800MU-21	24 VDC 1:1 Distribution	900-0746-21	30
LC-800MU-22	24 VDC 1:3 Distribution	900-0746-22	30
LC-800MU-41	48 VDC 1:1 Distribution	900-0746-41	30
LC-800MC-42	48 VDC 1:3 Distribution	900-0746-42	30
Model No.	**Description**	**Part No.**	**Ship Lbs.**
Modules	*Plug-Ins for Master Unit*		
OTU/M	Assy. Master Lightwave Transceiver (with Diversity)	090-0242-03	8
OTU/M	Assy. Master Lightwave Transceiver (without Diversity)	090-0242-04	8
N/A	Alarm Expansion Unit	090-0899-01	2

Remote Unit Standard Configurations

The LC-800 Remote Unit is available in a standard or compact cabinet, and in pad mount configurations. The Remote Units are specified by frequency bands, power supplies, receiver configurations and RF Power Amplifiers.

Compact Remote Unit

The Remote Unit includes a Power Supply, a Lightwave Transceiver, a Low Noise Amplifier, an RF Power Amplifier, and an Antenna Coupling Assembly. Options include mounting kits and battery backup.

Table 3-2. Configuration and Part Numbers—Remote Unit

Model No.	Description	Part No.	Ship Weight
LC-800COM-XX	LC-800 Remote Unit Compact Cabinet		
LC-800HPCOM-XX	LC-800HP Remote Unit Compact Cabinet		
Modules—Plug In Units For Remote			
OTU/R	Assy. Remote Lightwave Transceiver (with Diversity)	090-0252-03	8
OTU/R	Assy. Remote Lightwave Transceiver (without Diversity)	090-0252-04	8
Options (Available for Compact Cabinet)			
N/A	Mounting Kit, LC-800 Compact Remote with Service Plate and Channel	091-0042-01	25
N/A	Mounting Kit, LC-800 Compact Remote with Plate and Channel	091-0042-02	20
N/A	Mounting Kit LC-800 Compact Remote with Plate	091-0042-03	15
BPSS-11	Battery Power System: Compact AC Input, 24 V Output 16A Charger, 12 V 100 AH Batteries	250-1011-07	85

Lightwave microCell Master Unit Spare Modules

Table 3-3. Spare Parts List—Master Unit

Description	Part No.	Ship Weight
Power Supply Assy.,115 VAC	090-0238-01	10 lbs
Power Supply Assy., 230 VAC	090-0238-02	10 lbs
Power Supply, Assy., 24 VDC	090-0238-03	10 lbs
Power Supply Assy., 48 VDC	090-0238-04	10 lbs
Blower Assy.	090-0239-01	8 lbs
Blower, Radial, 12 VDC	149-0177-02	2 lbs
RF Distribution Assy., 1:1	090-0240-01	10 lbs
RF Distribution Assy., 1:3	090-0240-02	10 lbs
Master Lightwave Transceiver (with Diversity)	090-0242-03	8 lbs
Master Lightwave Transceiver (w/o Diversity)	090-0242-04	8 lbs
Alarm Expansion Unit	090-0899-01	3 lbs
Orderwire Handset	149-0352-01	1 lbs
Cord (Orderwire Handset)	103-0122-01	1 lbs
Additional Installation and Operations Manual	550-0746-01	2 lbs

LC-800 Lightwave microCell Remote Unit Spare Modules

Table 3-4. Spare Parts List—Remote Unit

Description	Part No.	Ship Weight
Power Supply Assy., 115 VAC (Compact)	090-0253-05	10 lbs
Power Supply Assy., 230 VAC (Compact)	090-0253-06	10 lbs
Power Supply Assy., 24 VDC (Compact)	090-0253-07	10 lbs
Power Supply Assy., 48 VDC (Compact)	090-0253-08	10 lbs
Power Supply Assy., 115 VAC	090-0976-01	10 lbs
Power Supply Assy., 24 VDC	090-0976-03	10 lbs
Blower Assembly (Compact)	090-0291-01	8 lbs
Blower, Radial, 12 VDC	149-0177-01	2 lbs
LNA Assembly (LC-800 with Diversity)	090-0264-06	5 lbs
LNA Assembly (LC-800 without Diversity)	090-0264-07	5 lbs
Remote Lightwave Transceiver (with Diversity)	090-0252-05	8 lbs
Remote Lightwave Transceiver (without Diversity)	090-0252-06	8 lbs
Power Amplifier Assembly (LC-800 Level 3 with Heatsink)	090-0729-05	25 lbs
Power Amplifier Assembly (LC-800 Level 4 with Heatsink)	090-0729-06	25 lbs
Power Amplifier Assembly (LC-800 HP Level 5)	090-1108-01	25 lbs
Power Amplifier Assembly (LC-800 Level 5 CDMA)	090-1108-02	25 lbs
Optical Test Cable, first	187-0500-01	1 lb
Optical Test Cable, second	187-0500-02	1 lb
Orderwire Handset	149-0352-01	1 lb
Cord (Orderwire Handset)	103-0122-01	1 lb
Additional Installation and Operations Manual	550-0746-01	2 lbs

Ordering Procedure

When you place an order for the LC-800 system, state the cellular system type in use (Amps, D-AMPS, and so on) and the operating frequency range on the purchase order. You must specify the number of Fiber Optic Units (Master and Remote plug-in assemblies), but not as separate line items.

The Master shelf can support one, two, or three plug-in assemblies, and the Remote cage can accept one assembly. Based upon the system configuration of features and options, a sales-order-specific part number will be assigned.

When ordering the LC-800 system, consider ordering AC/DC power equipment, antennas, and coaxial cables, and making provisions for physically mounting the equipment and antennas at the Master and Remote sites.

When ordering, specify a shipping destination and a billing address. Repeater Technologies will return an order acknowledgment with the scheduled shipping date. Each shipment includes an equipment list showing the equipment ordered and shipped, including details about system and equipment options. Contact the Repeater Technologies Sales Department for ordering information.

Contacting Repeater Technologies

Contact the Repeater Technologies corporate headquarters for sales information or technical assistance for the LC-800, or any other of our communications or related products.

Corporate Headquarters

1150 Morse Avenue
Sunnyvale, CA 94089-1605 USA

Tel: (408) 747-1900
(888) 747-1515 (USA and Canada)

Fax: (408) 747-0375

Web: **www.repeaters.com**

Customer Service

Tel: (408) 747-1946
(800) 938-1901 (USA and Canada)

End of Chapter

Figures

Tables

Introduction

This chapter describes the unpacking and installation of the LC-800 system, including necessary connections for the standard assemblies, power connections, alarm and orderwire connections, and optical fiber splicing.

System engineering guidelines and procedures that let you verify each step of the installation and the effectiveness of your equipment also are provided.

WARNING: *Only qualified service or technical personnel should install, service, or maintain the LC-800 equipment. To prevent personal injury and/or damage to the equipment, this chapter should be read in its entirety prior to equipment installation.*

CAUTION: *Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure. Invisible laser radiation is emitted when optical connectors are unterminated.* ***AVOID DIRECT EXPOSURE TO BEAM.***

General

Unpacking And Visual Inspection

When the LC-800 is received, it must be carefully inspected (inside the shipping container as well as out) for damage before transporting it to the installation site. If damage is found, note it on the waybill and have the delivery agent sign the waybill. Notify the transfer company immediately, submit a damage report to the carrier, and advise the Field Services department of Repeater Technologies in writing.

After unpacking the equipment, inventory the contents of the shipping containers against the packing lists.

Inspect each unit thoroughly for damage hidden by the packaging, paying particular attention to the following:

⇒ Bent or dented sheet metal
⇒ Loose or broken components
⇒ Loose mounting hardware
⇒ Faulty switches
⇒ Damaged connectors
⇒ Damaged or broken wiring or coaxial cables

Whenever shipping microCell equipment long distance, observe these guidelines:

⇒ Check the integrity of the cabling and the security of the internal mounting hardware.
⇒ Repack the units in the original or similar shipping containers.

Installation Guidelines

This section discusses system engineering considerations such as Fiber Path Engineering and RF Engineering guidelines.

System Engineering Considerations

Basic system design parameters include consideration for site selection, fiber optic path engineering, and RF engineering considerations.

WARNING: *Turn off the Power Supply before installing or removing the Power Amplifier Assembly. Hot plugging the Power Amplifier will damage the PA Assembly.*

Fiber Path Engineering

RF Power Budgeting

The first consideration in engineering the fiber optic connection between the Master and Remote sites is the RF power budget. The power budget is derived by subtracting all of the optical losses from the optical power delivered by the Master transmitter, and determining if the resultant power meets the specifications to drive the receiver.

The design must leave enough signal above the Receiver's minimum requirements to allow for system degradation and fluctuations introduced by splicing, connectors, etc.

See **Technical Specifications** for specifications of optical transmit and receive power as average output power. In its simplest form, the power budget is as follows:

Transmitter Output (minus) Receiver Input = Σ Losses + Margin

NOTE: *To meet equipment specifications, the Optical Output Power from the OTU (Optical Transceiver Unit) is approximately +3 dBm, and the minimum Receiver Input power is -7 dBm.*

The following types of loss should be considered when installing the LC-800 system:

⇒ Connector Loss
⇒ Splice Loss
⇒ Fiber Loss

Sample Loss Calculations

Connectors and splices can contribute significant losses in a fiber optic system. These losses are not difficult to measure. Connectors and splices have characteristic losses that you can multiply by the number in a system to estimate total loss.

The FC/PC connectors used in the LC-800 system are rated at a maximum 0.5 dB of loss per connector. Good splices at the 1310 nm (1.3 μm) are typically rated at 0.1 dB of loss.

The simplest approximation to loss in an optical fiber is to multiply the attenuation (in decibels per kilometer) by the transmission distance. Typical single mode fiber loss for 1310 nm diameter fiber is rated at 0.25 dB per kilometer.

See the following table, which shows a sample link loss budget for the LC-800 (with a 10 km fiber link, five splices, and two connectors) and describes typical fiber loss with good single mode splices and FC/PC connectors. The default configuration requires two splices to connect the equipment, and two FC/PC connectors.

Table 4-1. Sample Link Loss Budget

TX Laser power into fiber	3.0 dBm
Fiber loss (1310 nm) (10 km x 0.25 dB/km)	2.5 dB
Splice loss (5 x 0.1 dB)	0.5 dB
Connectors (2 @ 0.5 dB)	1.0 dB
Receive signal level	-1.0 dBm
System Margin	6.0 dB

RF Engineering Guidelines

This section discusses guidelines used in determining system output level vs. the number of channels being transmitted in the LC-800 system. See **Chapter 5. System Operation and Testing** for a further description of the function of the Controller Subassembly attenuator settings.

NOTE: *The table readings given in the followings sections are not from calibrated sources and should not be used for exact measurements. All values should be checked using calibrated test equipment.*

Forward Direction Setup

The performance of Forward direction transmission depends upon the number of channels transmitted, RF power input, distribution configuration, and system-specific losses and gains.

When configuring a system, pay particular attention to transmission power levels at all points in the transmission path.

CAUTION: *Use a 30 dB pad at the antenna port to load the system when measuring Forward signal power levels. Do not operate the Power Amplifier without a load—possible damage could result.*

The Forward signal path is as follows:

1. **RF Input Power (to OTU).** The LC-800 Master OTU has an allowable RF input power range dependent upon the channel configuration of the unit: see Table 4-2. Adjust the input if it falls outside this range.

Table 4-2. RF Input Power Ranges by Channel Configuration

Number of Channels	*Range of Input Level* (dBm)*	*Nominal RF Input Signal** (dBm)*	*FWD In Attenuation Setitng*
2	0 to -20	-20	0
4	-5 to -25	-20	6
8	-9 to -29	-20	8
10	-10 to -30	-20	10
16	-12 to -32	-20	12

**This level is the interface level that can be accommodated at the Master input. Power is measured per tone.*

***RF power amplifier output measured per tone in order to meet a -40 dBc intermodulation product.*

2. **Forward In Attenuation (Master OTU).** Set the FWD IN attenuator (a subassembly of the Master OTU) according to the number of channels in the system; see Table 8. Fwd In attenuation is not affected by the per-tone input power level, only the number of channels.

   The attenuator protects the system from high input signal levels. Adjust the FWD IN attenuation on the controller subassembly of the OTU.

3. **Optical Transmitter (Master OTU).** After attenuation, the RF signal is modulated to optical form and passed to the optical transmission unit in the OTU. An "RF COMP" indication on the LCD display allows the system operator to monitor the composite RF power at the OTU input to insure adequate RF power to modulate the laser diode.

   The composite RF power input to the Optical Transmitter *must* not exceed -3 dBm. Optical signal output from the OTU to the fiber should be about 3 dBm, regardless of the OTU RF input level.

4. **Optical Fiber Link.** The optical fiber link between the Master and the Remote units (the fiber connection) reduces the strength of the signal according to the sum of the losses in the link; see **Sample Loss Calculations** on page 4-3.

5. **Remote OTU.** The optical receiver in the Remote OTU has a minimum input level of -7 dBm. This limits the length of the fiber link between the Master and the Remote units.

   After receiving the optical signal, the OTU demodulates the signal from optical to RF and transfers it out of the OTU to an attenuation pad. The Remote OTU output should be the same as the Master OTU input.

6. **Attenuation Pad.** The RF signal passes from the OTU to a 10 dB step attenuator pad with 2, 3, 5, 10 dB steps CONTROL IN to the Power Amplifier.

7. **Power Amplifier Assembly.** The Power Amplifier in the PA assembly boosts the signal according to the gain setting on the PA unit. The standard gain setting for the amplifier is 73 dB.

   If adjusting PA gain, consider the effects of system IMD (a measurement in dBc of the non-linearity of the power amplifier). Note that IMD varies according to the carrier loading of the system. The LC-800 is specified for a 3rd order IMD for a given output power and a given number of system demands.

8. The IF assembly filters the signal before it is passed to the Combiner
9. **Antenna Coupler.** The antenna coupler passes signal to the Mobile Service Antenna for broadcasting. The signal strength loses 3 dB in the antenna coupler.

See the following table for sample signal levels in the forward signal path and the following figure for a foward path diagram.

Table 4-3. Sample RF Power Levels, Forward Direction

Master Unit					*Fiber Link*	*Remote Unit*					
		Remote OTU				*Master OTU*					
# Chnls	*Forward TX RF Input distribution**	*OTU RF Input**	*OTU RF Input, comp. (dBm)*	*OTU Optical TX Output*	*Fiber Loss†*	*OTU Optical RX Input*	*OTU RF Output**	*Attn Pad (loss)*	*PA— RF Output**	*Combiner Output**	*Antenna Coupler Output**
1 to 1 Distribution											
2	-20 dBm	-20 dBm	-16.99	3 dBm	4 dB	-1 dBm	-20 dBm	6 dB	33 dBm	30.5 dBm	30.5 dBm
4	-20	-20	-13.98	3	4	-1	-20	6	33	30.5	30.5
8	-20	-20	-10.97	3	4	-1	-20	6	33	30.5	30.5
10	-20	-20	-10.00	3	4	-1	-20	6	33	30.5	30.5
16	-20	-20	-7.96	3	4	-1	-20	6	33	30.5	30.5
1 to 3 Distribution											
2	-10 dBm	-20 dBm	-16.99	3 dBm	4 dB	-1 dBm	-20 dBm	6 dB	33 dBm	30.5 dBm	30.5 dBm
4	-10	-20	-13.98	3	4	-1	-20	6	33	30.5	30.5
8	-10	-20	-10.97	3	4	-1	-20	6	33	30.5	30.5
10	-10	-20	-10.00	3	4	-1	-20	6	33	30.5	30.5
16	-10	-20	-7.96	3	4	-1	-20	6	33	30.5	30.5

**Power per carrier.* *†Calculated with 10 km of fiber, 5 splices, and 2 connectors: .25(dB/km) x 10 + .1 x 5 + .5 x 2 = 4.*

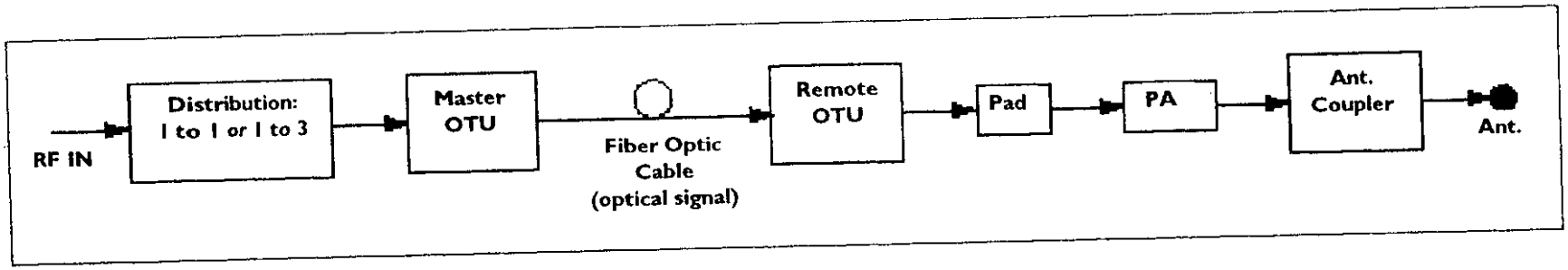


Figure 4-1. Forward Path Diagram

Reverse Direction Setup

The performance of the Reverse direction transmission depends upon the RF power input, signal distribution, and system-specific losses and gains. During system configuration, pay particular attention to power levels at all points in the transmission path.

See the following figure for a path diagram and the following table for sample signal levels in the forward signal path.

CAUTION: *Turn OFF the Power Amplifier before measuring signal levels in the Reverse direction. If the Power Amplifier unit is ON during measurements, possible damage to the LC-800 or test equipment may occur.*

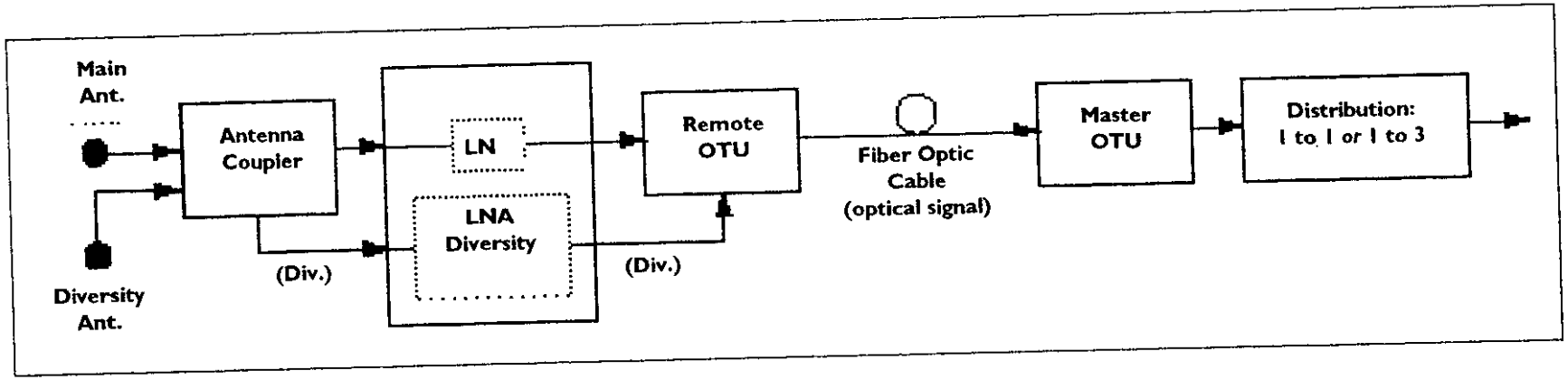


Figure 4-2. Reverse Path Diagram

Table 4-4. Sample RF Power Levels, Reverse Direction

Remote Unit					Fiber Link	Master Unit		
			Remote OTU			Master OTU		
# Chnls	Ant. Coupler RF Input*	Ant. Coupler RF Output*	LNA RF Output* (±2 dB)†	OTU Optical TX Output	Fiber Loss‡	OTU Optical RX Input	OTU RF Output*	Distribution RF Output*
1 to 1 Distribution								
2	-55 dBm	-57 dBm	-26 dBm	3 dBm	4 dB	-1 dBm	-31 dBm	-31 dBm
4	-55	-57	-26	3	4	-1	-31	-31
8	-55	-57	-26	3	4	-1	-31	-31
10	-55	-57	-26	3	4	-1	-31	-31
16	-55	-57	-26	3	4	-1	-31	-31
1 to 3 Distribution								
2	-55 dBm	-57 dBm	-26 dBm	3 dBm	4 dB	-1 dBm	-31 dBm	-41 dBm
4	-55	-57	-26	3	4	-1	-31	-41
8	-55	-57	-26	3	4	-1	-31	-41
10	-55	-57	-26	3	4	-1	-31	-41
16	-55	-57	-26	3	4	-1	-31	-41

**Single carrier level.*
†This variation in signal strength can impact Master OTU RF output and Distribution RF output.
‡Calculated with 10 km of fiber, 5 splices, and 2 connectors: .25(dB/km) x 10 + .1 x 5 + .5 x 2 = 4.

The Reverse signal path is as follows:

1. **Antenna Coupler**
   The signal passes from the antenna coupler to the LNA.

2. **LNA**
   The LNA boosts signal strength with a gain setting of 33 ±2 dB and passes it to the Remote OTU. The 2 dB variation in gain can impact OTU RF power output and Distribution RF power output. There are Main and Diversity signals, the signals are processed separately.

3. **Remote OUT**
   The Remote OTU combines Main and Diversity signals, modulates the RF signal to optical signal, and transmits it to the fiber link. Composite RF signal strength input to the Optical TX Unit *must be no greater than -3 dBm*. Optical signal output from the Remote OTU should be about 3 dBm, regardless of RF input to the OTU.

4. **Fiber Link**
   The fiber link transmits the optical signal to the Master OTU. The signal incurs a loss based on the length of the link and the number of connections—see **Sample Loss Calculations** on page 4-3.

5. **Master OUT**
   The Master OTU receives the optical signal, demodulates it to RF form, boosts the RF signal according to the Reverse channel gain, and passes the RF signal to the Distribution unit. Adjust Reverse channel gain by using the attenuator settings on the controller subassembly.

6. **Distribution Unit**
   The distribution unit passes the RF signal to the RBS equipment.

   The reference receive level in the Reverse direction is -55 dBm at the RX antenna output. The output level at the Master unit is set by the Reverse channel gain. The Reverse channel gain is set by the attenuator settings on the controller subassembly. With 24 dB of Reverse channel gain, the output is nominal at -31 dBm. With 0 dB of Reverse gain, output is nominal at -55 dBm. A minimum gain of 3 dB should be maintained on the Reverse link in order to limit the noise figure contribution of the optical link to the overall system. Note that Main and Diversity Reverse gains should be set independently.

If a Mobile transmits at full power close to the RX antenna, a *hot tone* is produced. This ordinarily would overload the system. The LC-800 automatically protects itself against hot tones by switching in attenuators in the LNA (main or diversity) and switching out the symmetrical attenuator on the Master cell site. This lets the unit maintain the same overall gain even in the presence of hot tones and supply an extended dynamic range of 40 dB in the Reverse direction.

In an environment in which many hot tones are expected, you can switch in 10 dB of attenuation in the LNA assembly by selecting the main and diversity attenuator settings on the controller subassembly.

Master Site Installation

This section describes the mounting procedure for the Master Unit Card Cage. The only tool required for installation is a flat blade screwdriver.

Physical Installation

The LC-800 Master Unit is designed for conventional 19-inch (482.6 mm) rack mounting. The chassis occupies 355.6 mm vertically, with a 292.1 mm forward projection. Access is required to the rear of the chassis for cabling. The unit is attached to the rack using screws (customer supplied item) applicable to the type of rack used for mounting.

