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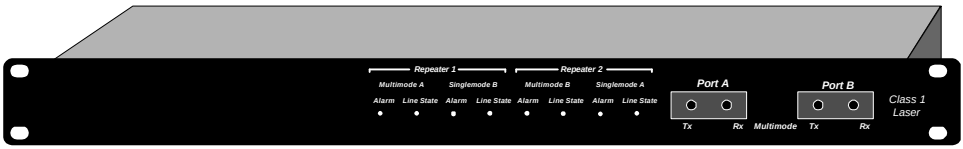
**FEBRUARY 1999**
**LCL163A**
**LCL163A-48**
**LCL163A-R**
**LCL164A**
**LCL164A-2MIC**
**LCL164A-48**

# CityLAN™ 100 SERIES
# LONG DISTANCE FDDI REPEATER





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## FEDERAL COMMUNICATIONS COMMISSION
## AND
## CANADIAN DEPARTMENT OF COMMUNICATIONS
## RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

*This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications.*

*Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par le ministère des Communications du Canada.*

## NORMAS OFICIALES MEXICANAS (NOM)
## ELECTRICAL SAFETY STATEMENT

## INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.

2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.

3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.

4. Todas las instrucciones de operación y uso deben ser seguidas.

5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.

6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.

7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.

8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.

9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

## CERTIFICATION NOTICE FOR EQUIPMENT USED IN CANADA

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications-network protective, operation, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single-line individual service may be extended by means of a certified connector assembly (extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility—in this case, your supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION:

> Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The LOAD NUMBER (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices, subject only to the requirement that the total of the load numbers of all the devices does not exceed 100.

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# 1. Technical Specifications

| | | | | |
|---|---|---|---|---|
| BIT ERROR RATE | | $2.5 \times 10^{-10}$ (max) | | |
| CONNECTORS | Multimode | Duplex SC Connector (fitted as standard) | | |
| | | FDDI MIC (optional) | | |
| | Single-mode | FC or SC | | |
| LINK LENGTHS | Multimode | 2km | | |
| | Single-mode | 60km SC (High Power Option) | | |
| | | 40km FC and SC (Standard Power Options) | | |
| OPTICAL POWER BUDGET | | | | |
| | Multimode | 62.5/125µm fiber | 12.5dB | |
| | Single-mode | 9/125µm fiber | 19dB (FC Standard Power Option) | |
| | | | 19dB (SC Standard Power Option) | |
| | | | 30dB (SC High Power Option) | |
| OPTICAL OUTPUT POWER | | | Min. | Max. |
| | Multimode | FDDI MIC (2km) | -19dBm | -14dBm |
| | | Duplex SC (2km) | -18.5dBm | -14dBm |
| | Single-mode | FC (Standard Power) | -12dBm | -7dBm |
| | | SC (Standard Power) | -15dBm | -8dBm |
| | | SC (High Power) | -4dBm | 0dBm |
| OPTICAL INPUT POWER | | | Min. | Max. |
| | Multimode | FDDI MIC (2km) | -31dBm | -14dBm |
| | | Duplex SC (2km) | -31dBm | -14dBm |
| | Single-mode | FC (Standard Power) | -31dBm | -14dBm |
| | | SC (Standard Power) | -34dBm | -8dBm |
| | | SC (High Power) | -34dBm | -3dBm |

| | | |
|---|---|---|
| | Wavelength | 1300nm |
| ENVIRONMENT | Temperature | Operating 0°C to 40°C |
| | | Storage -10°C to 70°C |
| | Humidity | Max 95% (non-condensing) |
| COMPLIANCE | EMC | CE DIRECTIVE 89/336/EEC |
| | | FCC Part 15 Subpart J |
| | Safety | CE DIRECTIVE 73/23/EEC |
| | | UL1950, cUL1950 |
| CASE DIMENSIONS | | 1U high, 19" rackmountable |
| | | 483mm x 165mm x 43mm (W x L x H) |
| POWER SUPPLY | | 90 to 264V @ 47 to 63Hz or 35-60V DC |
| POWER CONSUMPTION | | Less than 15W (51 BTU/hr) |
| CONTACT CLOSURES | | 30V, 1A DC (Max.); 120V, 0.5A AC (Max.) |