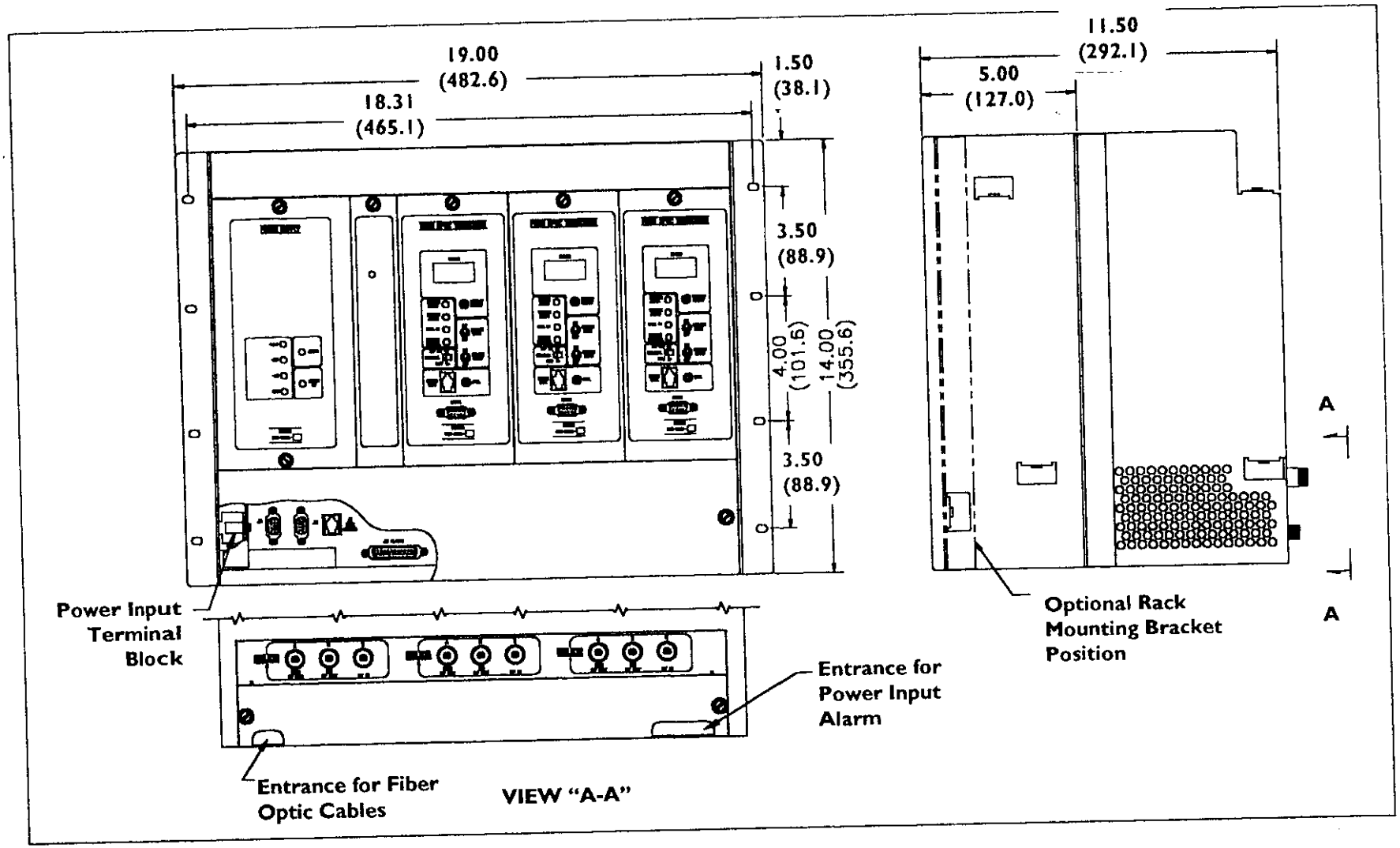


Figure 4-3. Mounting Dimensions for the Master Unit

Master Power Wiring

This section describes the terminal connector types and locations for wiring the Master Unit AC Mains and DC Battery of the microCell system. Required tools and equipment are as follows:

- ⇒ Flat Blade Screwdriver
- ⇒ NMT (Non Metallic Tubing)
- ⇒ Liquid-Tight connectors
- ⇒ Greenfield flexible tubing or EMT (Steel Electrical Tubing)

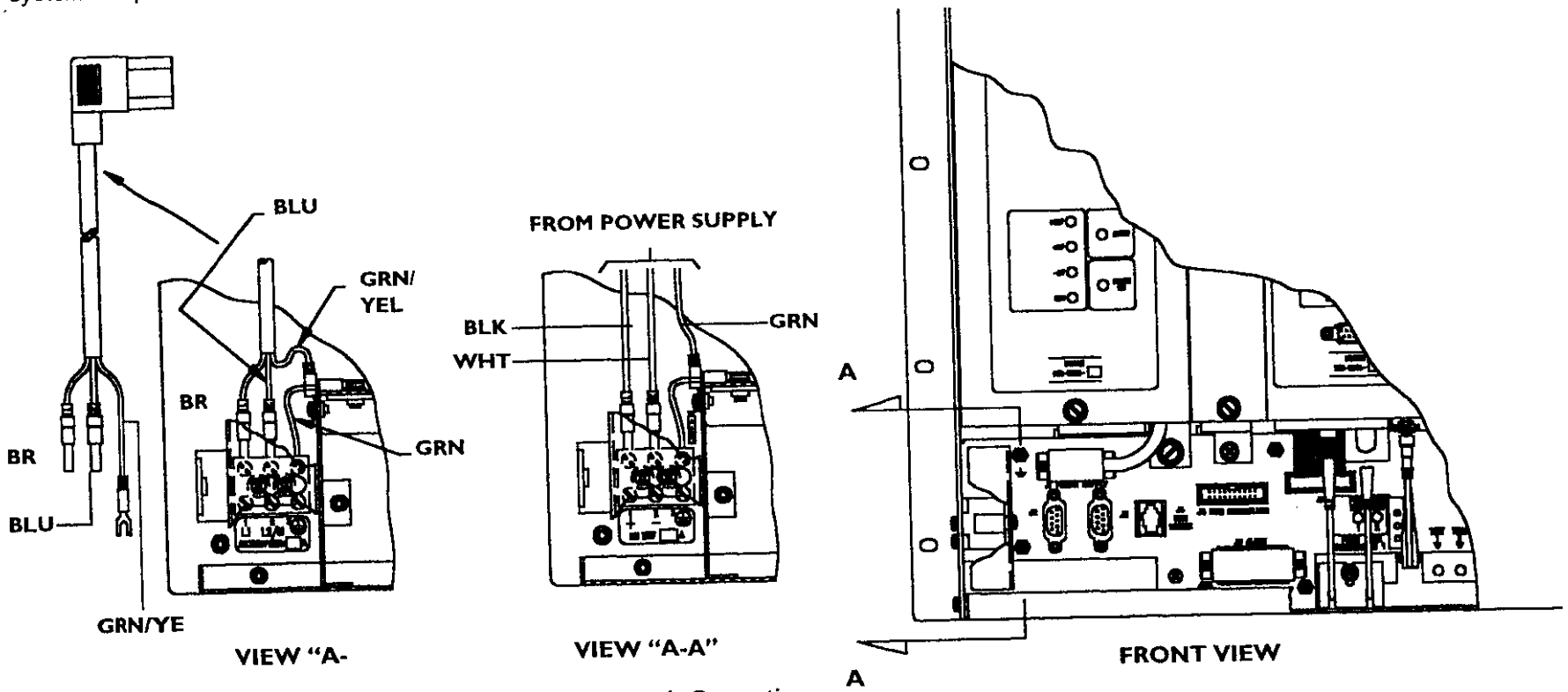


Figure 4-4. Power Wiring Terminal: Master Unit

Master Power Wiring—AC Mains

The LC-800 Master Unit is provided with a 3-position terminal block located in the lower left portion of the unit. The terminal uses compression screws for AC High [L1], AC Low [L2], and Ground [G] wires up to 3.5 mm in diameter, No. 8 AWG. Minimum recommended wire diameter is 1.6 mm, No. 14 AWG. AC Wires should go to a circuit breaker in an approved load box. Be sure the voltage of the AC mains and the LC-800 Fiber Optic Master Unit match.

NOTE: *The NEC (National Electric Code), section 250-93, Part C, specifies a minimum size of 8 AWG as the grounding wire.*

Use non-metallic tubing or an equivalent to contain the AC cable from the LC-800 to a junction box or load circuit breaker. The circuit breaker should be rated for 10 Amps for 230 VAC mains. The AC Power Requirements at the Master are:

One Transceiver Module	120 VAC 0.6 Amps, 230 VAC 0.3 Amps
Three Transceiver Modules	120 VAC 1.3 Amps, 230 VAC 1.0 Amps
AC Connections	L1 = Line 1, AC High; L2 = Line 2, AC Low or Neutral; G = Ground/Earth

WARNING: *Do not apply AC power at this time, as injury to personnel or damage to equipment can occur.*

Power Wiring—DC Battery

The LC-800 is provided with an internal terminal block for DC connections, located in the lower left portion of the unit.

⇒ The terminal uses compression screws for +24 V, –24 V, and ground wires up to 3.5 mm in diameter, No. 8 AWG.

⇒ Minimum wire diameter is 2 mm, No. 12 AWG.

⇒ The DC wires should be connected to a fuse or circuit breaker in an approved load box or DC distribution board. Be sure the voltage of the DC wiring and the LC-800 match.

NOTE: *The NEC (National Electric Code), section 250-93, Part C, specifies a minimum size of 8 AWG as the grounding wire.*

Use non-metallic tubing or an equivalent to contain the DC wires from the LC-800 to a junction box or load circuit breaker. The circuit breaker should be rated at 10 Amps for 24 VDC mains.

The DC Power Requirements at the Master are:

One Transceiver Module	24 VDC	2.0 Amps
Three Transceiver Modules	24 VDC	5.2 Amps
DC Connections	1 +24 V = (+) Battery Wire 2 –24 V = (–) Battery Wire 3 ⏚ = Ground/Earth	

If the battery polarity is +24 V Hot, –24 V Ground, then the –24 V terminal can be grounded. If the battery polarity is –24 V Hot, +24 V Ground, then the +24 V terminal can be grounded.

WARNING: *Do not apply AC power at this time, as injury to personnel or damage to equipment can occur.*

Fiber Optic Cable Installation

This section describes the procedures for installing the fiber optic cable at the Master and Remote sites.

Required equipment is:

⇒ Single Mode Optical Fiber—core diameter is typically 10 µm, with .25 dB/km attenuation

⇒ Single Mode Fiber Splicing Machine—Siecor M90, M91, or M92 Fusion Splicers

⇒ Laser Source—Wandel & Goltermann OLS-25, or equivalent

⇒ Power Meter—Wandel & Goltermann OLP-25, or equivalent

The fiber splicing should be done by a qualified splicing technician, using a single mode splicing machine. After splicing, insertion loss

and return loss should be tested to insure a good splice; see **Fiber Path Engineering** on page 4-2 for guidelines. Use a laser source and an optical power meter such as the Wandel & Goltermann models for this purpose.

Installation Procedure

The LC-800 is supplied with an FC/PC connector—a pigtail (a piece of fiber with connector on one end, and a cleave on the opposite end). You must have enough optical fiber to run from the Master to the Remote sites.

You can supply a splice panel, if desired; however, the Master and Remote Units contain space to place excess fiber (top area of the Master, bottom area of the Remote).

FC/PC connectors are keyed connectors. They contain a cylindrical guide that surrounds the optical fiber, with a screw-on collar on the outside of the connector assembly.

Before inserting the fiber optic connector into the matting barrel of the Fiber Optic Module, clean the tips of the fiber ferrule with a cotton-tipped swab and alcohol, or with optical tissue. Push the FC/PC connector into the allocated slot in the unit, then hand-tighten the outer collar.

NOTE: *Do not force the connector into the matting barrel or attempt to insert the connector at an angle. This will stress and possibly crack the barrel sleeving material, resulting in fiber-to-fiber misalignment and system failure.*

Alarm and Control Wiring—Master

This section describes the function and connection description of the External Alarm Interface Connections on the Master Unit.

The LC-800 is provided with a set of alarm outputs and control inputs. The Master Alarm Interface is found at connector J6.

The System Summary Alarms (relay contact closures) are brought into the monitoring system at the cell site and wired such that, if an alarm condition occurs in the microCell, it is reported through the Cell Site Alarm Reporting Conditions.

Table 4-5 describes the list of pins and their respective descriptions at the Master Alarm Interface connector labeled J6 Alarm (DB-25 Connector).

Table 4-5. Master Unit Alarm Connections for the External Alarm Interface

Pin	*Description*
1	No Connection
2	Ground
3	No Connection
4	Ground
5	Alarm Output #1, Open Door Alarm—Module #3
6	Transceiver Master Summary Alarm Relay—Module #3
7	No Connection
8	Alarm Output #2, External Equipment—Module #2
9	Transceiver Remote Summary Alarm Relay—Module #2
10	No Connection
11	Ground
12	Alarm Output #1, Open Door Alarm—Module #1
13	Transceiver Master Summary Alarm Relay—Module #1
14	No Connection
Pin	*Description*
15	NMS Alarm Output, not used
16	No Connection
17	Alarm Output #2, External Equipment—Module #3
18	Transceiver Remote Summary Alarm Relay—Module #3
19	No Connection

20	Ground
21	Alarm Output #1, Open Door Alarm—Module #2
22	Transceiver Master Summary Alarm Relay—Module #2
23	No Connection
24	Alarm Output #2, External Equipment—Module #1
25	Transceiver Remote Summary Alarm Relay—Module #1

Relay contacts are rated as follows:

Maximum Voltage..... 110 VDC
Maximum Current..... 1 Amp
UL Rating..... 1A, 30 VDC

NOTES:

⇒ *Alarm Inputs #1 and #2 are active Low.*

⇒ *Alarm Outputs #1 and #2 are Relay Closure to Ground when alarmed.*

⇒ *Summary Relay Alarm outputs are Closure to Ground when alarmed.*

⇒ *Remote Controlled Relay Output is a Closure to Ground when either Master or Remote Fiber Optic Transceiver front panel Remote Relay Switch is on the OFF position.*

Mating Connectors

Connector J6 is an IDC DB-25, 25-pin (f). A compatible plug is AMP 747948-1 (m).

RF Cable Installation

This section describes the procedure for connecting the Master site equipment to the host RF interface. For further detail on RF engineering and the LC-800, see **Engineering Guidelines**.

See the following table and figure for connector information and a view of the interface.

Table 4-6. Recommended Cables and Lengths

Cable Type	Part #	Connectors	Length
RG-8U (50 ohm) Coaxial	Belden 9914	Type N "Plug" (AMP 1-225661-6)	10 to 100 feet or 3 to 30 meters
HELIAX (2-inch) Coaxial	Andrew LDF2-50	L42W (Andrew)	10 to 300 feet or 3 to 90 meters
Fiber Optic (10 µm core, .9 mm to 3.0 mm outer diameter)*	Siecor (001R 31-31131 - 00)	FC/PC Splice (AMP 502-703-2)	Up to 9.3 miles or 15 km
* This outer diameter is required to mount the FC/PC connector.			

Required equipment is:

⇒ Three cables for Host Cellular Equipment to microCell Interface are required: one cable for RF TX, one cable for Main RF, and one cable for Diversity RF.

⇒ A 50 Ohm coaxial cable with a Type N jack connector.

Installation Procedure

The basic interfaces between the LC-800 system and the host cell user are the *converted* RF signals, the alarm and control functions, and any AC or DC power required. The RF signal interface takes place at the Cell Site Interface Unit. The Transceiver Modules are identified as Fiber Optic Transceiver 1, Fiber Optic Transceiver 2, and Fiber Optic Transceiver 3.

Locate the following labeled connectors at the back of each Transceiver Module:

RF In

This is the RF Input to the microCell system from the host cell equipment (Forward direction). The cable connection is labeled C.

RF Out Main

This is the RF Main signal output to the host cell equipment. The cable connection is labeled A.

RF Out Diversity

This is the RF Diversity signal output to the host cell equipment. The cable connection is labeled B.

Remote Site Installation

This section describes the installation procedure of the LC-800 Remote Unit, including required tools and equipment, as well as setup instructions and reference diagrams. See Table 4-7 for a list of pins and their respective descriptions at the Remote Alarm Interface Connector (DB-9) labeled J7 Alarm or J1 on the compact cabinet.

Table 4-7. External Alarm Interface Connection for Remote Unit

Pin	Description
1	Alarm Input #2, External Equipment
2	Ground
3	Transceiver Remote Summary Alarm Relay Output
4	Ground
5	No Connection
6	Alarm Input #1, Open Door Alarm
7	Transceiver Master Summary Alarm Relay Output
8	Remote Controlled Relay Output
9	No Connection

Relay contacts are rated as follows:

⇒ Maximum Voltage: 110 VDC
⇒ Maximum Current: 1 Amp
⇒ UL Rating: 1A, 30 VDC

NOTES:

⇒ *Alarm Inputs #1 and #2 are active Low.*

⇒ *Alarm Outputs #1 and #2 are Relay Closure to Ground when alarmed.*

⇒ *Summary Relay Alarm Outputs are Closure to Ground when alarmed.*

⇒ *Remote Controlled Relay Output is a Closure to Ground when either Master or Remote Fiber Optic Transceiver front panel Remote Relay Switch is on the OFF position.*

Physical Installation

This section describes the mounting procedure for the Remote Unit Cabinet Assembly.

The LC-800 Remote Unit can be mounted on crossarms of a square rail, or UNISTRUT channel supported by a pole, tower, or building wall. Use 3/8-inch or M-10 (10 mm) bolts for mounting.

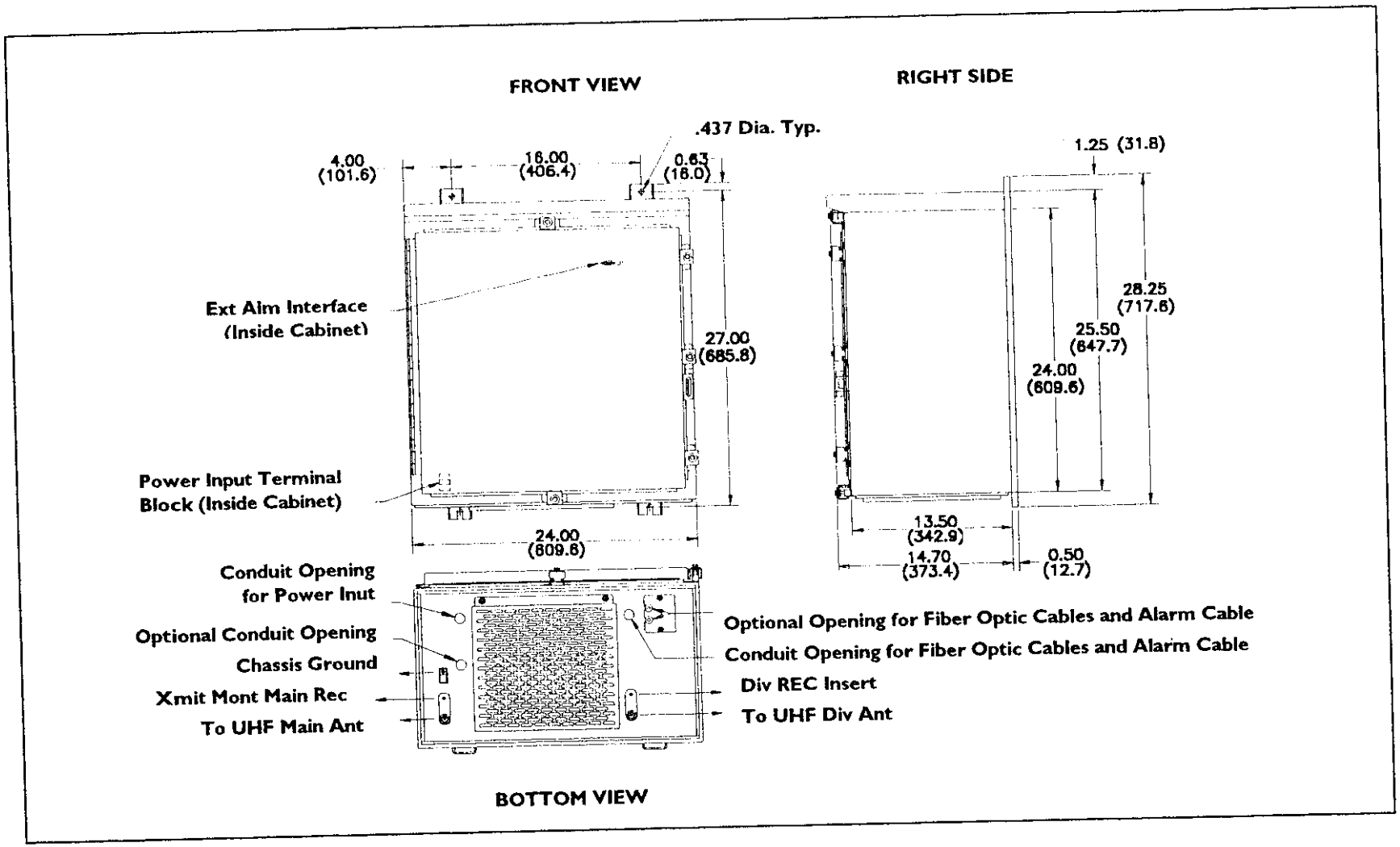


Figure 4-5. Mounting Dimensions: Remote

Required tools are: Wrench: ¼-inch, Flat blade screwdriver.

Remote Power Wiring

This section describes the terminal connector types and locations for wiring the Remote Unit AC Mains and DC Battery of the microCell system—see the following figure.

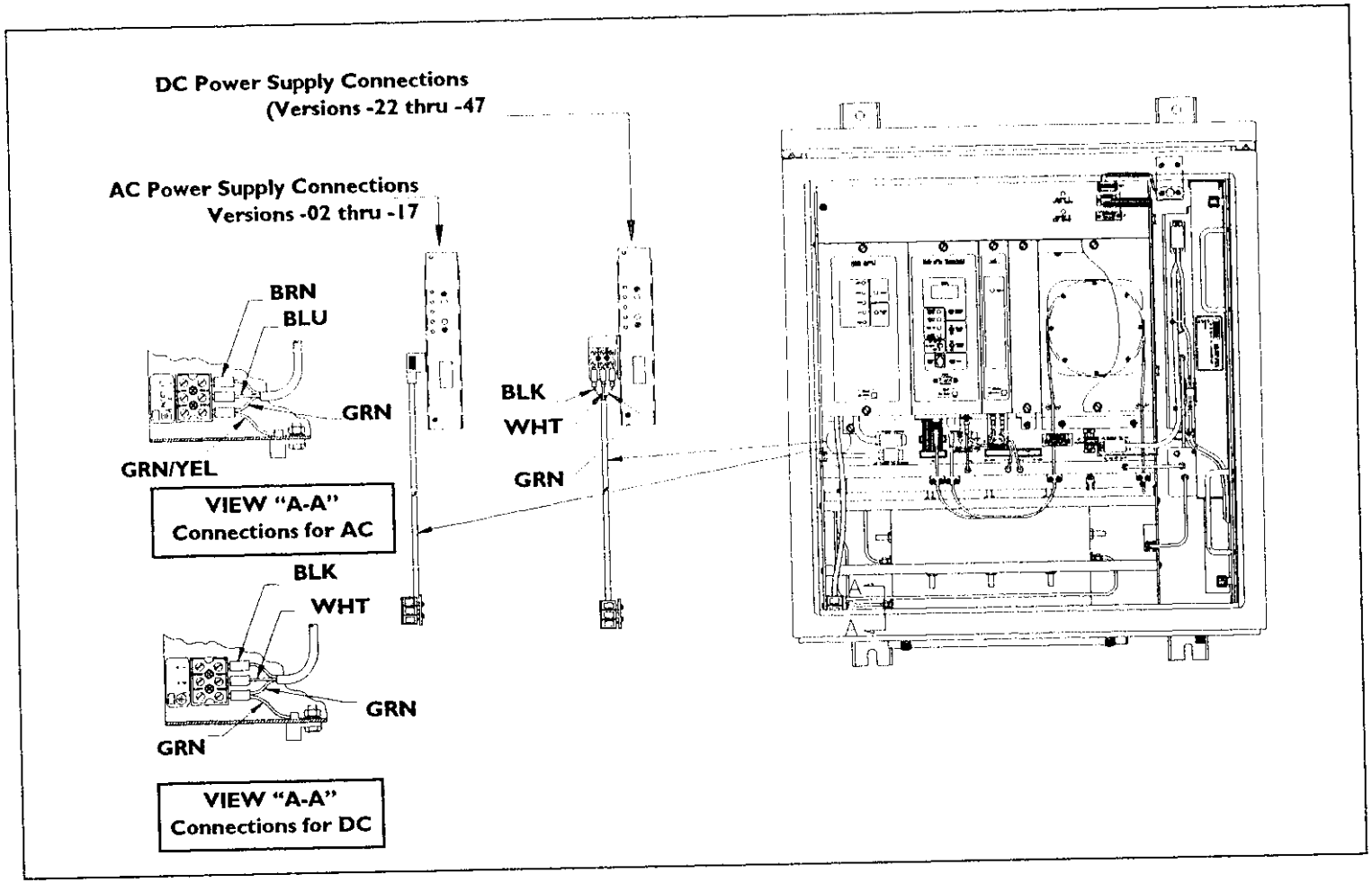


Figure 4-6. Power Wiring Terminal: Remote

Required tools and equipment are as follows:

⇒ Flat blade screwdriver
⇒ NMT (Non Metallic Tubing)
⇒ Liquid-tight connectors
⇒ Greenfield flexible tubing or steel electrical tubing (EMT)

Remote Power Wiring—AC Mains

The LC-800 Remote Unit is provided with a 3-position terminal block located in the lower left portion of the unit.

⇒ The terminal uses compression screws for AC High [L1], AC Low [L2] and Ground [G] wires up to 3.5 mm diameter, No. 8 AWG.
⇒ Minimum recommended wire diameter is 1.6 mm, No. 14 AWG.
⇒ AC Wires should go to a circuit breaker in an approved load box. Be sure the voltage of the AC mains and the LC-800 Fiber Optic Remote Unit match.

NOTE: *The NEC (National Electric Code), section 250-93, Part C, specifies a minimum size of 8 AWG as the grounding wire.*

Locate the 1-inch opening at the lower left of the LC-800 Remote Unit (through which the AC wiring must be routed to the terminal block) and remove the plastic cap-plug. Use non-metallic tubing to contain the AC wiring from the LC-800 to a junction box or load circuit breaker (which should be rated for 10 Amps for 230 VAC mains).

AC Power Requirements at the Remote:

⇒ 115 VAC, 0.7 Amps
⇒ 230 VAC, 1.3 Amps

AC Connections:

⇒ L1 = Line 1, AC High
⇒ L2 = Line 2, AC Low or Neutral
⇒ G = Ground/Earth

WARNING: *Do not apply AC power at this time, as injury to personnel or damage to equipment may occur.*

Power Wiring—DC Battery

The LC-800 is provided with an internal terminal block for DC connections, located in the lower left portion of the unit. The terminal uses compression screws for +24 V, –24 V, and ground wires up to 3.5 mm in diameter, No. 8 AWG.

⇒ Minimum recommended wire diameter is 2 mm, No. 12 AWG.
⇒ The DC wires should be connected to a fuse or circuit breaker in an approved load box or DC distribution board. Be sure the voltage of the DC mains and the LC-800 match.

NOTE: *The NEC (National Electric Code), section 250-93, Part C, specifies a minimum size of 8 AWG as the grounding wire.*

Locate the 1-inch opening at the lower left of the LC-800 Remote Unit (through which the DC wiring must be routed to the terminal block) and remove the plastic cap-plug. Use non-metallic tubing or an equivalent to contain the DC wires from the LC-800 to a junction box or load circuit breaker. The circuit breaker should be rated for 10 Amps for 24 VDC mains.

DC Power Requirements at the Remote:

⇒ 24 VDC, 12 Amps
⇒ DC Connections:

1	+24 V = (+) Battery Wire
2	–24 V = (–) Battery Wire
3	⏚ = Ground/Earth

If the battery polarity is +24 V Hot, –24 V Ground, the –24 V terminal can be grounded. If the battery polarity is –24 V Hot, +24 V Ground, the +24 V terminal can be grounded.

WARNING: *Do not apply DC power at this time, as injury to personnel or damage to equipment may occur.*

Earth, Ground, Lightning Protection

A screw compression ground lug is located on the enclosure. Connect this lug to a suitable earth ground, copper ground rod, copper pipe, grounded steel building frame, or similar ground point using 4 to 7 mm, No. 6 to No. 2 AWG copper wire.

CAUTION: *All cabinets, enclosures, antennas, coaxial cables should be adequately bonded to ground to reduce any damage from a lightning strike or nuclear EMP.*

Alarm and Control Wiring—Remote

This section describes the function and connection description of the external alarm interface connections on the Remote Unit.

The LC-800 Remote Unit is provided with a set of alarm outputs and control inputs.

⇒ The Alarm Interface at the Remote Unit is found at connector J7.

⇒ The Remote Alarms (relay contact closures) are sent by way of telemetry to the Master site for the operator's convenience.

⇒ The Remote alarm wiring instructions are provided for operators who wish to monitor system alarms at the Remote site. Summary Alarms are also available.

⇒ For the compact Remote cabinets, the Alarm Interface Connector is routed to the Blower Panel Assembly.

⇒ Remote and Master Alarm Summaries, as well as the Remote relay, can be monitored at connector J1.

⇒ Terminal block TB1 provides External Alarm Input Connections for the Open Door Switch and the External Equipment Alarm Input. Both inputs are active low—see Table 13 and Figure 19 for more information.

Mating Connectors

Connector J7 is an IDC DB-9, 9-pin (f). A compatible plug is AMP 747944-1 (m).

Antenna System Installation

This section discusses the required tools and equipment and procedures for installing the Remote site antennas. See Figure 19 for mounting dimensions. Required equipment is as follows:

⇒ Two cables for RF Antennas to microCell RF Interface, one cable for Main TX/RX antenna, one cable for Diversity RX antenna

⇒ A 50 ohm coaxial cable with a Type N jack connector

The LC-800 is equipped to accept a Main/Receive antenna and a Diversity antenna.

1. Locate the antenna output connectors for the Main (labeled TO UHF MAIN ANT on the bottom of the Remote Unit) and Diversity (labeled TO UHF DIV ANT). These are Type N connectors.
2. Fit the connectors into place.

For information about powering up the system, see **Chapter 1. Introduction and System Overview**.

Various LC-800 Configurations

See Figures 4-7 through 4-11 for illustrations of various LC800 configurations.

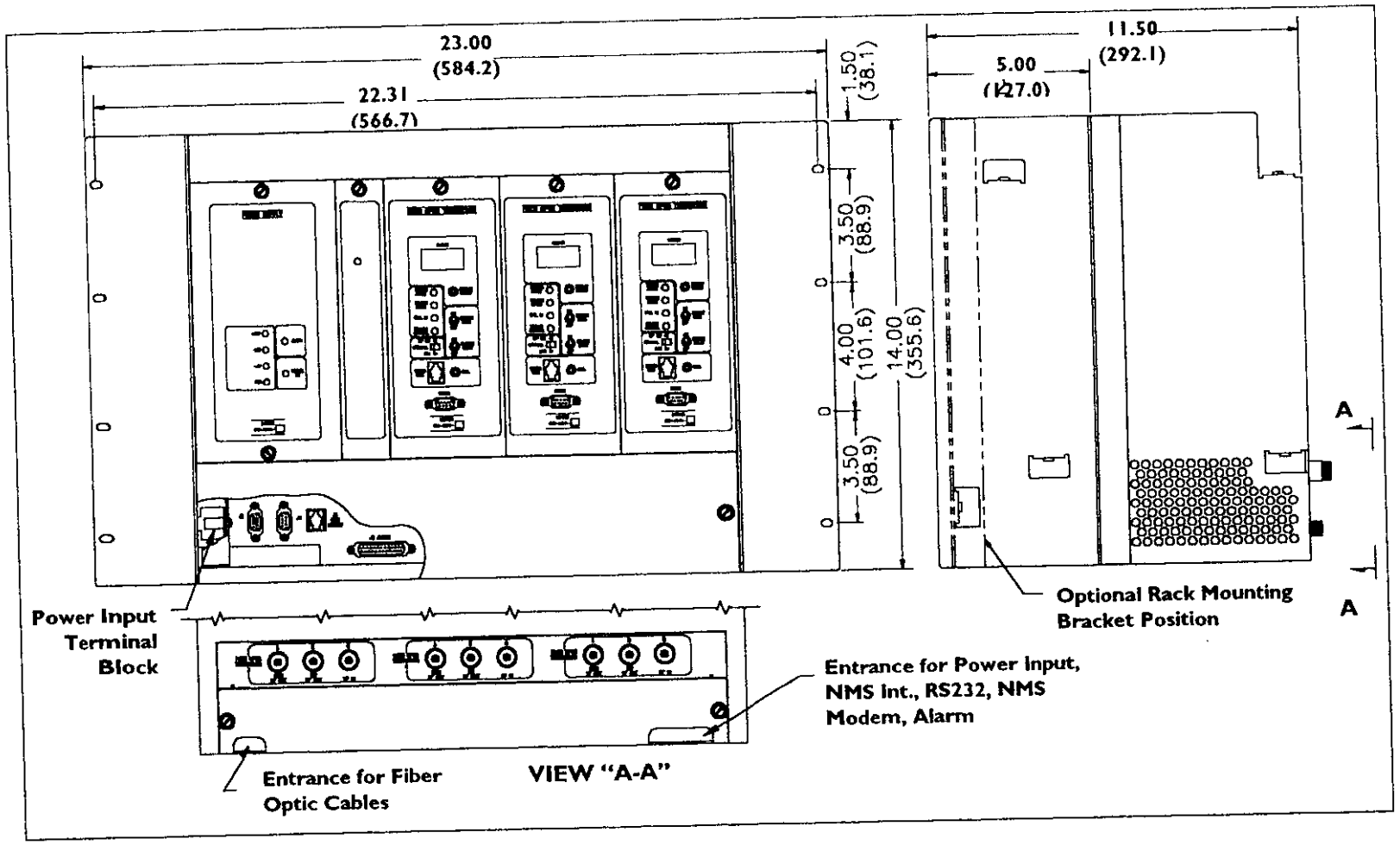


Figure 4-7. Master Mounting Dimensions for 23-Inch Rack

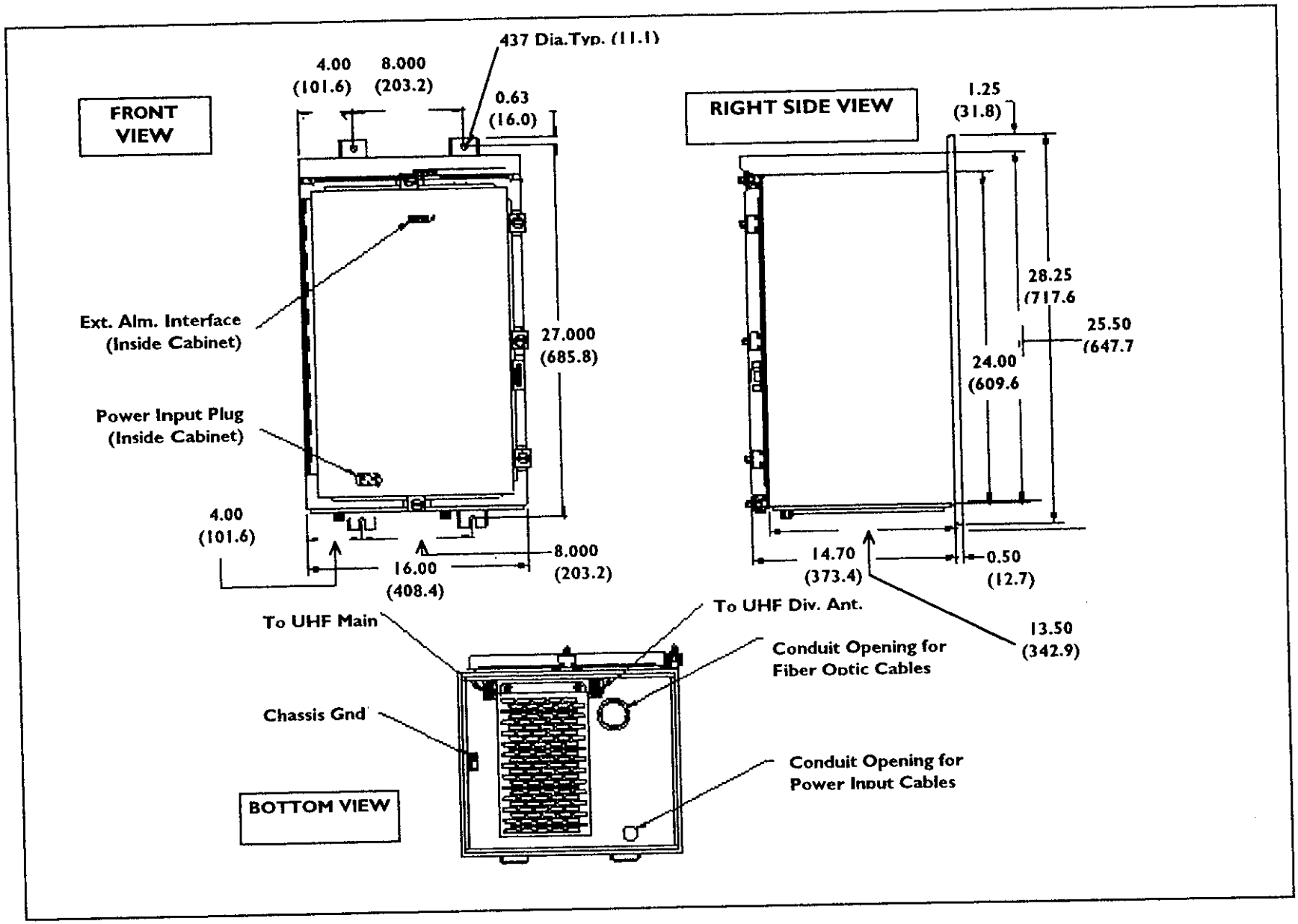


Figure 4-8. Compact Remote AC Version Mounting Dimensions

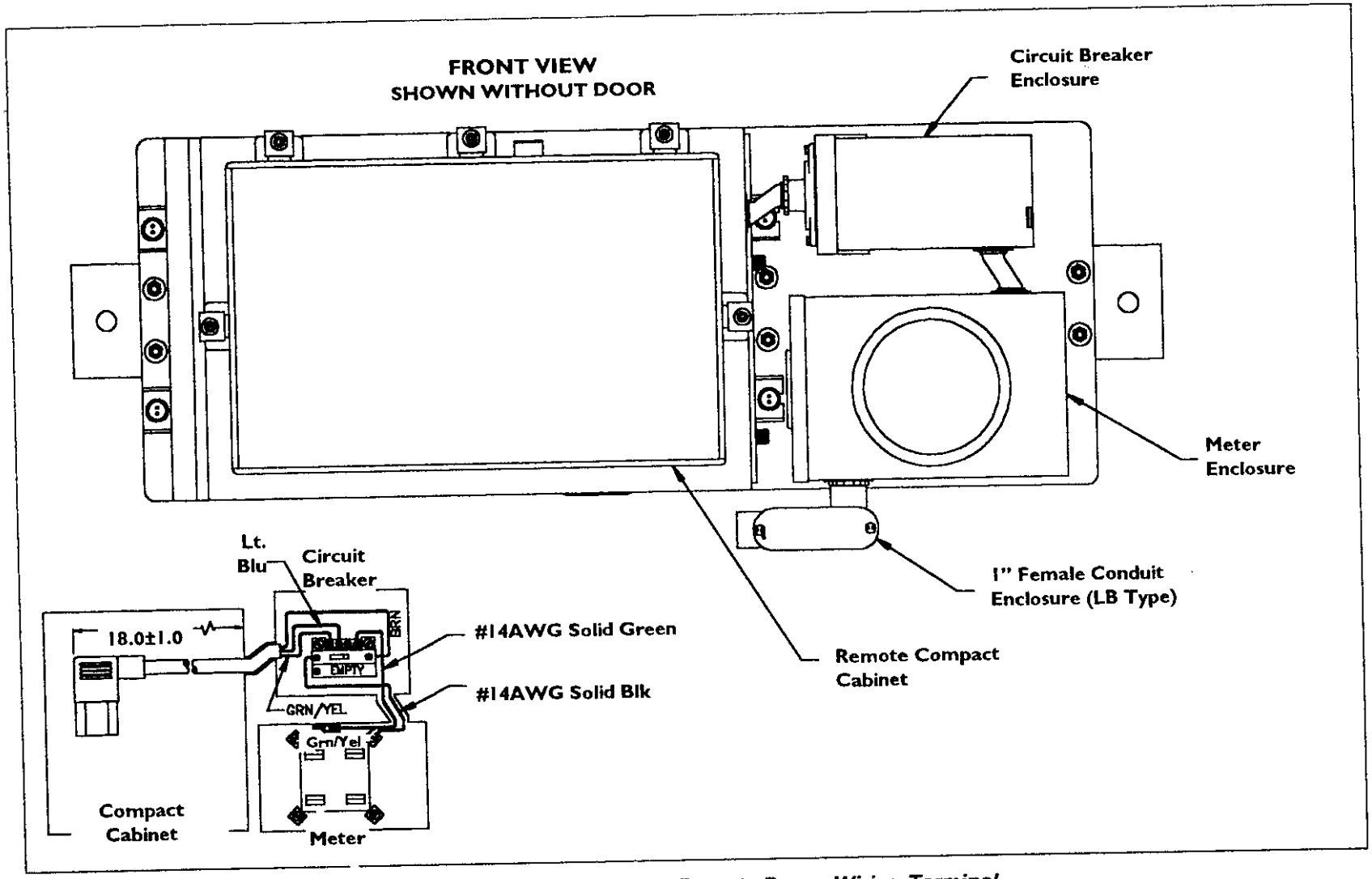


Figure 4-9. Compact Remote Power Wiring Terminal

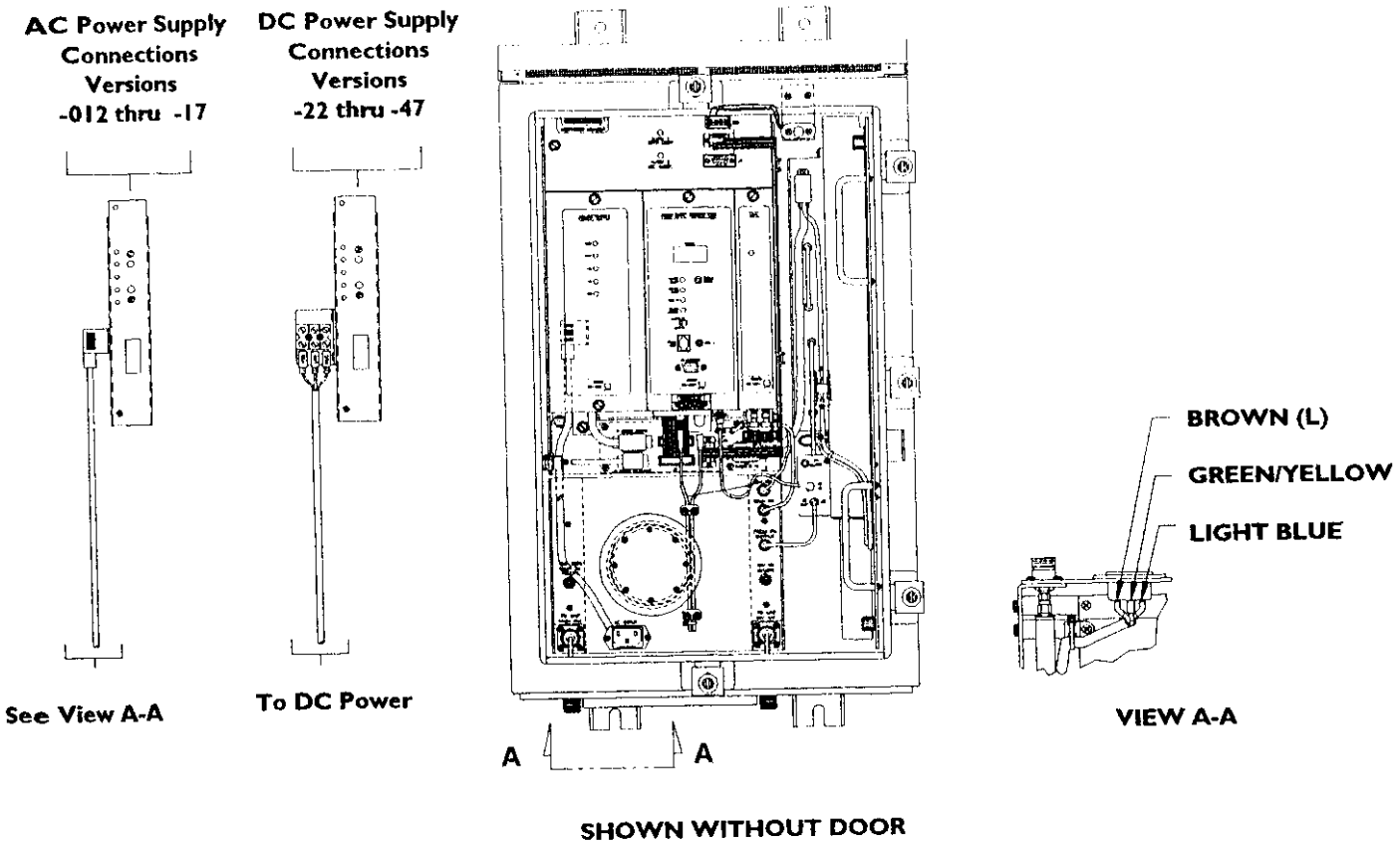


Figure 4-10. Compact Remote with Service Power Wiring Terminal

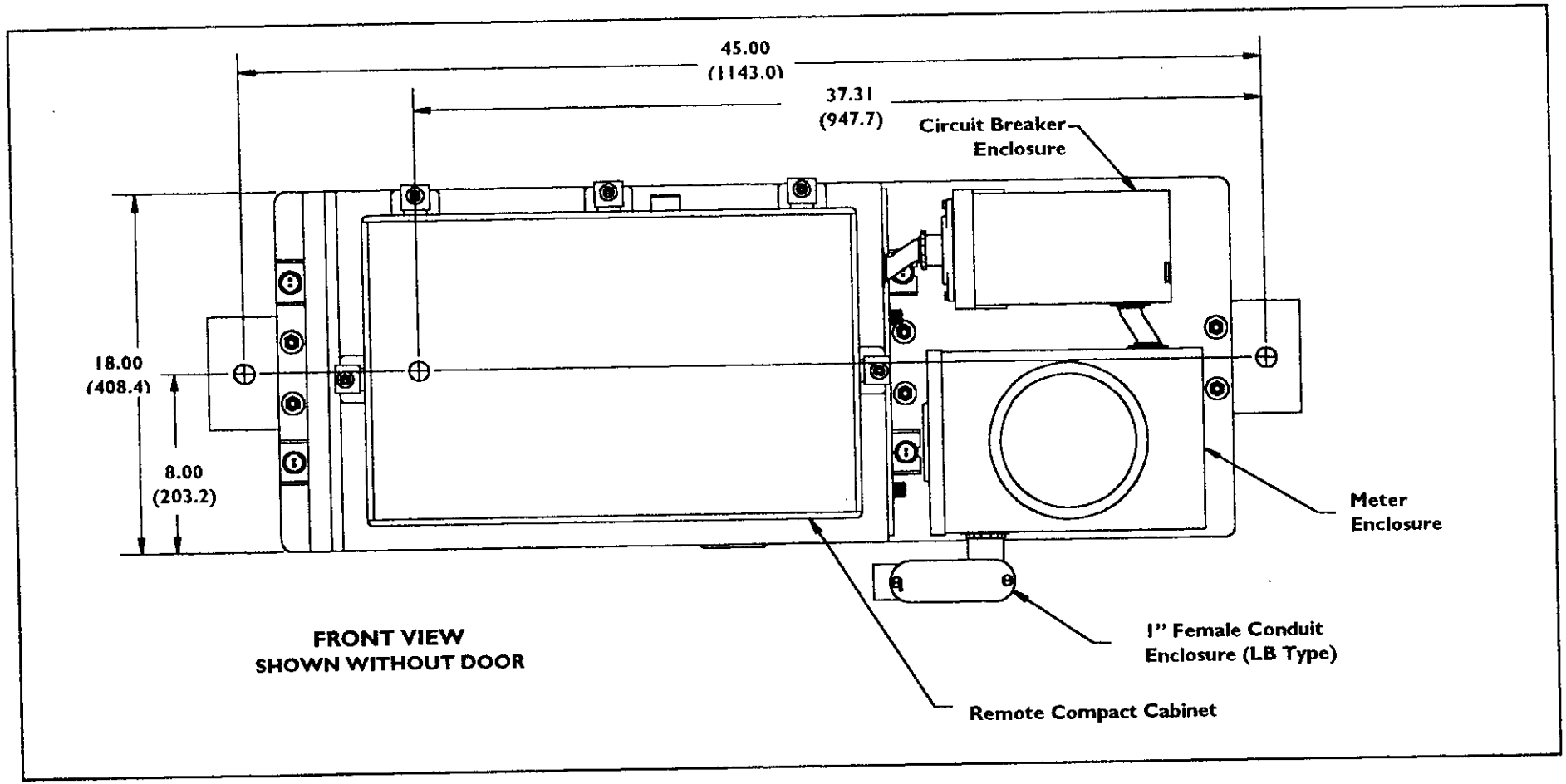


Figure 4-11. Compact Remote with Service Mounting Dimension

End of Chapter

Figures

Tables

Introduction

This section describes the functions of the microCell Fiber Optic Transceiver Master and Remote Front Panel Controls and Controller Cards. Read this entire chapter before changing any of the default settings on the Controller Cards.