# 2. Product Overview

The BLACK BOX® CityLAN™ FDDI Extended Distance Repeater (LCL163A/LCL164A) supports 100Mbps ANSI X3T9.5/X3T12 data over greatly extended distances on single-mode fiber.

## 2.1 Drive Distance

On the multimode side the LCL163A/LCL164A repeaters support a distance of 2km. The single-mode interface supports a 40km drive distance as standard. With high power SC optics on the single-mode interface, a distance of 60km is obtainable.

## 2.2 Station Count

Any number of repeaters can be used within a network. The only constraint being that each device is included in the total station count for the overall ring. Each repeater has 4 physical layer entities. There is a re-timing function on each port, therefore each repeater is considered as 2 stations. The default value for the number of physical layer entities on a ring is 1,000, i.e. 500 Dual Attach Stations (DAS).

## 2.3 Power Supply

The unit is powered using a nominal 100V-240V-AC supply (+/- 10%). The power supply is universal across all acceptable input voltage ranges.
A 48V-DC power supply is available as an order time option.

## 2.4 Ergonomics

The dual repeater is housed in a standard 19", 1U high rackmount case (165mm deep) for optimum use of rack space.

Variants of the CityLAN™ FDDI repeaters are available as single and dual repeaters. Dual repeaters (LCL164A) support the connection of a DAS via two fiber pairs. The single repeater (LCL163A) supports an SAS connection. The units are all functionally the same and two single repeaters are functionally the same as a single dual repeater.

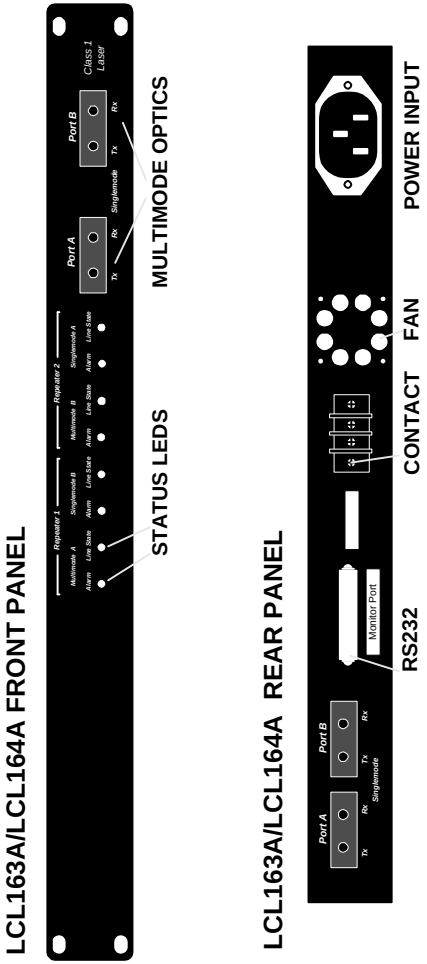
## 2.5 Contact Alarms

The unit has dry contact alarms to report failure conditions. These operate as normally open and normally closed contacts. See Section 6.5, Alarm Reporting, for details.