Test Equipment And Tools

See the following table for a list of required test equipment and tools for the LC-800 test procedures.

Table 5-1. Required Test Equipment and Tools

Item	*Qty*	*Tests*
Voltmeter, Fluke 75 or equivalent	1	Power System, Analog Test Points
Power Meter, HP 435B with 8481 sensor (Optional)	1	Power Output
Cellular Service Monitor with signal generator, IFR-1500, HP-8594A	1	Antenna, Gain, Power
Type N (m) Power Loads (Termination's), 50 Ohm, 20 Watt	2	Off-Air test
RF Cables, RG-213, Type N (m), 6 feet, 2m	3	Antenna, Gain, Power
Adapter, N (f), N (f)	1	Antenna, Gain
Adapter, N (f), BNC (m)	2	Antenna, Gain
Adapter, N (f), SMA (m)	2	Gain, Power
Open End Wrench or Spanner, 5/16-inch	1	Power Monitor, Maintenance
Screwdriver, 3-inch, 6 mm blade	1	Wiring, Maintenance
Screwdriver, c-inch, 3 mm blade	1	Wiring, Maintenance
Screwdriver, #1 Phillips	1	Wiring
Optical Source, 1310 nanometers [Wandel & Golterman OLS-25 with FC/PC Optical Connector]	1	Fiber Tests
Optical Power Meter [Wandel & Golterman OLP-25 with FC/PC Optical Connector]	1	Fiber Tests
Handset & Modular Cord [Metro Tel #3010 with 7960-0150 Cord]	2	General Use

Description Of Controls

The following figure shows the switches (S1, S2, S3), push-buttons (P1, P2), and LEDs (L1, L2, L3, L4) associated with the various functions of the Master Transceiver Module. It also shows switches (S4, S5, S6), push-buttons (P3, P4), and LEDs (L5, L6, L7, L8) associated with the various functions of the Remote Transceiver Module.

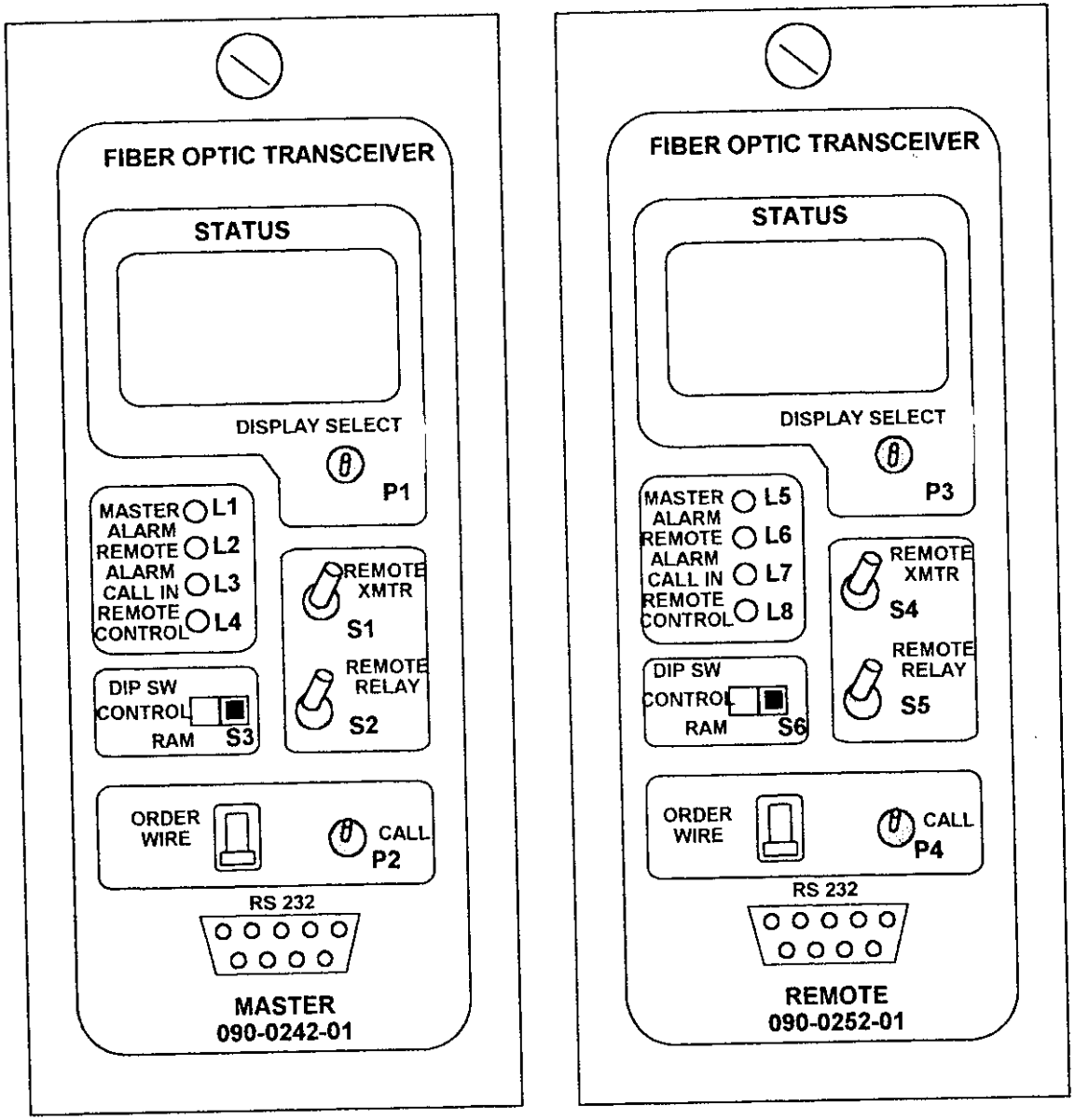


Figure 5-1. Front Panel—Fiber Optic Master and Remote Units

The following figures show the DIP Switch Configuration (labeled S1 through S7) and the Jumper Configuration Sockets (JP11, JP13, JP14) associated with the various functions of the Master and Remote Controller Cards.

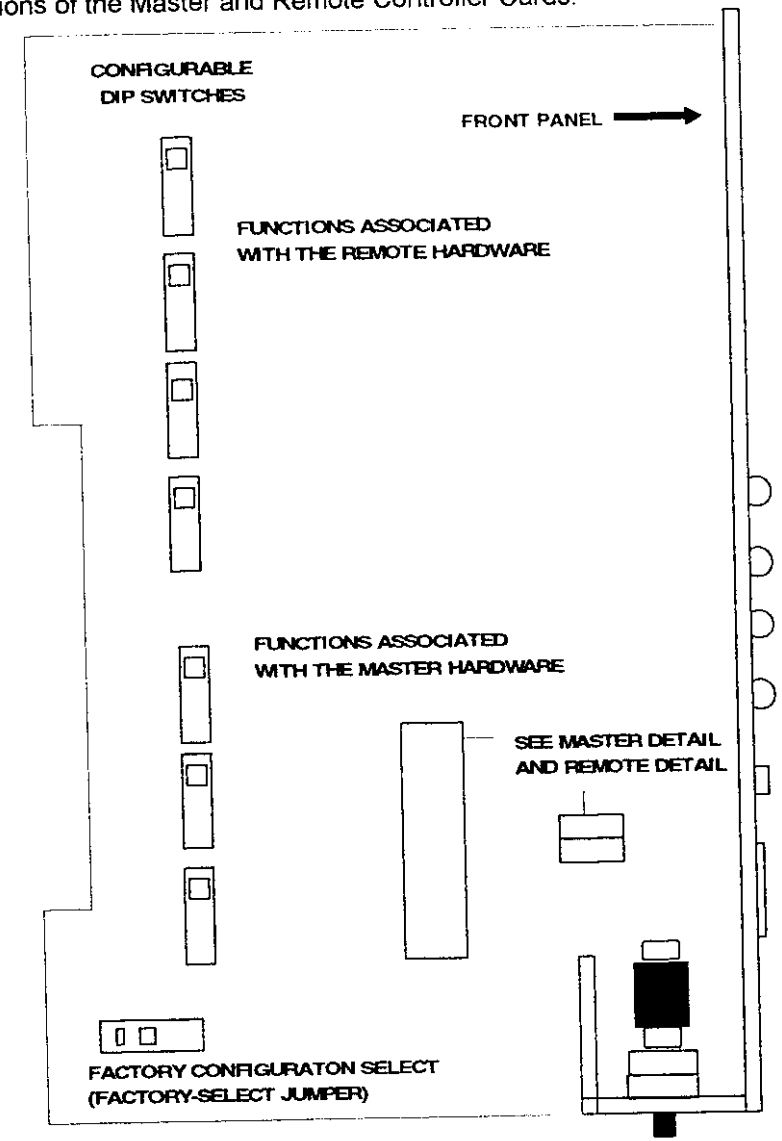


Figure 5-2. LC-800 Controller Board

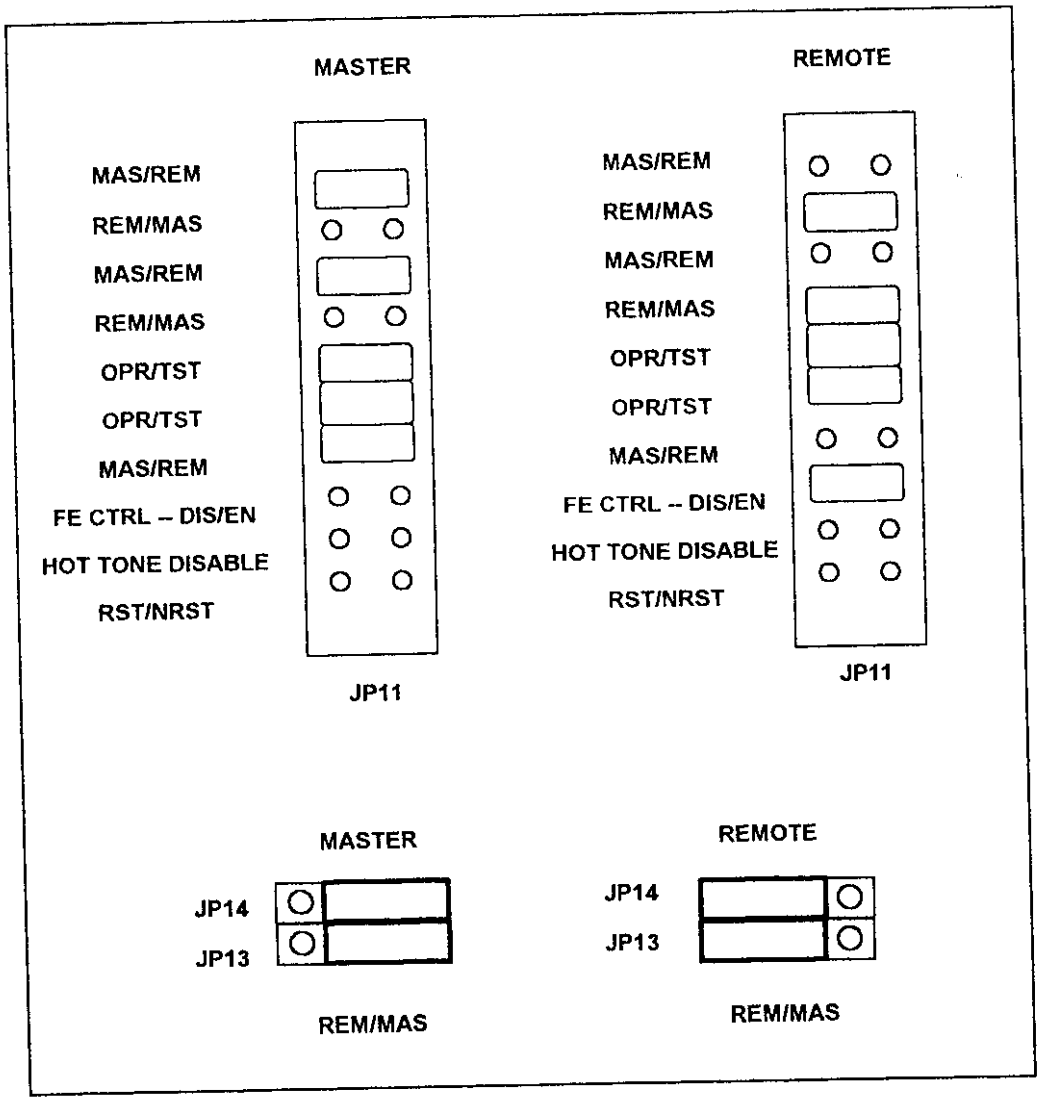


Figure 5-3. Configurable Dip Switches

Master Unit Front Panel

The following explanation applies to the front panel of the Fiber Optic Transceiver Master Module.

Master Unit LCD Display

The following descriptions in capital letters are written exactly as they appear on the LCD display, followed by a short explanation.

Example: MASTER (Card Address): This display indicates the configuration and address of the current card. The address is set by DIP Switches on the Controller Card.

Example: RM XMTR (Remote Transmitter): This display indicates the power amp ON/OFF state.

Example: FWD IN (Forward Input Attenuator): This display indicates the Forward direction attenuation prior to the optical transmitter for the Master Unit. Displayed values are from 0 dB to 20 dB in 2 dB steps.

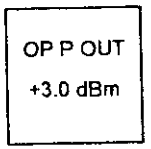
Example: REM LNAM (Remote LNA Main): This display indicates the attenuator values (in dB) on the Remote LNA Main channel—typically 40 dB. *Hot tones* can force 10 dB step attenuation.

Example: REV GAIN MN (Reverse Channel Gain Main): This display indicates the Main channel output attenuator setup, which controls Main channel Reverse system gain. Displayed values are from 0 dB to 24 dB. Main Reverse gain is set up by DIP Switches on the Controller Card. The DIP Switches show the amount of attenuation inserted at the output attenuator. The display shows the Reverse direction gain.

Example: REM LNAD (Remote LNA Diversity): This display indicates the attenuator values on the Remote LNA Diversity channel—typically 40 dB. *Hot tones* can force 10 dB step attenuation.

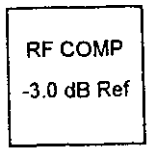
Example: REV GAIN DIV (Reverse Channel Gain Diversity): This display indicates the Diversity signal output attenuation setup, which controls Diversity channel Reverse gain. Displayed values are from 0 dB to 24 dB. Diversity Reverse gain is set up by DIP Switches on the Controller Card. The DIP Switches show the amount of attenuation inserted at the output attenuator. The display shows the Reverse direction gain.

Example: OP P OUT (Optical Power Out): This display indicates the optical laser output power, typically +3 dBm. This is for indication and is accurate to approximately 1 dB.



Example: OP P IN (Optical Power In): This display indicates the Optical Laser Input Power, typically greater than -7 dBm. This is for indication and is accurate to approximately 1 dB.

Example: RF COMP (RF Composite Signal Level): This display indicates the composite RF power at the input to the transmit DFB laser. The value of RF composite depends on input level and the number of channels used, and is recommended to operate at -3 dB reference.



NOTE: *When OP P OUT, OP P IN, or RF COMP are out of range, a series of asterisks (*******) is displayed, as shown in this example.*

LEDs

L1

This LED is ON when a major alarm occurs in the Master Unit. This is a RED LED.

L2

This LED is ON when a major alarm occurs in the Remote Unit. This is a RED LED.

L3

This LED is ON when a user at the Remote site is attempting to communicate via orderwire. This is a YELLOW LED.

L

This LED is ON when the local unit (Master) is being controlled by the far-end unit (Remote). This is a YELLOW LED.

Switches

S1

This switch allows the operator to shut down the Forward PA at the Remote site.

UP = ON
DOWN = OFF

S2

This switch activates the Remote site relay.

UP = ON
DOWN = OFF

S3

This switch lets you select whether the initial values are set up using Controller Card DIP Switches or using software through the computer interface. This feature is not yet available.

Push-Buttons

P1

This button cycles through the various status readouts on LCD Display (see LCD Display description above).

P2

This button lights the Remote site LED (L7) and momentarily activates an audible signal which notifies the Remote site user of an attempt to communicate via handset.

Connectors

RJ-11

Telephone orderwire interface for diagnostic procedures through handset.

RS 232

Interface connection for diagnostic procedures through computer terminal. See

Remote Unit Front Panel

The following explanation applies to the front panel of the Fiber Optic Transceiver Remote Module.

Error! Reference source not found. on page **Error! Bookmark not defined.** shows the LEDs (L5-L8), switches (S4-S6), and push-buttons (P3, P4) associated with the various functions of the Remote Transceiver Module.

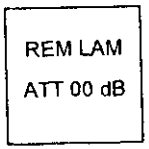
Remote Unit LCD Display

The following descriptions in capital letters are written exactly as they appear on the LCD display, followed by a short explanation.

Example: REMOTE (Card Address): This display indicates the configuration and address of the current card. The address is set by DIP Switches on the Controller Card.

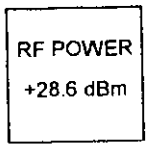
Example: RM XMTR (Remote Amplifier): This display indicates the Forward PA ON/OFF state and the PA step attenuator state.

Example: REM LNAM (Remote LNA Main): This display indicates the attenuator values on the Remote LNA Main channel—typically 40 dB. *Hot tones* can force 10 dB step attenuation.



Example: REM LNAD (Remote LNA Diversity): This display indicates the attenuator values on the Remote LNA Diversity channel—typically 40 dB. *Hot tones* can force 10 dB step attenuation.

Example: RF POWER (RF Power in dBm): This display indicates the measurement of RF Power in dBm delivered at the Power Amplifier output. This is for indication only and is accurate to approximately 2 dB. RF Power is influenced by the number of channels in use.



Example: OP P OUT (Optical Power Out): This display indicates the optical laser output power—typically +3 dBm. This is for indication and is accurate to approximately 1 dB.

Example: OP P IN (Optical Power In): This display indicates the Optical Laser Input Power—typically greater than -7 dBm. This is for indication and is accurate to approximately 1 dB.

NOTE: When OP P OUT, OP P IN, or RF POWER are out of range, a series of asterisks (*******) is displayed, as shown in this example.

LEDs

L5 This LED is ON when a major alarm occurs in the Master Unit. This is a RED LED.

L6 This LED is ON when a major alarm occurs in the Remote Unit. This is a RED LED.

L7 This LED is ON when a user at the Master site is attempting to communicate through orderwire. This is a YELLOW LED.

L8 This LED is ON when the local unit (Remote) is being controlled by the far-end unit (Master). This is a YELLOW LED.

Switches

S4 This switch lets an operator turn off the Forward PA at the Remote site.

UP = ON
DOWN = OFF

S5 This switch activates the Remote site relay.

UP = ON
DOWN = OFF

S6 This switch is inactive until a later firmware revision is implemented.

Push-Buttons

P3 This button cycles through the various status readouts on LCD Display (see LCD Display description above).

P4 This button lights the Master site LED (L4) and momentarily activates an audible signal, which notifies the Remote site user of an attempt to communicate through handset.

Connectors

RJ-11

Telephone orderwire interface for diagnostic procedures though handset. In applications in which more that one Master Transceiver Module is used at the Master shelf, the orderwire is shared among all Master Modules through a connection at the Card Cage Interface Board. Therefore, only one handset is necessary at the Master site to communicate to all Remote Units simultaneously. The Call IN indicator at each Master Module indicates which Remote Units are Calling IN.

RS 232

Interface connection for diagnostic procedures via computer terminal.

Controller Board—Master and Remote

Both Master and Remote Fiber Optic Transceivers share the same Controller Board hardware. The Controller Board is a micro-controller based system. The board is configured to work as a Master or as a Remote controller using jumper straps at JP11, JP13, and JP14.

NOTE: *If any of the jumper straps is missing or misplaced, the Lightwave microCell system ceases to operate properly.*

Control Modes

There are three possible control modes:

- ⇒ Local Control
- ⇒ Remote Under Far End Control
- ⇒ Master Under Far End Control

Local Control

For local mode, both Master and Remote Transceiver Modules must be under local control. This means:

- ⇒ The jumper straps are installed at the FE CTRL-DIS/EN Jumper setting on both Master and Remote Controller Boards.
- ⇒ Both Master and Remote Fiber Optic Transceivers (front panel L4 and L8, respectively) LEDs are OFF.

You can program functions associated with the Master hardware through the Master Controller Board. You can program remote functions only through the Remote Controller Board.

To turn ON the Power Amplifier:

- ⇒ Both front panel switches (Master and Remote Modules) must be ON.
- ⇒ While in Local control, S3.1 at the Remote Controller Board must be on its ON position also.

NOTE: *If any of these three switches are not on their ON position, the PA is OFF and a Remote Alarm Indication is observed.*

Programmable functions associated with the Master Transceiver hardware are the FRWD IN step attenuator and both REV GAIN controls (Main and Diversity). The functions associated with the Remote Transceiver are ignored.

Functions associated with the Remote Unit hardware are:

- ⇒ The LNA step attenuators Main and Diversity
- ⇒ The Power Amplifier step attenuators

As explained previously, both Master and Remote front panel RMT TXR Switches, as well as the S3.1 DIP Switch, must be in the ON position. The functions associated with the Master Transceiver are ignored.

Remote Under Far End Control

When the FE CTRL-DIS/EN Jumper at the Master Controller Board is removed, the Remote Unit is under the control of the Fiber Optic Master Transceiver Module.

When the FE CTRL-DIS/EN Jumper at the Remote Controller Board is removed, the Master Module is under the control of the Remote Fiber Optic Module.

NOTE: *Do not have both units under FAR END CONTROL at the same time.*

While the Remote Unit is under Far End Control, the RMT CONTROL LED at the front panel is ON. If the Master is under Far End Control, the FE CONTROL front panel LED at the Master Module is ON.

Control Remote from Master Site

If you want to control the Remote Unit from the Master site, you must remove the FE CTRL-DIS/EN Jumper at the Master Controller Board and install it at the Remote Controller Board. Then all of the DIP Switch programmable functions associated with the Master Transceiver and Remote Unit hardware are enabled (all programmable functions of the LC system are controlled from the Master Transceiver Controller).

Thus, the LNA attenuator, PA output attenuator, and all of the Master controls can be set from the Master site. Any previous settings pre-programmed at the Remote Controller Board are ignored—the Master programmable settings take precedence.

Control Master from Remote Site

If you want to control the Master from the Remote site, install the FE-CTRL DIS/EN Jumper at the Master and remove it at the Remote Controller Board. Then, all of the control functions are enabled at the Remote site. The RMT CONTROL LED at the Master Transceiver front panel is ON. In this mode, all the programmable functions are enabled at the Remote Controller Board. Any settings pre-programmed at the Master Controller Board are ignored. The Remote programmable settings take precedence.

If the Remote Unit was originally under Local control and is later placed under Far End control, the initial settings at the Remote are ignored once the unit is under the Master control. Therefore, all the initial settings done at the Remote while in local control must be duplicated at the Master Controller Board. There is no need to reset the Remote controls; they simply are ignored while the unit is under far end control.

The CARD ADDRESS can be set independently of the mode of operation. If the CARD ADDRESS is changed while the module is ON, the module must be RESET for this change to take effect.

NOTES:

⇒ *When the unit is under FAR END CONTROL, all of its control settings are ignored.*

⇒ *You can turn ON the Power Amplifier only when all three PA Switches are ON.*

⇒ *Both Master and Remote module front panel RMT TX switches must be ON and one of the S3.1 Switches must be ON.*

⇒ *If both units are under local control, S3.1 at the Remote must be ON.*

⇒ *When the Master is under FAR END CONTROL, S3.1 at the Remote must be ON.*

⇒ *When the Remote is under FAR END CONTROL, S3.1 must be ON. Note that the normal CONTROL MODE is for the Remote to be under FAR END CONTROL.*

Remote Relay Operation

The Remote relay is activated when both Front Panel Switches on the Master and Remote Fiber Optic Transceivers are ON. This is a relay output. It is open when both switches are ON and closed when either or both switches are OFF . The Remote Relay output can be monitored at the Alarm interface port J7 pin 8 at the Remote Power Interface panel or at J2 pin 8 on Compact cabinets.

The following is an explanation of the DIP Switch and Jumper settings on the Fiber Optic Transceiver Master and Remote Controller Boards.

See Figure 5-3 on page 5-5 for the DIP Switch Configuration (Labeled S1 through S7), and the Jumper Socket Configuration (JP11, JP13, JP14) associated with the various functions of the Master and Remote Controller Cards.

Jumper Settings

Jumper H—Remote Control Jumper

When OFF, the Remote Unit is under the control of the Master Unit (LED lights are active on the Remote). All Master DIP Switches now control parameters for Remote. The Front Panel Toggle Switches REMOTE TX ON/OFF and RELAY ON/OFF function independently of the Remote Control Jumper settings.

NOTE: *The LC-800 is shipped with Jumper H OFF. The Remote Unit is under the control of the Master Unit. This means that LED L8 on the Remote is ON.*

Jumper I—Hot Tone Disable

When OFF, the Master Unit *hot tone* circuit is ACTIVE. When ON, the Master Unit *hot tone* circuit is INACTIVE.

NOTE: *Jumper I settings only apply to the Master Unit. The Remote Unit hot tone circuit is always ACTIVE.*

Jumpers JP12, JP13, and JP14

Do not alter the settings of these factory-set jumpers.

JP11

Legend	Master	Remote
MAS/REM	JUMPER	OPEN
REM/MAS	OPEN	JUMPER
MAS/REM	JUMPER	OPEN
REM/MAS	OPEN	JUMPER
OPR/TST	JUMPER	JUMPER
OPR/TST	JUMPER	JUMPER
MAS/REM	JUMPER	OPEN
FE CTRL-DIS/EN	OPEN*	JUMPER
HOT TONE DIS/EN	OPEN**	OPEN
RST/NRST	OPEN***	OPEN***

* Removing this jumper forces the Remote Unit to be under the control of the Master Unit (Remote under Far End Control, default mode).
** See Hot Tone Function.
*** Placing a jumper momentarily at this setting forces the Controller Board to reset itself.

JP12

Factory selected on a per system configuration.

JP13

Legend	Master	Remote
REM/MAS	JUMPER on MAS	JUMPER on REM

JP14

Legend	Master	Remote
REM/MAS	JUMPER on MAS	JUMPER on REM

Hot Tone Function

The Hot Tone Function provides protection to the optical components from overloading. It also extends the dynamic range of the Lightwave microCell equipment.

Four level detectors are located at the LNA for each channel, Main and Diversity. For input levels above -45 dBm at the antenna port, the level detectors start to insert attenuation in 10 dB steps. The nominal threshold levels for the detectors are -45, -35, -24 and -15 dBm.

⇒ With the Hot Tone function enabled, the Master hardware step attenuators remove 10 dB of attenuation for each LNA attenuator step. The result—the RF signal levels are

attenuated prior to the optical link and are amplified in proportion to the LNA attenuation before they leave the Master Unit, thus allowing the cell site equipment to sense these higher inputs.

⇒ With the Hot Tone Function disabled, the Master hardware step attenuators also are disabled. The result—*hot tones,* as detected by the LNA, are attenuated prior to the optical link, but are not amplified in proportion to the LNA attenuation.

To disable the Hot Tone function, install the Hot Tone Dis/En Jumper at JP11 on the Master Controller Board.

NOTE: *The Hot Tone function cannot be controlled from the Remote Controller Board. This jumper always is left open.*

DIP Switch Settings

DIP Switch settings are dependent on the mode of operation explained previously in this section. See **Figure 5-4** on page 5-14 for appropriate DIP Switch settings.

S1 (Main LNA)

This switch determines the signal attenuation at the Main LNA. Default configuration is 0 dB.

RIGHT = ON
LEFT = OFF
#1: 10 dB Attenuation
#2: 10 dB Attenuation
#3: 10 dB Attenuation
#4: 10 dB Attenuation

NOTE: *The LC-800 is delivered with 0 dB attenuation selected.*

S2 (Diversity LNA)

This Switch determines the signal attenuation at the Diversity LNA. Default configuration is 0 dB.

RIGHT = ON
LEFT = OFF
#1: 10 dB Attenuation
#2: 10 dB Attenuation
#3: 10 dB Attenuation
#4: 10 dB Attenuation

NOTE: *The LC-800 is shipped with 0 dB attenuation selected if the system is equipped with Diversity, or with 40 dB attenuation if equipped without Diversity.*

S3 (Power Amp)

This switch controls attenuation of Power Amplifier.

RIGHT = ON
LEFT = OFF
#1: ON/OFF
#2: 3 dB attenuation
#3: 6 dB attenuation
#4: 10 dB attenuation

NOTE: *The LC-800 is delivered with 6 dB PA attenuation selected.*

S4 (RF IN)

This switch controls incoming RF signal attenuation. For -20 dBm In with 8 channels, 8 dB attenuation is recommended.

The unit is shipped with the following defaults.

RIGHT = ON
LEFT = OFF
#1: 2 dB attenuation
#2: 4 dB attenuation
#3: 6 dB attenuation
#4: 8 dB attenuation

S5 (Main RF Out)

This switch sets up the Reverse channel gain for the Main channel.

RIGHT = ON
LEFT = OFF
#1: 2 dB attenuation
#2: 4 dB
#3: 8 dB
#4: 10 dB

NOTE: *The LC-800 is delivered with 24 dB of Main channel gain selected, therefore, with 0 dB attenuation at the switches.*

S6 (Div RF Out)

This switch sets up Reverse channel gain for the Diversity channel.

#1: 2 dB
#2: 4 dB
#3: 8 dB
#4: 10 dB

NOTE: *The LC-800 is delivered with 24 dB of Diversity channel gain selected, therefore, with 0 dB attenuation at the switches.*

S7 (Card Address)

This switch determines the card address number of the current card (256 addresses are selectable; the selected card address appears on the LCD display). The LC-800 is delivered with card address 00 selected.

NOTE: *The LC-800 is delivered with recommended values configured as defaults. Consult the appropriate sections of this manual if any changes to the default values need to be made.*

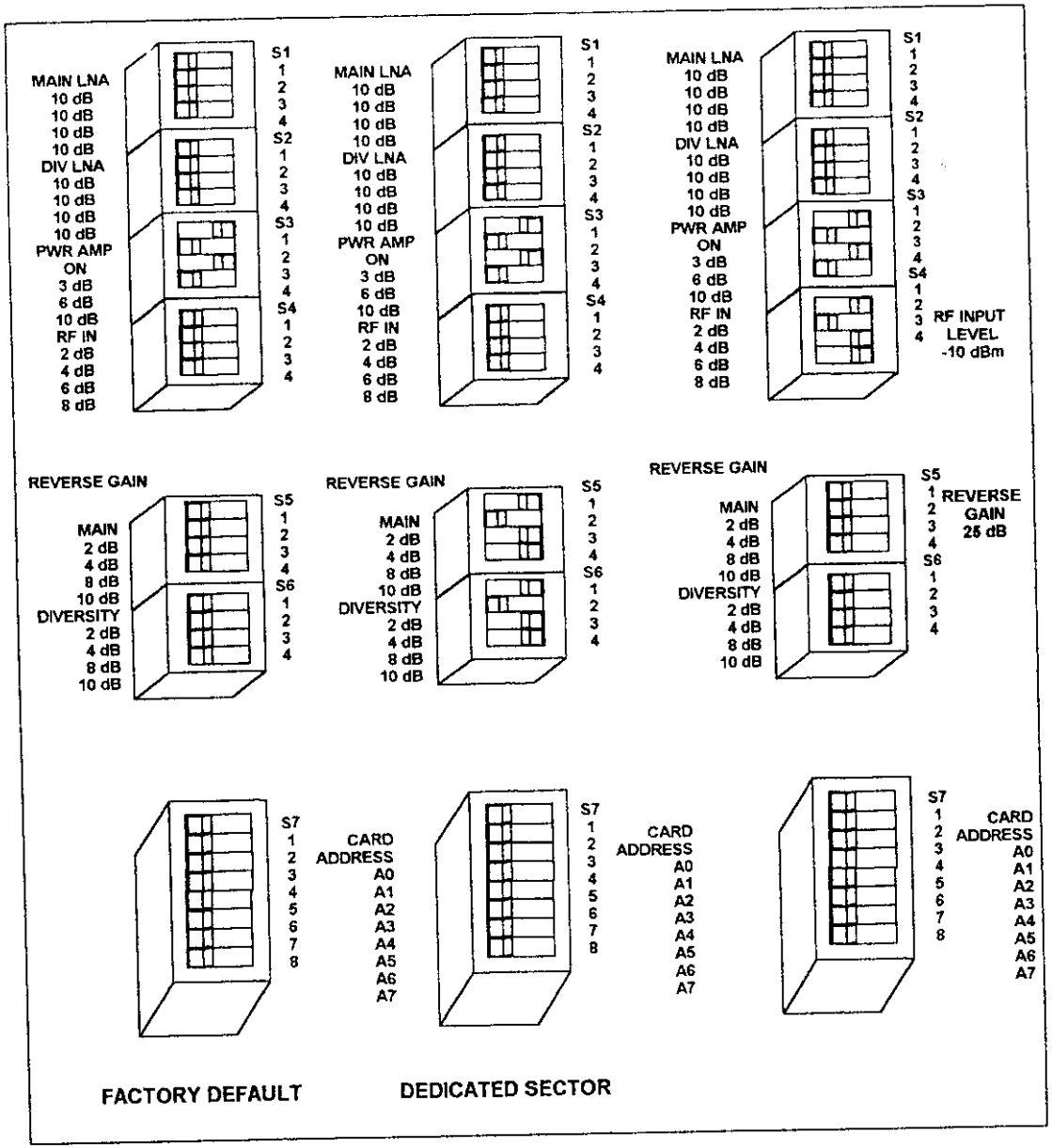


Figure 5-4. DIP Switch Settings

System Operation

This section describes system operation procedures including system power up and system configuration. Before proceeding with system power up and configuration, make sure all of the procedures in **Chapter 4. Installation Instructions** have been implemented.

Refer to the following material while reading through this section:

⇒ **Fiber Optic Master and Remote Units**

⇒ **LC-800 Controller Board figures**

System Power Up

After verifying that all of the cabling and power wiring is connected properly, proceed with system power up.

Master Power Up

1. Place the fuse in the circuit breaker box and turn the switch ON.
2. Make sure the Front Panel Switch Remote XMTR on the Fiber Optic Master Unit is set to ON.

   The LED on the Power Supply Module front panel should light, indicating power to the module.

   The Fiber Optic Master Unit Module LCD display should read LC-800 PEGI (LC-800HP PEGI, for Level 5) followed by a 4-second self test routine.
3. After the self-test, the LCD display shows current alarm status conditions. If major alarms are reported, again verify that all RF and optical cables are connected.

Remote Power Up

1. Place the fuse in the circuit breaker box and turn the switch on.
2. Make sure the Front Panel Switch "Remote XMTR" on the Fiber Optic Remote Unit is set to ON.

   The LED on the Power Supply Module front panel should light, indicating power to the module.

   The Fiber Optic Remote Unit Module LCD display should read LC-800 PEGI (LC-800HP PEGI, for Level 5), followed by a 4-second self test routine.
3. After the self-test, the LCD display will show current alarm conditions. If major alarms are reported, verify that all cables are connected.

System Configuration

Once the system has been powered up successfully, proceed with system configuration. Forward RF power levels, reverse gain, and local versus. far-end control are the system configuration variables.

The LC-800 is delivered with the Remote Unit under the control of the Master Unit. Therefore, the Fiber Optic Master Unit Controller Card settings establish all system controls.

Setting/Changing Forward RF Power Levels

Based upon the desired number of channels to be transmitted over the system, set up the Forward RF power using the RF IN DIP Switch on the Master Controller Board (which will, in turn, determine the RF output power at the Power Amplifier). The Controller Card DIP Switches are accessible by disconnecting the power cable to the Fiber Optic Master Unit and carefully pulling the module from the shelf.

Refer to the front panel LCD display for verification of level settings.

Setting and Changing Reverse Channel Gain

As with the Forward Power Level DIP Switches, you can configure reverse channel gain using the DIP Switches on the Fiber Optic Master Unit Controller Board, based upon the desired RF Input level (nominal at -55 dBm). Two switches (labeled Reverse Gain Main and Reverse Gain Diversity) can be located on the board.

Refer to the front panel LCD display for verification of level settings.

Orderwire Usage

Standard 4-wire telephone handsets can be plugged directly into the RJ-11 connector on the front of the Fiber Optic Master and Fiber Optic Remote Units. To verify and signal that a call is being made, press the button located next to the connector and note the LED labeled **Call In** at the far end should light up. An audible signal sounds for a moment after the button is pressed.

Remote Unit Self-Control

Should the operator want to place the Remote Unit under its own control, the jumper labeled **Remote Control** on the Fiber Optic Master Controller Card must be connected. Note that, upon initial installation of the LC-800 system, no changes should be made to the Controller Board Switch settings.

A condition in which you may want to place the Remote Unit under its own control is in a situation where *hot tones* occur. The two DIP Switches labeled MAIN LNA and DIV LNA control the reverse gain attenuation in 10 dB steps for the purpose of mitigating the effects of *hot tones*.

Refer to the front panel LCD display for verification of level settings.

Chapter 6 . Fault Identification

Tables

Introduction

This chapter describes procedures to follow when an alarm occurs in the LC-800 system, including fault reporting and determination, with accompanying alarm indication matrices. Repair and return procedures for the LC-800 also are discussed.

For more information, see **Chapter 4. Installation Instructions**.

Fault Reporting

This section describes the ways in which LC-800 alarms can be reported to the operator.

Network Monitoring System

Summary Alarms at the Master or Remote sites are reported through the network monitoring system. The network monitoring interfaces are found at connector J6 for the Master site and connector J7 for the Remote site. This is a feature that is not yet available.

Routine Maintenance Checks

Pay close attention to the front panel status LEDs and LCD display when performing routine maintenance. Any changes in status from the previous reading should be checked and verified. If the conditions are valid, take appropriate action to return the equipment to the normal operating mode.

Service Complaint

Equipment failures can be reported to the operator by a customer unable to obtain cellular service in an area covered by the output of the LC-800. These reports tend to highlight the more severe system faults.

Fault Determination

This section provides guidelines for determining equipment alarm causes, discussing signal path faults in the Forward and Reverse directions, Power System Faults, Alarm System Failure, and other faults.

Signal Path Faults

Signal path faults can occur, and therefore should be researched, in both the Forward and Reverse directions.

Forward Direction—RBS to Mobile

Look for signal path failure in the **Forward** direction at critical points such as the following:

⇒ The interface between the Radio Base Station and the Master Unit (RF connections)

⇒ The optical fiber path (connectors and splices)

⇒ The RF connections between the Remote Fiber Optic Transceiver Module and PA Input

⇒ The RF connector to the coaxial cable feeding the antenna

⇒ Antenna system to mobile user

Reverse Direction (Mobile to RBS)

Signal path failure in the **Reverse** direction can occur in the following areas:

⇒ Mobile user to Remote antenna (receive antennas)

⇒ The Interface between Antenna Coupling and LNA Inputs

⇒ The outputs of the LNA

⇒ The optical fiber path (connectors and splices) at both the Master and Remote Units

⇒ The interface between the Master Unit and the RBS—RF connections

Power System Faults

AC Power Failure

At the Master and Remote sites, check the power connection at the wiring terminals in the unit. Examine the circuit breaker (fuse, switch) in the load box, and determine the overall integrity of the power wiring for shorts or disconnections.

DC Power Failure

At the Master and Remote sites, check the power connection at the wiring terminals in the unit, and examine the DC distribution board and breaker in the load box. Determine overall integrity of the power wiring for shorts or disconnections.

The Master and Remote Units have banana plugs to check to ground using a digital voltmeter (dvm). These voltages should be within ±0.2 Volts of the specified value: +24 VDC, Remote only (+26 VDC for Level 5, Remote Only); +12 VDC; +5 VDC; -5 VDC.

Alarm System Fault

This feature is not yet available.

If the Network Monitoring System shows an alarm, but upon further inspection at the site it is determined that no alarm has occurred, there may be a fault in the Alarm Reporting System itself.

Alarm Indication Matrix

The alarm indication matrices list possible reasons an alarm condition is present and the suggested remedial action—see **Table 6-1** and **Table 6-2**.

Table 6-1 provides a logical progression of alarm indication analysis for each of the main modules in the LC-800 system.

Table 6-1. Master Site Alarm Indication Matrix

Module	Indication	Cause	Solution
Power Supply Assembly 090-0238-XX	Alarm (Red LED)	Power Supply Failure⇒	Check Power Supply Test Points at 12 V, +5 V and -5 V. Replace unit.
Fiber Optic Master Unit 090-0242-XX	Master Alarm (Red LED)	Low optical output power at laser TX⇒	LCD display OP P OUT indicates <xxxxxx Check Power Supply voltages.
		Low optical Input Power at laser RX⇒	LCD display OP P IN indicates <xxxxx Clean fiber tip, test output with power meter.
		Failure of Master Controller Board⇒	Replace unit.
		Failure of Master RF Board⇒	Replace unit.

Table 6-2. Remote Site Alarm Indication Matrix

Module	Indication	Cause	Solution
Power Supply Assembly 090-0253-XX	Alarm	Power Supply Failure⇒	Check Power Supply VDC Test Points at +24 V, +12 V, +5 V and -5 V. Replace unit.
LNA Assembly 090-0264-XX	Alarm	Failure of LNA Module⇒	Replace unit.

Module	Indication	Cause	Solution
Power Amplifier Assembly 090-0729-01	Alarm	Power Amplifier in OFF state⇒	LCD Display RM XMTR indicates OFF Check state of Remote and Master front panel Remote XMTR Switches. Check state of Remote and Master Controller Board Switches.
Fiber Optic Remote Unit 090-0252-XX	Remote Alarm (Red LED)	Low optical output power at laser TX⇒	LCD display OP P OUT indicates <xxxx-. Check Power Supply voltages.
		Low Optical Input Power at laser RX⇒	LCD display OP P IN indicates <xxxx. Clean fiber tip, test output with power meter.
		Power Amplifier in OFF state⇒	Check state of Remote and Master front panel "Remote XMTR" Switches. Check state of Remote and Master Controller Board Switches.
		Low RF power transmitted by Power Amplifier⇒	Check cable connection integrity.
		Failure of Master Controller Board⇒	Replace unit.
		Failure of Master RF Board⇒	Replace unit.

Repair

This section suggests basic repair procedures the operator can perform which may rectify problems without having to resort to the return of LC-800 parts or modules. Module removal and spare unit installation are also discussed.

Basic Repair

Basic repair procedures which should be taken before resorting to a return of the faulty part include cleaning and repair of faulty connectors. As previously suggested, examine all connectors in the problem area and re-solder or clean connections as needed.

NOTE: *If the circuit breaker at the site was triggered, reset the breaker.*

Module Removal

To remove LC-800 plug-in modules for examination, first remove the ribbon connectors to the Power Alarm Interface Board, then loosen the thumbscrews and carefully remove the modules from their slots. After reinserting the modules, be careful not to over tighten the thumbscrews.

Installation of Spare Units

When installing spare units for the LC-800, check that the part number of the replacement matches the original part number. The three types of connectors the operator will encounter during spares installation are:

SMA

A threaded screw-on connector, best tightened by hand to 6 or 8 in.-lbs. These connectors are found at the Remote site only.

SMB

A snap-on connector that fastens in a plug-in manner. These connectors are found at both the Master and Remote sites.

FC/PC

A fiber optic connector that pushes on through an internal guiding slot, with a screw-on outer collar. These connectors are found at the Fiber Optic Inputs to the Master and Remote sites.

Ensure the DIP Switch settings for the FOUs are correct before installing the unit. Check the DC voltages from the PSUs once the units have been installed and ensure that all cables are in the correct position and have been installed correctly.

Return Procedure

Once it is determined that a unit is faulty, contact the Repeater Technologies Repair Department at (408) 743-9380 or 1 (888) 747-1515. A representative will issue an RMA (Return Authorization Number) and shipping instructions.

The following information will be requested:

⇒ Billing and shipping addresses
⇒ Part number
⇒ Description of the problem unit
⇒ Serial number of the problem unit
⇒ Summary of the unit's problem
⇒ Purchase Order number if unit is more than two years old
⇒ Contact name
⇒ Contact's fax number

A copy of the RMA will be faxed to the contact. This copy should be returned with the unit to Repeater Technologies along with the purchase order, if required.

Return-ship the units in the original or similar containers to minimize the potential for shipping damage. Ensure that the packing material adequately protects the unit from undue contact with the shipping container.

End of Chapter

Recommended Inspections

The LC-800 system does not require any regularly scheduled maintenance, other than that required by local telecommunications regulations. However, there are some inspections that can be made on a routine basis to ensure continued trouble-free operation.

Cable Inspections

Periodically inspect the cables and connectors that interconnect the RF and optical equipment. Check for connector tightness, and that the cables are in good condition.

Outdoor Housing Inspections

Periodically inspect all hardware securing the outdoor equipment housings, pipe mounts, etc., and, if necessary, tighten hardware. Inspect housings for signs of water leakage, or other possible intrusive damage. The filter should be periodically checked and, if necessary, cleaned. To inspect the filter:

1. Loosen the captive screws at the base of unit until the filter lowers.
2. If necessary, remove dust or other foreign particles from filter.
3. Re-insert and secure the filter.

Antenna Inspections

Visually inspect the UHF antennas at the Remote site for indications of damage or loose hardware.

Fiber Optic Cable Inspections

As the light spot diameter of the fiber is only 10 µm, careful attention to the handling of the fiber optic cable and connector is required.

WARNING: *Do not stare directly at the end of the fiber optic fiber. The laser output power is +3 dBm. Looking directly at the light source can damage the cornea of your eye. Always orient the fiber tip away from your eyeball when cleaning.*

To inspect the fiber, disconnect the FC/PC connector at the bottom of the module. Moisten a lint-free tissue with isopropyl alcohol and wipe the surface of the fiber lens.

Power Plant Inspections

The Battery Power System uses maintenance-free batteries. Maximum performance and battery life is achieved by keeping the batteries properly charged. To do so, follow the manufacturer's instructions in the accompanying Operations and Maintenance Manual. The Preventive Maintenance Schedule provided in the manual encompasses all recommended maintenance and suggested intervals for this product.

Local Regulatory Inspections

Local regulatory agencies may periodically require the verification of the Transmit Output Power and Transmit Frequency. These transmit inspections apply to the RF transmit equipment at the Remote site. Because RF transmit output sections of the LC-800 system are equipped with in-line monitor ports, transmit output power and carrier frequencies can be verified without affecting service.

Table 1. Maintenance Schedule

Intervals	Master Unit		Remote Unit		
Months	Cables /Fiber	Voltages	Cables /Fiber	Voltages	Filter
6	Inspect	Measure	Inspect	Measure	Clean
12	Inspect	Measure	Inspect	Measure	Clean
18	Inspect	Measure	Inspect	Measure	Clean
24	Inspect	Measure	Inspect	Measure	Clean

Intervals	Antenna Systems	
Months	Cables	Antenna
6	Inspect	Inspect
12	Inspect	Inspect
18	Inspect	Inspect
24	Inspect	Inspect

Table 2. Maintenance Matrix

Remote

As Installed	Inspected
REMOTE ___	REMOTE ___
RM XMTR ATT __ dB	RM XMTR ATT __ dB
REM LNAM ATT __ dB	REM LNAM ATT __ dB
REM LNAD ATT __ dB	REM LNAD ATT __ dB
OP P OUT __ dBm	OP P OUT __ dBm
RF COMP __ dB Ref	RF COMP __ dB Ref
OP P IN __ dBm	OP P IN __ dBm
RF POWER __ dBm	RF POWER __ dBm
REM LNAD ATT __ dB	REM LNAD ATT __ dB
OP P OUT __ dBm	OP P OUT __ dBm
OP P IN __ dBm	OP P IN __ dBm

Master

As Installed	Inspected
MASTER ___	MASTER ___
RM XMTR ___	RM XMTR ___
FWD IN __ dB	FWD IN __ dB
REM LNAM ATT __ dB	REM LNAM ATT __ dB
REV GAIN MN __ dB	REV GAIN MN __ dB
REV GAIN DIV __ dB	REV GAIN DIV __ dB

End of Chapter

Chapter 8 . Controller Interface Script

Introduction

The LC-800 Controller Interface Script (P/N 519-0434-03) reveals internal hardware alarm conditions and allows field service personnel to troubleshoot the Lightwave microCell Equipment. The following hardware is required to run the Script:

- ⇒ A PC or laptop computer with a 386 or higher processor
- ⇒ A DB-9 (m-f) cable connector

Two methods of Fault Diagnostics can be used to troubleshoot the Lightwave microCell Equipment:

Digital Alarms
Alarm Reports and Alarm Summary Outputs.

Diagnostics relevant to the RF signal flow
RF troubleshooting can be considered as part of equipment malfunction fault diagnostics. (For RF troubleshooting, service personnel must have access to a spectrum analyzer, a suitable signal source, and optical test equipment.)

NOTE: *Only qualified service personnel should perform tests on the LC-800 Lightwave equipment.*

Alarm trees are provided in ***Appendix A***. Trees are structured as alarm outputs. Block and Level Diagrams are provided in ***Appendix B***. These diagrams depict the RF signal flow End-to-End in both the Forward (downlink) and Reverse (uplink) directions. Both 1-to-1 and 1-to-3 input to output configurations are presented.

There are three major components on the Script structures:

Switch settings
The Switch Setting group provides information regarding the DIP Switch settings on the Fiber Optic Transceiver Controller.

Alarm and Relay/LED Status
The Alarm and Relay/LED Status reports the alarm status and relay/LED state. Current values for the RF and Optical power levels are also reported here.

Alarm History
The Alarm History is a database record over time for critical alarms. There are database records for the Master and the Remote Fiber Optic Transceivers.

Loading and Running the Controller Interface Script

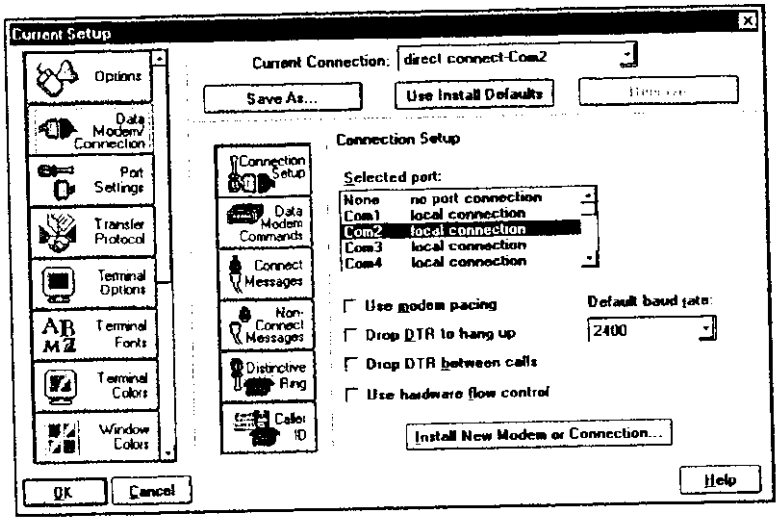
To load and run the Repeater Technologies Script file to run with PROCOMM PLUS:

1. Install PROCOMM PLUS version 2.1 for Windows on the computer's hard drive. PROCOMM version 3.0 should *not* be used. If necessary, refer to the PROCOMM PLUS User Guide for information on installation and getting started.
2. Load the LC-800 S/W Script File into the A drive of the computer. (The floppy disk is located in a plastic sleeve at the front of the LC-800 manual.)
3. Copy the Script file, *lc-lrc.wax*, into the Prowin2/Aspect directory. Store the floppy disk in a safe place.
4. Using a DB-9 serial cable, connect the serial port of computer to the RS-232 port of either the Master or the Remote unit.
5. Start PROCOMM PLUS. When the PROCOMM PLUS Terminal Window opens, a data string (which writes every 5 seconds) displays on the left of the screen. If this data string does not display, setup was unsuccessful and the following should be checked:
   - ⇒ The cable connection between the computer and the LC-800.
   - ⇒ The COM port being used on the computer matches the selected port in PROCOMM. To check this:

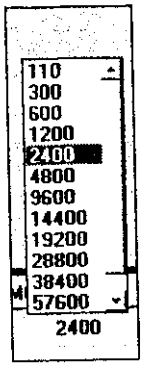
◊ Click the **Setup** button on the PROCOMM Action Bar to open the **Current Setup** screen.

◊ Select **Data Modem Connection** from the dialog groups on the left.

◊ Under the **Selected Port**, choose the computer port being used (usually COM1 or COM2, labeled on the computer).

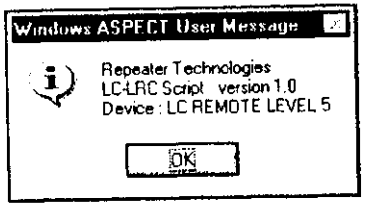


⇒ The baud rate or the port settings are not correct. The baud rate should be set at 2400 and port settings at N-8-1 (parity, data bits, and stop bits). If either setting needs to be changed, click the Quick Select option (the option button on the Quick Select Line) and choose the correct program setting from the pop-up list.



6. Once settings are correct, run the controller interface Script from the PROCOMM PLUS main control screen.

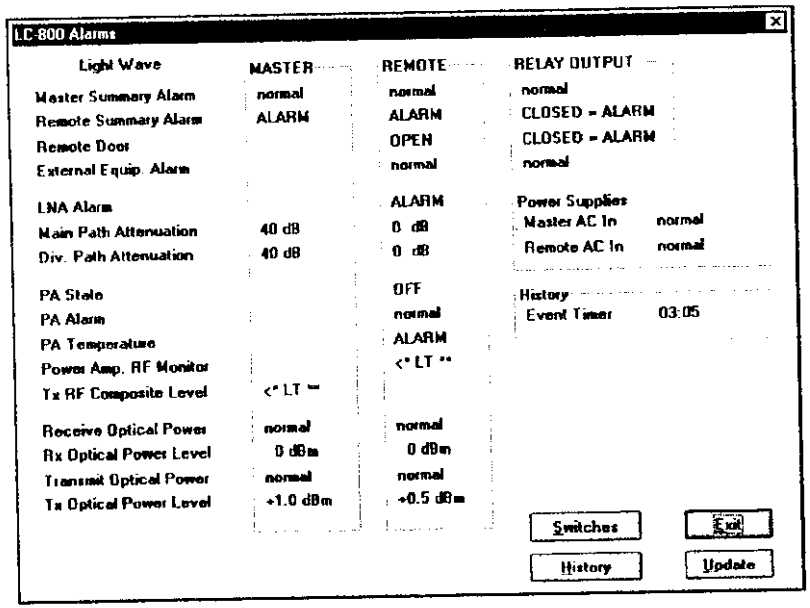
   Choose the **lc-lrc** Script from **Script File** pull down list. If *lc-lrc* already is selected, click on the **Start Script** icon (running man) to run the Script. Note that the Aspect Window identifies the connected unit—Master or Remote.



7. Click **OK** to open the **LC-800 Alarms** screen. Note that, after clicking OK, the Script reads the board configuration. A number of messages display during the upload from the Transceiver Module.

Summary of the LC-800 Alarms Screen

The LC-800 Alarms screen displays both alarm and power data for both the Master and Remote units in separate columns.



Note the following information about the **Alarms** screen:

⇒ Power levels are recorded in dBm. If a power level is greater than or less than a specified threshold a special symbol will display: ** GT *> for greater than, and <*LT ** for less than.

⇒ The PA State identifies the power amplifier as ON or OFF.

⇒ Relay outputs are associated with the Master Summary Alarm, the Remote Summary Alarm, the Remote Door, and the External Equipment Alarm. When the alarm is normal the relay is open, and when the alarm is active, the relay is closed.

⇒ Attenuation for the Main Path and the Diversity Path is reported in dB. The Main Path Attenuation and Div. Path Attenuation at the Master Unit relates to the Master Fiber Optic Transceiver hardware attenuators. The Main Path Attenuation and Div. Path Attenuation at the Remote Unit show the amount of attenuation inserted at the LNA Module.

If the Hot Tone Function is ENABLED, 10 dB of attenuation is removed at the Master hardware signal path for each 10 dB of attenuation inserted at the LNA. If the Hot Tone Function is DISABLED, the Main and Diversity path attenuators should remain at 0 dB regardless of the LNA attenuation setting.

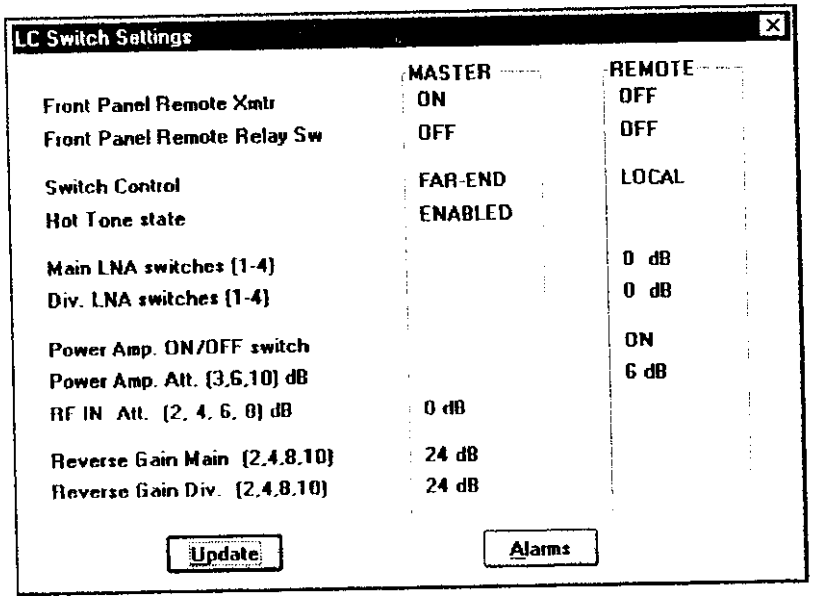
⇒ The Master and Remote Alarm Relay is a Summary Alarm reported by a relay contact closure. The Active state indicates a closure to ground. The Alarm summaries are reported at J7 on the Remote Unit and at J6 at the Master Unit.

⇒ Master and Remote power supply alarms apply to either an AC or a DC power supply.

⇒ Alarm definitions are either normal (no alarm) or ALARM (an active alarm). The unit's alarm state is updated every five seconds as indicated by the Event Timer in the History box.

LC Switch Settings

Click the **Switches** button on the **Alarms** screen to open the **LC Switch Settings** screen.



Front Panel Switch Settings

This option reports the Front Panel Switch settings of both Master and Remote Fiber Optic Transceivers. The Front Panel Switch settings control the following:

⇒ The Front Panel Remote Transmitter Switch turns the Power Amplifier ON or OFF.

⇒ The Front Panel Remote Relay Switch controls a relay contact closure to ground at the Remote Unit. This contact closure is reported at J7 pin 8. The relay contact is open when both front panel switches (Master and Remote) are in the ON position.

If any change to the front panel switches is made while in this menu, the change will not be reported until clicking Update. To obtain a hard copy of any display screen, use the Print Screen function on your keyboard.

Switch Control
For information on jumper and DIP switch settings.

Hot Tone
For information on the hot tone function.

LNA Attenuator DIP Switch Settings

Because both Master and Remote Fiber Optic Transceivers use identical controllers, the DIP Switch Control settings are reported for both devices.

The MAIN LNA SW1 through SW4 relate to the S1 DIP Switch set on the Fiber Optic Controller Board. The DIV LNA SW1 through SW4 relate to the S2 DIP Switch set on the Fiber Optic Controller Board. MAIN LNA relates to the 10 dB step LNA attenuator controls for the Main Channel. The DIV LNA relates to the Diversity channel.

Nomenclature:

DIP Switch ON means attenuation IN.
DIP Switch OFF means attenuation OUT.

Power Amplifier Attenuation and RF IN Attenuation

Here the Controller Board DIP Switch sets S3 and S4 are displayed for both Master and Remote Fiber Optic Transceivers—see **Figure 5-3** for information about DIP switch settings.

The RF IN settings are relevant to the Forward input attenuator located at the Master Fiber Optic Transceiver hardware. This attenuator controls the input level prior to the Optical transmitter. This 20 dB attenuator can be set in 2 dB steps.

Nomenclature:

Pwr Amp ON/OFF SW

ON means the Power Amplifier is ON.
OFF means the Power Amplifier is OFF.

NOTE: *The Power Amplifier ON/OFF state is dependent on an "AND" function for the front panel switches and DIP Switches.*

Pwr Amp XXdB SW:

ON means attenuation IN.
OFF means attenuation OUT.

Reverse Gain Attenuation DIP Switch Settings

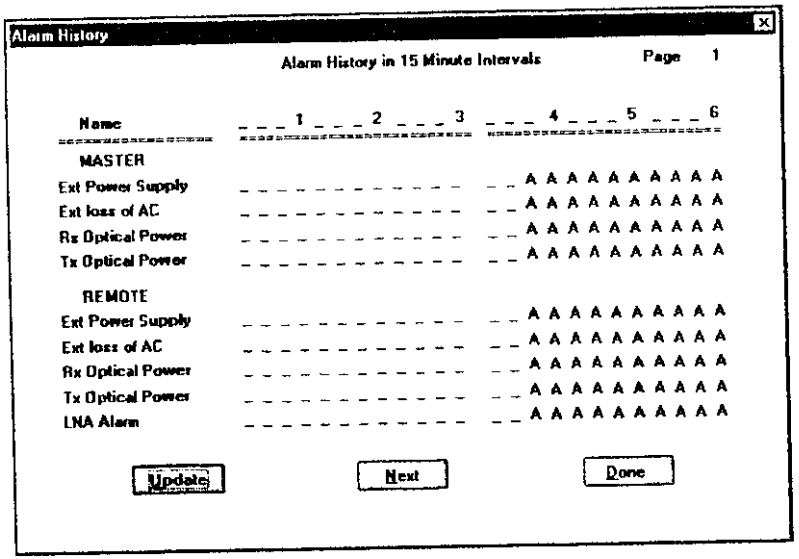
Reverse gain control is set using the Controller Board DIP Switch S5 for the Main channel and DIP Switch S6 for the Diversity channel.

Nomenclature:

ON means attenuation IN—lower gain or signal level.
OFF means attenuation OUT—higher gain or signal level.

Local Alarm History

Click the **History** button on the **Alarms** screen to open the **Alarm History** screen.



The Alarm History screen displays both Master and Remote alarms. When the unit is turned ON, the Alarm History screen is filled with Alarms.

The Alarm History Record is updated by the Transceiver Controller at 15 minute intervals and can hold up to 96 intervals (the equivalent of a 24-hour period). After the 24-hour period, the controller continues to update the history record with new alarm data. The first interval is the most recent update. Any alarm in the active state is reported into the Alarm History Record as an A. The Inactive state is reported as an underscore.

The Alarm History Record resides in the Fiber Optic Transceiver Controller hardware and the Software Interface is used to read this record. The Software Interface does not refresh the display screen automatically. You always must refresh the screen by clicking **Update**.

Fiber Optic Transceiver Alarm History

The Alarm History for the Master Fiber Optic Transceiver follows. Nine critical alarms are reported at 15 minute intervals. Use the **Page Up** and **Page Down** keys to scroll through the **History** record.

Nomenclature:

Ext Pwr Supply: Back up power failure.
Ext Loss of AC: AC line Loss.
RX Optical Pwr: Received optical power failure.
TX Optical Pwr: Transmitted optical power failure.
A=Active; Underscore=Inactive.

Remote Fiber Optic Transceiver Alarm History

The Remote Fiber Optic Transceiver Alarm History is shown below. There are eight critical alarms reporting to the Alarm History Data Base.

Nomenclature:

Ext Pwr Supply: Back up power failure.
Ext Loss of AC: AC line Loss.
RX Optical Pwr: Received optical power failure.
TX Optical Pwr: Transmitted optical power failure.
A = Active; Underscore = Inactive.

Chapter 9 . Customer-Specific Documentation

The LC-800 is shipped with customer-specific documentation which includes packing lists, sales order information and copies of the factory test data. This documentation can be a useful source of configuration information and should be kept with the Operations Manual.

Some installations may have been engineered by Repeater Technologies, and a site survey, engineering report, and *as built* documentation would also be available. Keep all documentation in an easily accessible location.

End of Chapter

Figures

Tables

End of Section

Appendix A . Alarm Trees

Introduction

The Lightwave microCell Equipment Alarm Reporting can be configured into three alarm trees—Alarm Expansion Module, Master Fiber Optic Transceiver Module and the Remote Fiber Optic Transceiver Module. Each of these modules gathers alarm information from other modules and sends the alarm status to the Cell Site equipment or to the other modules.

For example, alarms originating on the Power Amplifier Module are reported at the Fiber Optic Remote Transceiver Module. Then the Fiber Optic Remote Transceiver Module reports to the Fiber Optic Master Transceiver Module, which in turn reports to the Alarm Expansion Module. Finally, the Alarm Expansion Module reports to the Cell Site Equipment.

Alarm reporting is not unidirectional—alarms can originate at the Master site and report to the Remote site as well.

An explanation of the alarms and their trigger conditions follows.

Alarm Definitions

All of the Lightwave microCell Equipment Alarms can be classified as follows:

System Summary Alarms
Alarmed if any Unit Summary Alarm is active.

Unit Summary Alarms
Summary Alarms triggered by Module Alarms.

Module Summary Alarms
These are set by internal alarms and, in some cases, by user control.

Internal Alarms
These alarms are set by the internal hardware. The user has no control over these alarms.

External Control Alarms
These alarms are set by hardware settings controlled by the user.

Alarm Flow—Remote to Master Unit

Alarms at the Remote equipment are summarized at the Fiber Optic Remote Transceiver. Then, an alarm report is sent to the Master Fiber Optic Transceiver. The Master Fiber Optic Transceiver outputs the Remote Summary Alarm and the Master Equipment Alarms. The outputs from the Master Fiber Optic Transceiver are then gathered by the Alarm Expansion Module.

This Module provides the appropriate alarm interface to the various Cell Site equipment requirements and provides a limited set of alarms. Further visual diagnostic and computer aided diagnostics reveals the fault.

Alarm Flow—Master to Remote Unit

Alarm reports from the Master to Remote Unit manifest as relay closures to ground. Alarm interface connector is located at the Remote Cabinet Blower Panel Assembly. See the following table for a description of the pinout for the alarm output connector J1.

Table A-1. J1 Pin Descriptions

Pin	Description
1	Alarm Input #2, External Equipment.
2, 4	GND.
3	Remote Summary Alarm.
5, 9	No Connection.
6	Alarm Input #1, Open Door Alarm.
7	Master Summary Alarm.
8	Remote Controlled Relay Output.

Alarm Diagnostics

Alarm Expansion Module

Follow the Alarm Expansion Module Alarm tree while performing alarm diagnostics reported by this module—see the following figure.

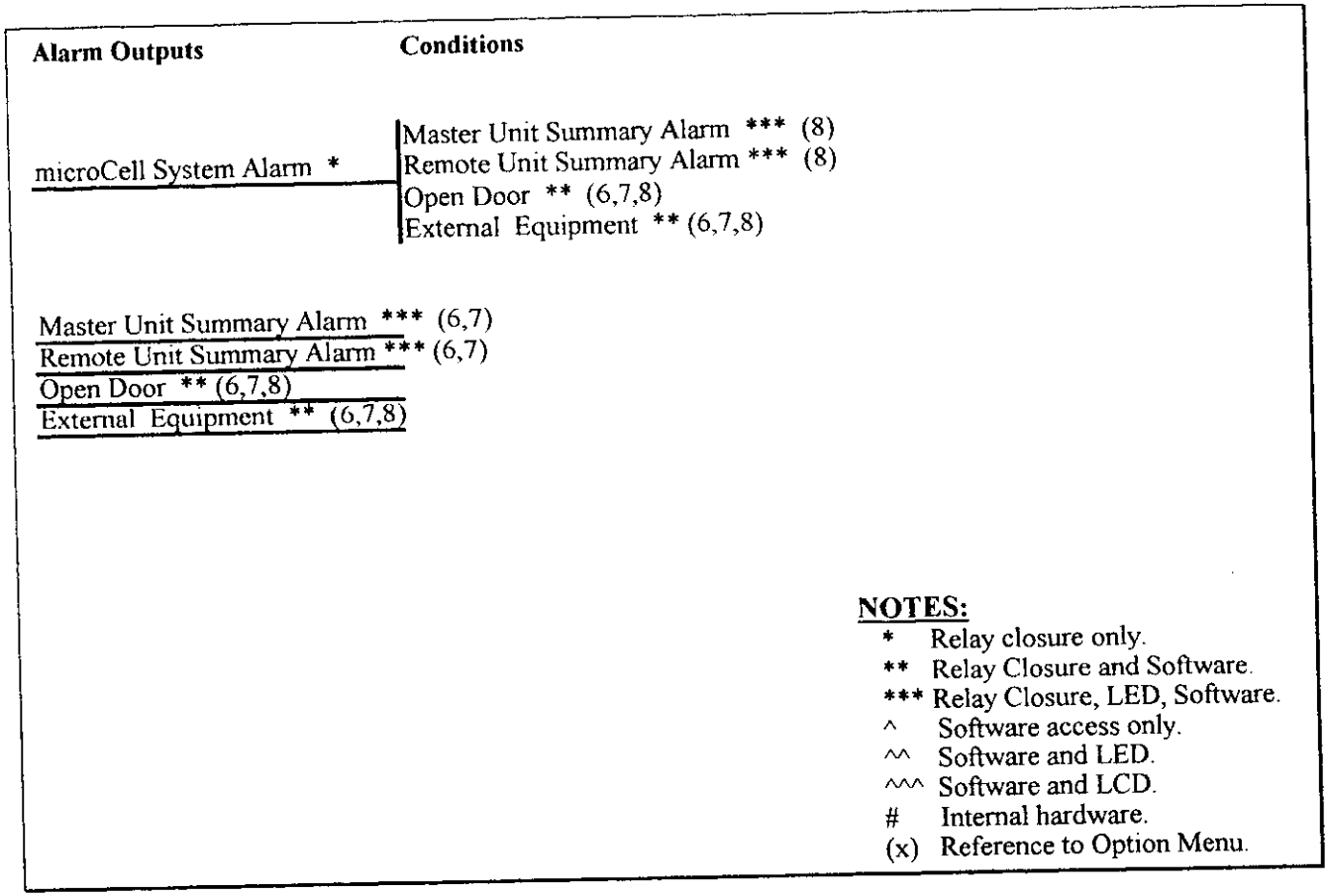


Figure A-1. Alarm Expansion Module

The Alarm Expansion Module reports alarms by contact closures that are interfaced to the Cell Site Equipment and by LED illumination at the front panel of the module. There are five alarms for each Master /Remote pair. Each Alarm Expansion Module can gather alarm information from three Master/Remote pairs. Note that the Master Card Cage can host three Master Fiber Optic Transceiver Modules.

Each set of five alarms are grouped into System 1, System 2 and System 3. System 1 is relevant to the Master Fiber Optic Module closest to the Master Card Cage Power Supply. See the following table for a description of alarms.

Table A-2. Alarm Description

Alarm Type	Front Panel Description
Master Summary Alarm	MAS FO TXR
Remote Summary Alarm	FO TXR
Remote Cabinet Door	RMT DOOR
External Equipment	EQUIP.
System Summary	SYS SUM.

Master Summary Alarm

This is the Master Unit Summary Alarm. There are numerous conditions within the Master Unit which could trigger this alarm—see **Figure A-2**.

Remote Summary Alarm

This is the Remote Unit Summary Alarm. There are numerous conditions which could trigger this alarm—see **Figure A-3**.

Remote Cabinet Door

This alarm is set if the Remote Cabinet Door is ajar or not closed tightly.External Equipment

This alarm is set at the Remote cabinet by the external equipment such a Battery Backup System. The Alarm Input is located at J1 at the Remote Cabinet Blower Panel Assembly.

System Summary

The System Summary is triggered when any of the above alarms is set.

Fiber Optic Transceiver Module

Follow the Master or Remote Summary Alarm tree while performing alarm diagnostics reported by the Master or Remote Fiber Optic Transceiver Module.

The Master Fiber Optic Transceiver Module reports alarms by contact closures that are interfaced to the Alarm Expansion Module and by LED illumination, as well as LCD readouts at the front panel of the Transceiver Module.

Each Master Fiber Optic Transceiver Module operates independently of the other Master Fiber Optic Transceiver Modules installed in the Card Cage. The Master Fiber Optic Transceiver Module gathers Alarm information from its Remote mate and from the Master Card Cage Power Supply.

Master Unit Summary Alarm

This Alarm manifests itself by illuminating the Master Summary Alarm LED at the front panel of the module. The conditions triggering this alarm could be the Power Supply or the Optical parameter level for both transmitter and Receiver circuits.

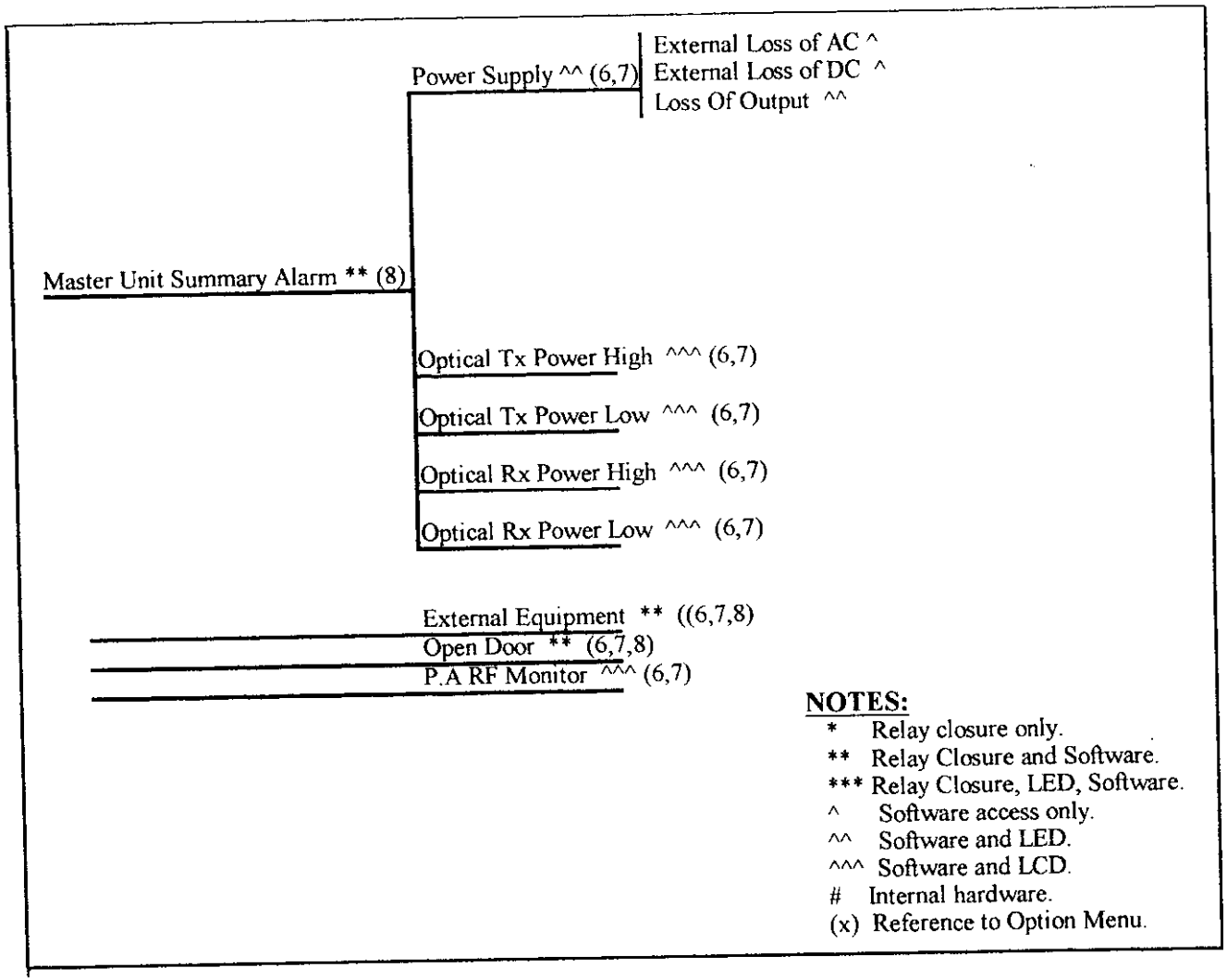


Figure A-2. Master Unit Summary Alarm

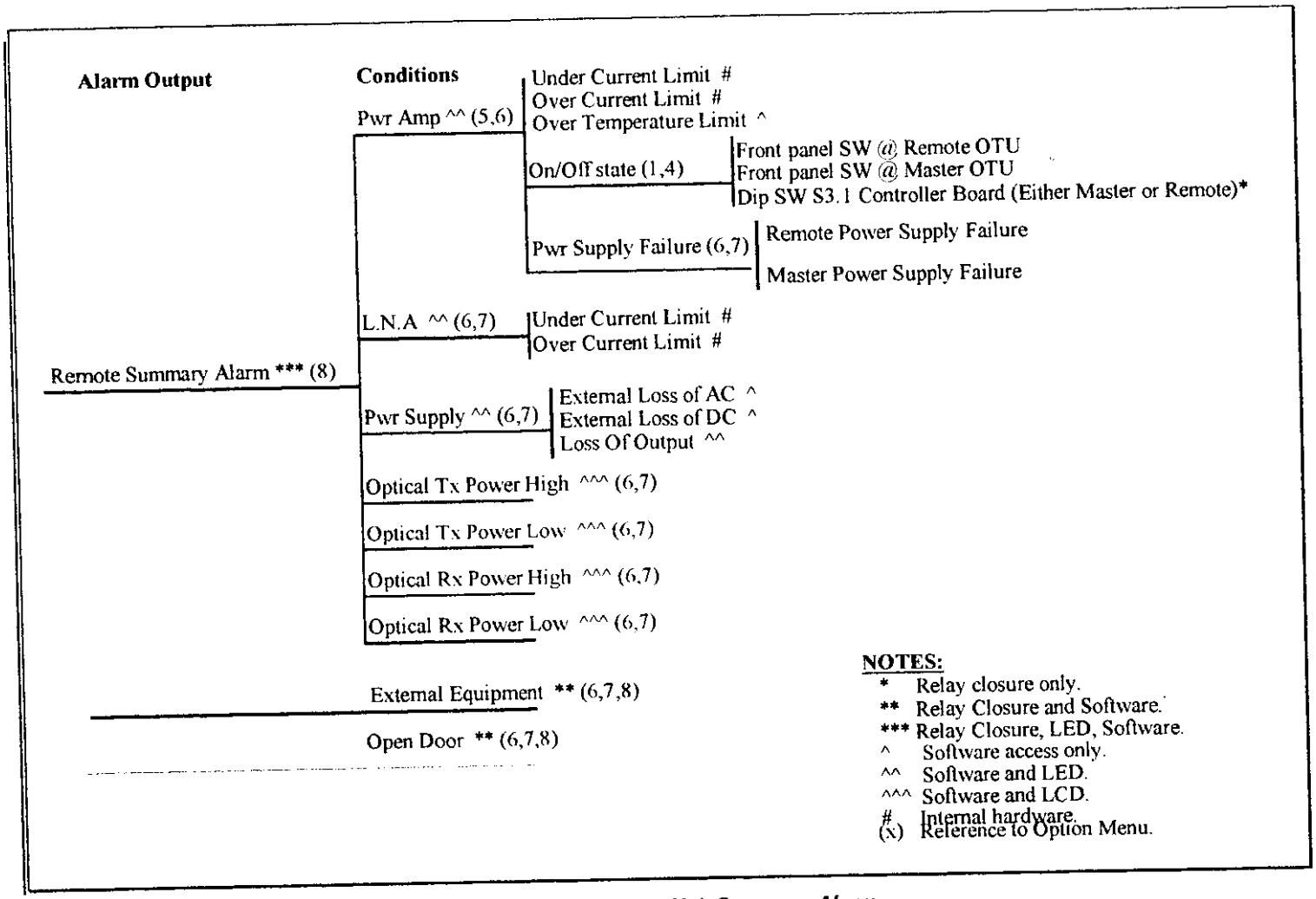


Figure A-3. Remote Unit Summary Alarm

Power Supply Alarm

This will illuminate a RED LED on the front panel of the Power Supply Module under the following conditions:

⇒ External Loss of AC

⇒ External Loss of DC

⇒ Loss of output

Alarms not reported by the Master Summary Alarm LED are the External Equipment and Remote Door Alarms. These two alarms are passed over to the Alarm Expansion Module without triggering any other alarm within the Master Fiber Optic Transceiver Module.

Remote Unit Summary Alarm

This Alarm manifests itself by illuminating the Remote Summary Alarm LED on the front panel of the module. The conditions triggering this alarm are as follows:

Power Amplifier Alarm

This alarm manifests itself by illuminating the Power Amplifier Module LED. There are two types of conditions that trigger this alarm. One set of conditions are internal to the PA hardware. These include environmental conditions such as the PA exceeding its temperature range or its current consumption being out of specified limits.

The other set of conditions are dependent on user control. In order for the PA to be in its ON state, the front panel switches for both Master and Remote Fiber Optic Transceiver Modules must be in their ON position. The other criteria is that the DIP Switch setting S3-1 must be in the ON position at the Controller Board. The DIP Switch setting is dependent on the mode of operation, (Far End control or Local control).

Low Noise Amplifier

The LNA Module will be in its alarmed state when the front panel LED is illuminated. This alarm is triggered by internal circuitry that monitors the current consumption.

Remote Power Supply

Three possible conditions apply: (1) external loss of AC, (2) external loss of DC, (3) loss of output.

Optical parameter level

For both transmitter and Receiver circuits.

Alarms not reported by the Remote Summary Alarm LED are the External Equipment and Remote Door Alarms. These two alarms are passed over to the Master Fiber Optic Transceiver Module without triggering any other alarm within the Remote Fiber Optic Transceiver Module.

Appendix B . RF Diagnostics

Introduction

To effectively diagnose the Lightwave microCell, the equipment must be operating on its default mode. That is, the Remote must be under Far End Control, the Hot tone function enabled, the PA attenuation set to -6 dB, Forward input attenuator set to 0 dB, and Reverse gain set to +24 dB, LNA attenuation set to 0 dB. Optical attenuation should be 0 to -10 dB (optical).

Forward Signal Direction

CAUTION: *Use a 30 dB pad when measuring power levels from the Power Amplifier output. Do not operate the Power Amplifier without a load.*

See Figure B-1 on page B-2 for reference and set the input level at -20 dBm single tone at the Type N connector located at the back of the Master Card Cage.

Reverse Signal Direction

CAUTION: *The Power Amplifier must be OFF before performing this test. Possible damage to the PA Assembly or test equipment may occur. Do not operate the Power Amplifier without a load.*

See Figure B-2 on page B-3 for reference and set the input level at -55 dBm single tone at the Type N connector located at the Antenna port of the Remote Cabinet.

Module To Module Gain And Losses

RF Distribution Board:

1-to-1 1 dB loss
1-to-3 10 dB loss

Fiber Optic Master to Fiber Optic Remote 0 dB

(Forward Direction, 0 to 10 dB optical attenuation range)

Fiber Optic Remote to Fiber Optic Master -6 dB loss

(Reverse Direction, 0 to 10 dB optical attenuation range)

Fiber Optic Remote to PA Input: 10 dB loss

PA Gain:

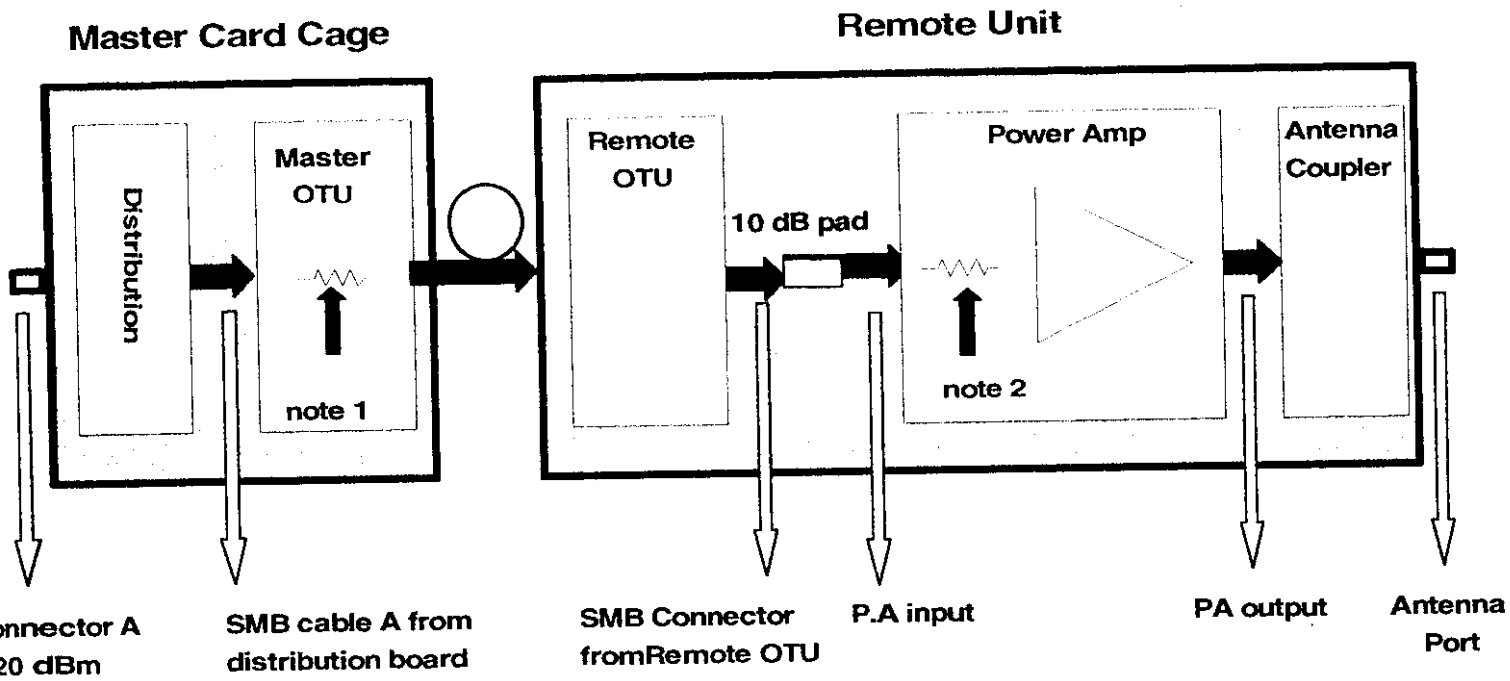
Level 3 62 dB gain
Level 4 68 dB gain
Level 5 71 dB gain

PA Output to Antenna Port: 2 dB loss

Antenna Port to LNA Input: 2 dB loss

LNA Gain: 33 dB gain

Test conditions: Input: -20 dBm TTL.
Note: RF Input Attenuator set to zero.
Note: PA Attenuator set to 10 dB.



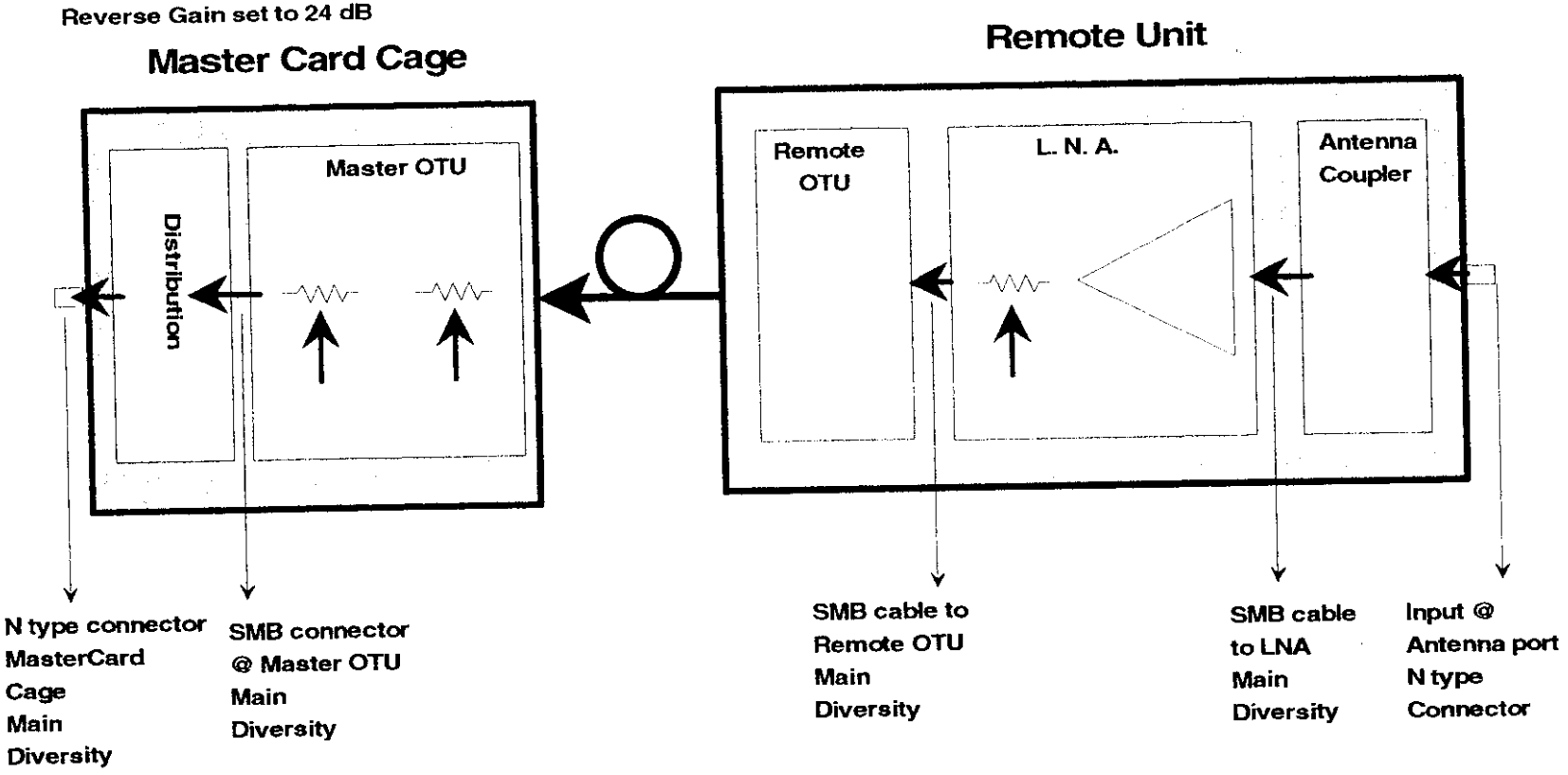
SIGNAL LEVELS AT INDICATED LOCATIONS

distribution board type						
1:1	-20 dBm	O to -10 dB optical Attenuation AGC Range	-20 dBm	-30 dBm	+ 31.5 dBm	+29.5 dBm
1:3	-30 dBm		-30 dBm	-40 dBm	+ 21.5 dBm	+19.5 dBm

Figure B-1. Block and Level Diagram—Forward (Downlink) SignaDirection

Test Conditions:

Input: -55 dBm TTL
LNA attenuation set to zero
Reverse Gain set to 24 dB



SIGNAL LEVELS AT INDICATED LOCATIONS

distribution board type					
1:1 -31 dBm	-31 dBm	O to -10 dB optical Attenuation	-25 dBm	-58 dBm	-55 dBm
1:3 -31 dBm	-21 dBm	AGC Range	-25 dBm	-58 dBm	-55 dBm

Figure B-2. Block and Level Diagram—Reverse (Uplink) Signal Direction

End of Appendix

Appendix C . Functional Tests

Introduction

To perform the functional tests and to correctly diagnose the Lightwave microCell equipment a thorough understanding of the modes of operations is required. Fault diagnostics require a full understanding of how the Lightwave microCell equipment hardware works and how it is inter-related.

Hot Tone Function

This function is inter-related to the Fiber Optic Master and Remote Transceiver Modules and the LNA Module. The Hot Tone attenuator can be activated manually through the LNA Attenuation DIP Switch Control or automatically by the RF Level Detectors located within the LNA hardware.

The Hot Tone function is dependent on the bi-directional communication between Master and Remote Units. If the telemetry signal in either direction is lost, Master to Remote or vice versa, the Hot Tone Function would be impaired partially or in whole. Before troubleshooting this function, one must ensure that a sound communication link is present.

Hot Tone Enabled

When the Hot Tone function is enabled, for every 10 dB of attenuation inserted at the LNA, 10 dB of attenuation is removed at the Master hardware signal path.

Hot Tone Disabled

When disabled, attenuation at the Master hardware signal path is not removed.

Optical AGC

The optical attenuation AGC range is 0 to 10 dB. This is tested using a variable optical attenuator. RF signal level should remain constant throughout the AGC range. Once outside the AGC range, the RF signal level should drop 2 dB for every dB of optical attenuation.

To make accurate optical measurements, observe all optical handling procedures.
All optical connector surfaces must be contamination free.

Optical Power

Optical Input Power is measured using an optical power meter. The measurement is made at the Input Fiber Optic Cable.

Optical output power is measured at the Fiber Optic Transceiver Module using appropriate fiber optic cables.

Attenuator Control

All of the attenuator controls are tested by monitoring the RF signal level and then changing the DIP Switch Control settings

Forward Input Attenuator

This attenuator is located within the Master Fiber Optic Transceiver Module. The step attenuator precedes the Optical Transmitter Circuit.

PA Step Attenuator

The step attenuator is located within the Power Amplifier hardware.

Reverse Gain Attenuator Control

The Reverse Gain Attenuator Control is located at the Master Fiber Optic Transceiver Module hardware. This attenuator is the last stage for the Reverse signal path. The Reverse gain is controlled by inserting attenuation in the signal path. The DIP Switch Controls show how the attenuation step associated with each DIP Switch step while the LCD readout displays the actual Reverse gain setting.

End of Appendix

Appendix D . Alarm Expansion Unit

Description

The Alarm Expansion Unit (part number 090-0899-01) provides alarm and status information for the Repeater Technologies LC-800 and LC-900 Lightwave microCells. The unit features local display of equipment status with LEDs and provides relay outputs to indicate status to Remote Alarm Monitoring Equipment. The unit is a plug-in module that plugs into the LC-800/900 Master Card Cage.

Operation

Equipment alarms in the LC-800/900 Master Unit reflect the status of both the Master Unit (located at the RBS) and any Remote Units. (Remote Unit status comes to the Master Unit through a pilot signal carried over the optical fiber connection between the Remote and Master.) Alarms are available as contact closures to ground.

Master Unit equipment for LC-800/900 systems is comprised of an equipment shelf with one, two, or three Fiber Optic Master Units installed. Each system can generate four alarms:

- ⇒ MAS FO TXR (Master Fiber Optic Transceiver)
- ⇒ RMT FO TXR (Remote Fiber Optic Transceiver)
- ⇒ RMT DOOR (Remote enclosure door)
- ⇒ RMT EQUIP (Remote equipment)

The Alarm Expansion Unit accepts these inputs and generates a Summary Alarm for each system. The module outputs five alarms—the four input sources and the Summary Alarm for each system, totaling 15 alarms.

Alarm Expansion Unit Specifications

Interface Specifications

Inputs	Twelve digital open-collector or Form B relays that pull up to 12 volts through 5.1 K ohms
Outputs	Fifteen Form C relays (NO C NC) contacts rated at 100 volts, .25 A
Power Requirements	12 VDC at .5 A maximum
Output Connector	"Champ" 50-pin Bail Lock, AMP part #55057
Mating Connector	"Champ" 50-pin, AMP part #55032-1, Repeater Technologies part #142-0125-01

Environmental and Mechanical Specifications

Temperature..... -20° to 50° C
Humidity ..... 90% relative
Altitude ..... 4550 meters/15,000 feet maximum
Weight..... 1 lb./45 kg
Size 11 x 8.5 x 1 inches/27.94 x 21.59 x 2.54 cm

Alarm Listing

SYS SUM—System Summary Alarm

This alarm includes any of the following alarms:

- ⇒ **MAS FO TXR (Master Fiber Optic Transmit)***
  - ◊ Optical Power Out (above 4.5 dBm, below -1 dBm)
  - ◊ Optical Power In (below -7 dBm)
  - ◊ Master Power Supply (loss of DC/loss of AC)

  *The Master Unit reports a MAS FO TXR Alarm when the optical fiber is not connected.

⇒ **RMT FO TXR (Remote Fiber Optic Transmit)****
- ◊ Optical Power Out (above 4.5 dBm, below -1 dBm)
- ◊ Optical Power In (below -7 dBm)
- ◊ Remote Power Supply (loss of DC/loss of AC)
- ◊ Low Noise Amplifier (current out of range)
- ◊ Power Amplifier Alarm (current out of range)
- ◊ Power Amplifier Temperature (temperature above range)

**The Power Amplifier will not turn ON if there is a RMT FO TXR Alarm.

⇒ **RMT DOOR (Remote Door)**
- ◊ Cabinet door open on Remote

⇒ **RMT EQUIP (Remote Equipment)**
- ◊ User configured Alarm Input commonly used to monitor battery or battery charger

NOTE: *On-board jumpers normally are installed in positions J2, J4, J6, J8, J10, J12, J14, J16, J18, J20, J22, and J24. Removal of these jumpers disables Alarm Inputs. Installation in the odd-numbered positions inverts the logic of the inputs.*

Table D-1. Connector Pin Assignments

Pin #	Function	Alarm Name	Pin #	Function	Alarm Name
1	NC	SYS 1 MAS FO TXR	26	C	SYS 2 RMT EQUIP
2	C		27	NO	
3	NO		28	NC	SYS 2 SUM
4	NC	SYS 1 RMT FO TXR	29	C	
5	C		30	NO	
6	NO		31	NC	SYS 3 MAS FO TXR
7	NC	SYS 1 RMT DOOR	32	C	
8	C		33	NO	
9	NO		34	NC	SYS 3 RMT FO TXR
10	NC	SYS 1 RMT EQUIP	35	C	
11	C		36	NO	
12	NO		37	NC	SYS 3 RMT DOOR
13	NC	SYS 1 SUM	38	C	
14	C		39	NO	
15	NO		40	NC	SYS 3 RMT EQUIP
16	NC	SYS 2 MAS FO TXR	41	C	
17	C		42	NO	
18	NO		43	NC	SYS 3 SUM
19	NC	SYS 2 RMT FO TXR	44	C	
20	C		45	NO	
21	NO		46	Reserved	
22	NC	SYS 2 RMT DOOR	47	Reserved	
23	C		48	Reserved	
24	NO		49	Reserved	
25	NC	SYS 2 RMT EQUIP	50	Ground	

Ordering Information

Configuration

The Alarm Expansion Unit is available in one configuration identified as follows:

ASSY ALARM EXPANSION 090-0899-01

One Alarm Expansion Unit is ordered with each LC800 or LC 900 Master Card Cage Assembly. This unit supports one, two, or three

Fiber Optic Transceivers and operates with either a 1-to-1 or 1-to-3 system configuration.

The mating connector is identified as follows:

"Champ" 50-pin AMP #55032-1, Repeater Technologies #142-0125-01

Spares

The recommended spare quantity is one spare unit at each RBS site.

Ordering Procedure

Orders should include the assembly name, part number, and quantity required. The order should also indicate the type of LC equipment in use (LC-800 or LC-900), if the Alarm Expansion Unit is an add-on, and the type of Base Station Equipment in use.

Indicate the shipping destination, billing address, and payment method on the purchase order. An equipment list, detailing equipment ordered and shipped is included with both the order acknowledgment and the shipment.

Contact the Repeater Technologies corporate headquarters for sales information or technical assistance

Corporate Headquarters

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Tel: (408) 747-1946
(800) 938-1901 (USA and Canada)

Alarm Expansion Unit Installation

Although the Alarm Expansion Unit ships in protective packaging, you must inspect the unit and the shipping container for damage as soon as it is received. If damage is found, notify the shipping company and submit a damage report immediately in compliance with their procedures. Repeater Technologies strongly recommends that users save original packaging materials to use for any future transport of the unit.

Mounting and Installation

The Alarm Expansion Unit plugs into an LC-800 or LC-900 Master Card Cage. While the Alarm Expansion Unit power must be OFF during installation, the LC-800/900 can remain ON and in service. A small, flat-blade screwdriver is the only tool required for installation.

To install the Alarm Expansion Unit:

1. Locate the circuit breaker or fuse for the Alarm Expansion Unit and turn the power OFF.
2. Remove the blank panel in the J5 (NMS Controller) position of the Card Cage.
3. Insert the Alarm Expansion Unit into the J5 position and tighten the thumb screws.
4. Insert the 20-pin connector into the J5 connection port.
5. Insert the DB-25 connector into the J6 connection port and secure the locking hardware.
6. Turn on the power to the Alarm Expansion Unit.

Connectors and Cables

The type of connector used in the Alarm Expansion Unit is the "Champ" style, 50-pin connector.

The mating connector is as follows:

Part Number	552032-1
Manufacturer	AMP Inc., Harrisburg, PA, 1-800-552-6752
Number of Positions	50
Wire Size	#24–26 AWG solid; #24 AWG 7 strand

A suitable interconnect cable is as follows:

Part Number	9585
Manufacturer	Belden, PO Box 1980, Richmond, IN, 47375, 1-800-BELDEN1
Number of Positions	25, pair
Wire Size	#24 AWG solid, twisted pairs

Connection to the Alarm Monitoring System

Motorola HD2

Refer to the Repeater Technologies Application Note *Motorola Site Documentation*.

The CSC and the VCC cards include Dry-Contact Inputs, which you can use to detect external conditions at the base site. When enabled, an alarm condition is indicated by an open contact and a non-alarm condition is indicated by an external closure (less than 200 Ω loop resistance).

These inputs cause alarms in the base site controller, which, in turn, are passed on to the EMX. Each CSC card includes five such inputs; each VCC card includes two such inputs. Each input is wired (with a return lead for each) to the card AUXIO connector.

Refer to the Motorola site documentation for card location and pin number assignments. The alarm groups are allocated and addressed in the Motorola software. The Alarm Test function is used to verify operation.

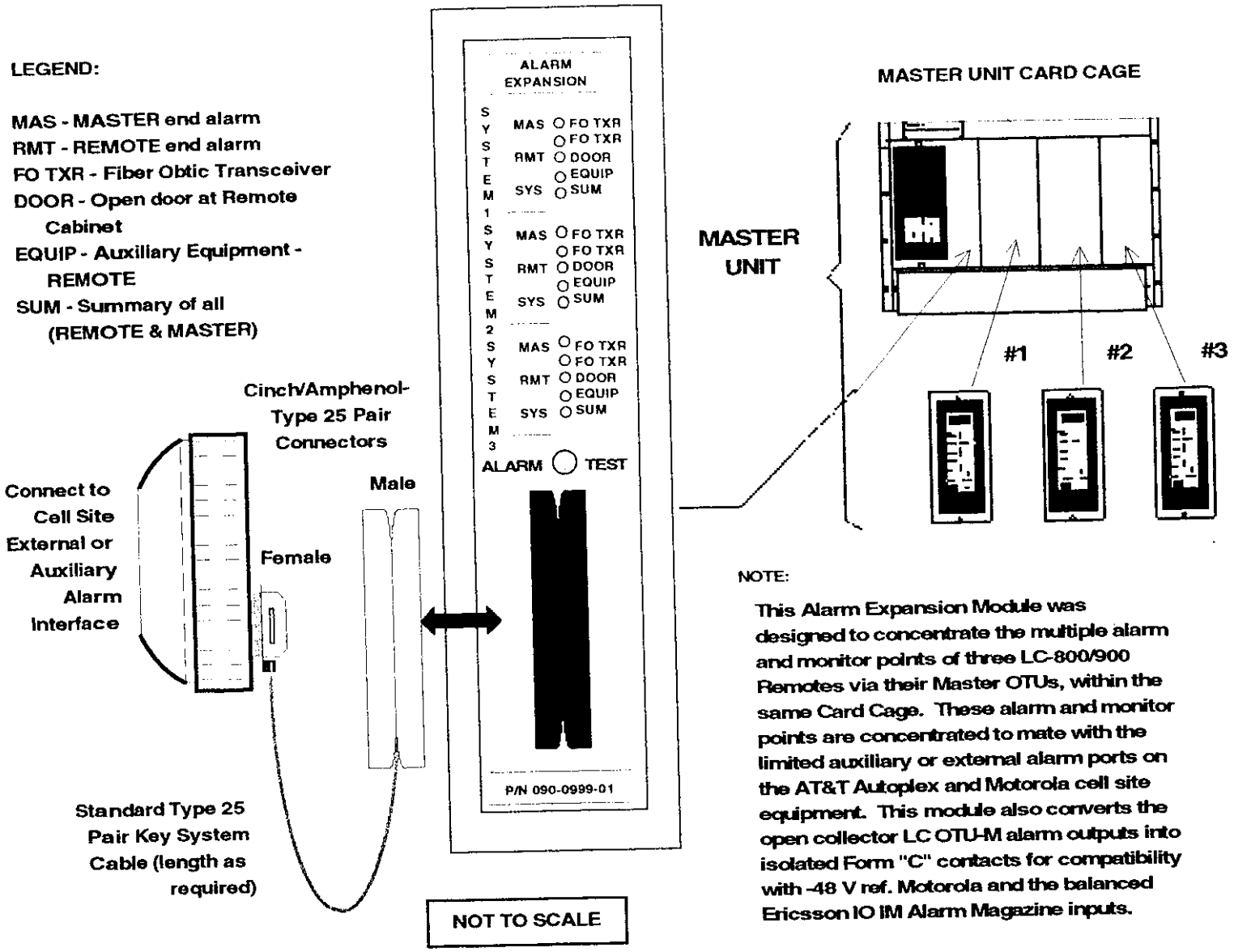
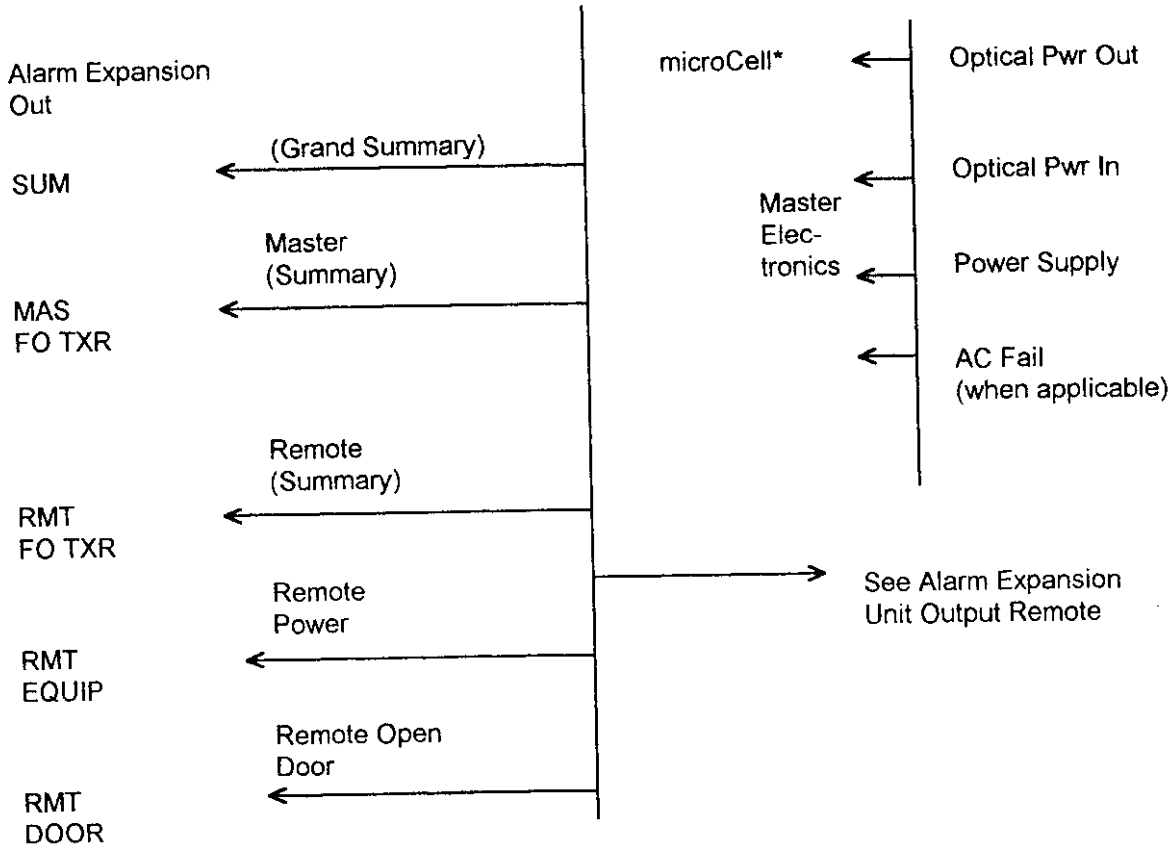


Figure D-1. Card Cage View

In this design, five (5) alarms can be connected to the Cell Site External Alarm Interface Unit (ALI) for each LC-800/900 m/C: See Alarm Expansion – Out

microCell MASTER CARD CAGE AT CELL SITE



These alarms are brought off the LC-800 microCell Alarm Expansion Module as FORM "C" relay contacts.

*This alarm also includes these subordinate alarms: MASTER, REMOTE, REMOTE POWER, and REMOTE OPEN DOOR.

Figure D-2. Alarm Expansion Unit Outputs—Master

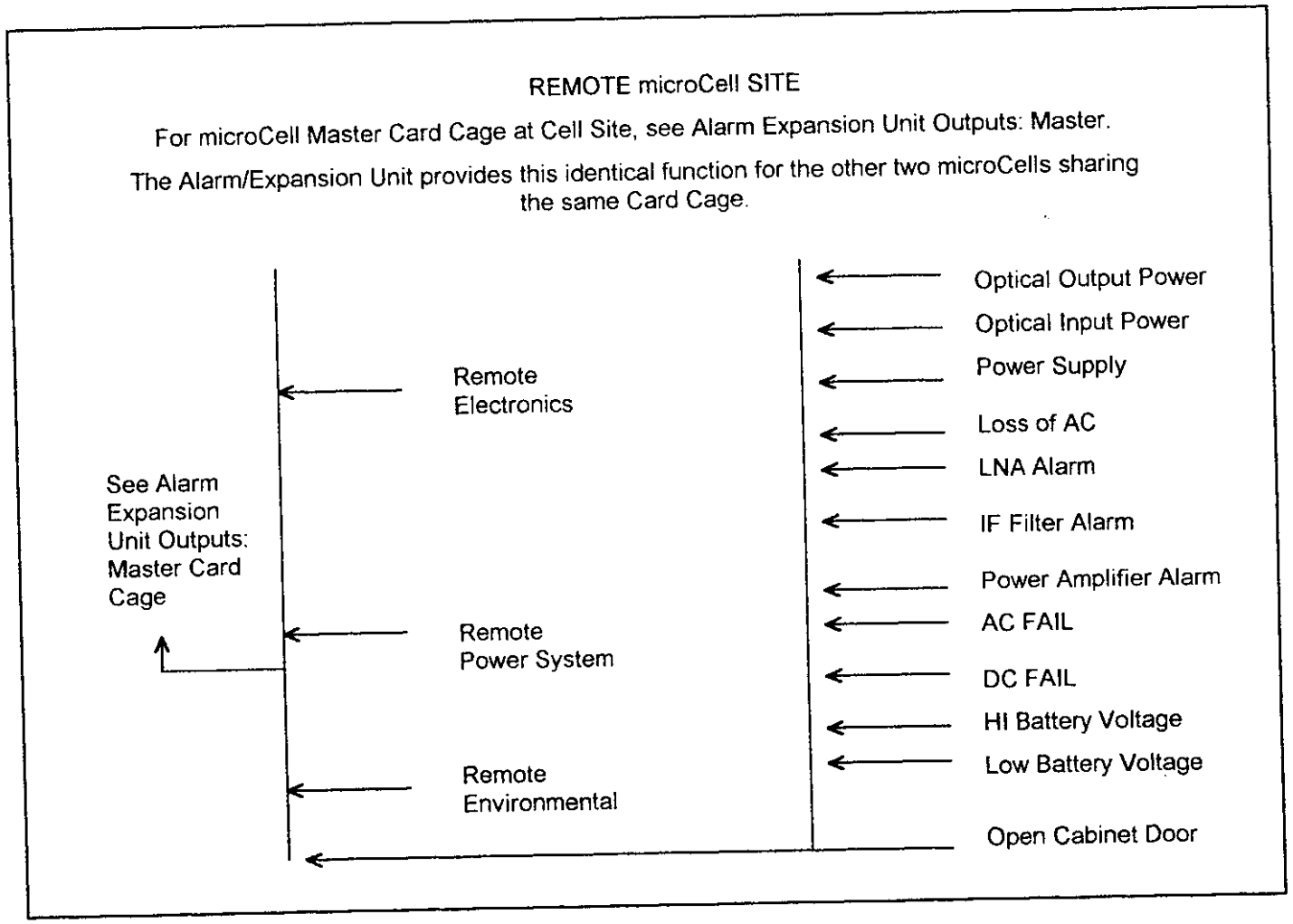


Figure D-3. Alarm Expansion Unit Outputs—Remote Site

Operation

Controls

The Alarm Test Switch is the only front panel control. Pushing this switch activates the LEDs and the output relays. The switch contact is made when pushed and is released as the switch is released.

The Alarm Test Switch is intended to be used for general system testing.

Fault Isolation

An Output Alarm Indication with no input indication can be isolated by unplugging the J6, DB-25 connector. All alarm indications should clear. If not, the Alarm Expansion Unit may be faulty.

Maintenance

The unit requires no scheduled maintenance.

Revision Compatibility

The Alarm Expansion Unit is fully compatible with LC-800/900 equipment with Rev. B Controller Boards, which were implemented in approximately August, 1994. The FO MAS and FO RMT and SUM Alarms are compatible with earlier units, but the RMT DOOR and RMT EQUIP Alarms are not connected in earlier units.

Glossary

ACU	Alarm/Control Unit
ALC	Automatic Level Control
AMPS	Advanced Mobile Phone System. Standard analog cellular telephone service.
BNC	Bayonet Nut Connector or Bayonet Neil Consulman. The type of connector that often is used for coaxial cables, such as those for Thin-Wire Ethernet or RGB video.
BTS	Base Transceiver Station
BUPS	Backup Power Supply
CDMA	Code Division Multiple Access. An improvement on AMPS and TDMA cellular telephone. Uses a technology called direct sequence spread spectrum to provide more conversations for a given amount of bandwidth and digital service.
C/E	Carrier-to-Echo Ratio
C/I	Carrier-to-Interface Ratio. The ratio between the mean signal level of the desired radio signal and the signals from other, interfering sources, typically expressed in dB.
CPC	Circular Plastic Connector
CRC	Cyclical Redundancy Code. A key component in the error-detecting capabilities of many protocols, this is a number of bits (usually 16 or 32) generated from and appended to the end of a block of data to provide error detection.
DAMPS	Digital Advanced Mobile Phone System (equivalent to TDMA)
dB	Decibel or decibels
dBc	Decibels referenced to the carrier level
dBi	Decibels referenced to the isotropic antenna
dBm	Decibels referenced to one milliwatt
DF, DFB	Distributed Feedback (Laser)
dvm	Digital voltmeter
EM	Electromagnetic
EMI	Electromagnetic Interference
ERP	Effective Radiated Power
F/B	Front-to-back ratio
FCC	Federal Communications Commission. The U.S. regulatory body responsible for the use of radio frequency transmissions and allocating frequency spectrum.
FE	Front end
FIFO	First In, First Out
Forward Direction	Direction of transmission from the base station through the repeater and on to mobile or hand-held units. Downlink transmission.
Forward Gain	Gain setting for forward transmissions.
FRU	Field Replaceable Unit
FSK	Frequency-Shift Keying
GSM	Global System for Mobile Communications (previously Groupe Speciale Mobile). The current and rapidly

	gaining acceptance Pan-European (and Pacific Rim and South Africa) digital cellular telephone standard developed by the European Telecommunnications Standards Institute's Groupe Special Mobile. Also used in some Middle Eastern countries and parts of Australia.
GUI	Graphical user interface.
Hand-Off	Transferring the service of a call in progress on a cellular system from one cell or sector to another, typically also involving a change in the voice channel used.
Hot Tone	If a Mobile transmits at full power in close proximity to a receive antenna, a hot tone (for example, a receive signal above -40 dBm) is produced. Too hot a tone can overmodulate a system and force it to drop all calls. Systems designed to control reverse attenuation will moderate the potentially damaging effect of hot tones.
IF	Intermediate frequency
IM	Intermodulation
IMD	Intermodulation distortion
LED	Light-emitting diode
LNA	Low noise amplifier
LO	Local oscillator, high-level input into mixer
microCell	Any small diameter cell site
MSC	Mobile Switching Center (equivalent to MTSO)
MTSO	Mobile Telephone Switching Office (equivalent to MSC)
Multipath	Radio propagation between a transmitter and receiver where the received signal is a compound of multiple rays that have undergone one or more reflections or refractions. Cellular coverage is most often provided in a multipath environment, especially in high-density city areas.
NR	Network repeater
OTU	Optical Transceiver Unit
PA	Power Amplifier
PCS	Personal Communications Service
PSTN	Public Switched Telephone Network
PEP	Peak Envelope Power
PLL	Phase Locked Loop
QCCD	Quick Connect Connecting Block
RBS	Radio Base Station. *See also* BTS.
Reverse Direction	Direction of transmission from the Mobile or portable through the repeater and onto the RBS. Uplink transmission.
Reverse Gain	Gain setting for Reverse transmissions
RF	Radio frequency
RFI	Radio frequency interference
RSL	Receive Signal Level
RSA	Rural Service Area
RSSI	Receive Signal-Strength indicator
RX	Receive
Simulcast	The process of transmitting the same signal from two or more sites simultaneously.
SMA	A type of connector.
SMB	A type of connector.
TDMA	Time Division Multiple Access (equivalent to DAMPS).
TSA	Traffic Service Area
TX	Transmit

UHF	Ultra High Frequency
UPS	Uninterruptable Power Supply
VAC	Voltage, alternating current
VDC	Voltage, direct current
VSWR	Voltage to Standing Wave Ratio
XPD	Cross polarization

End of Glossary