## 2.6 Management Interface

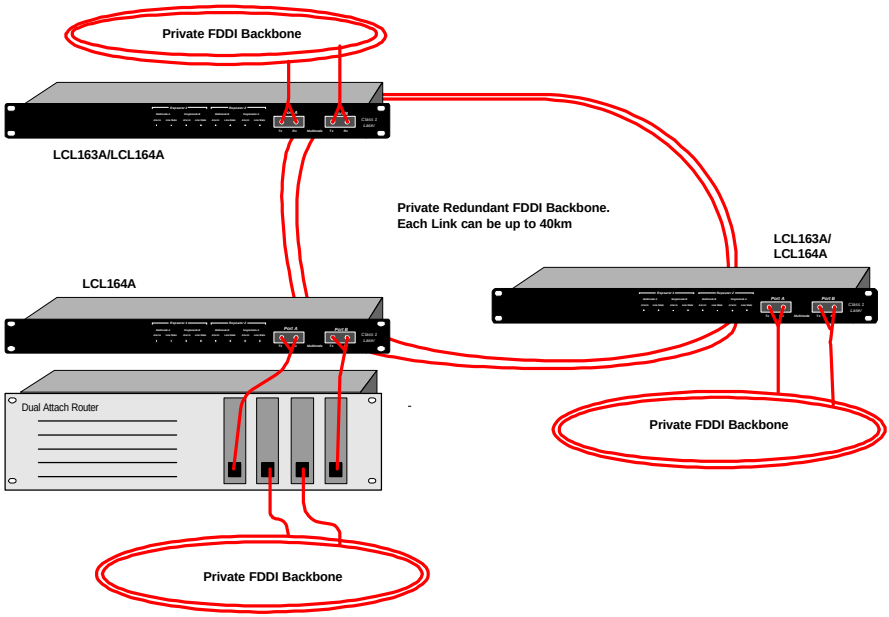
A serial management interface provides out-of-band control and management of the LCL163A/LCL164A, either via modem or via a direct VT100 terminal attachment. See Chapter 6, Management Serial Interface.

**Figure 1: LCL163A/LCL164A Front and Rear Panels**



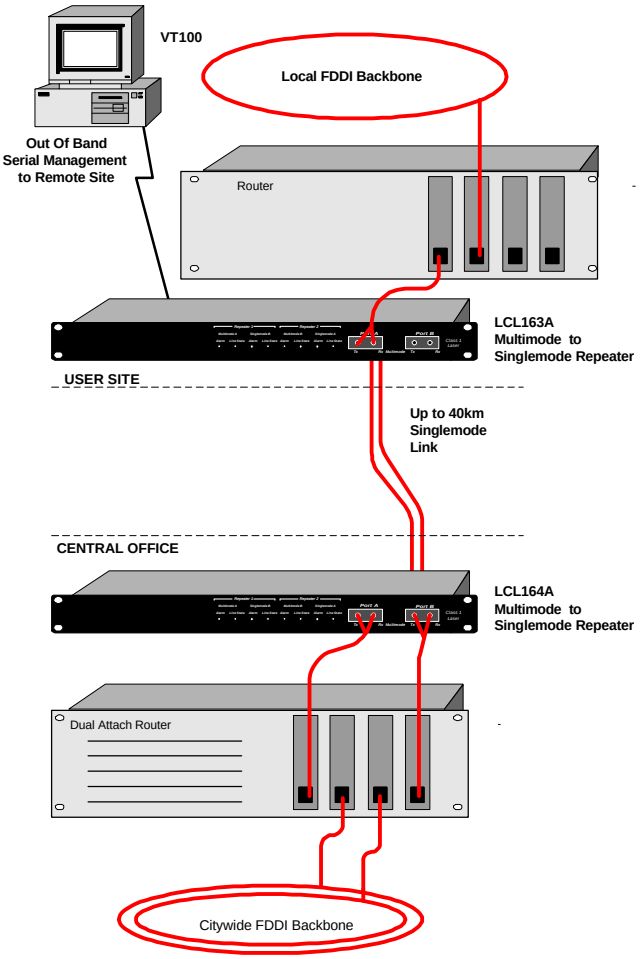
# 3. Typical Applications

**Figure 2: Linking Three Buildings around a City using LCL163A/LCL164A Extended Distance Repeaters**



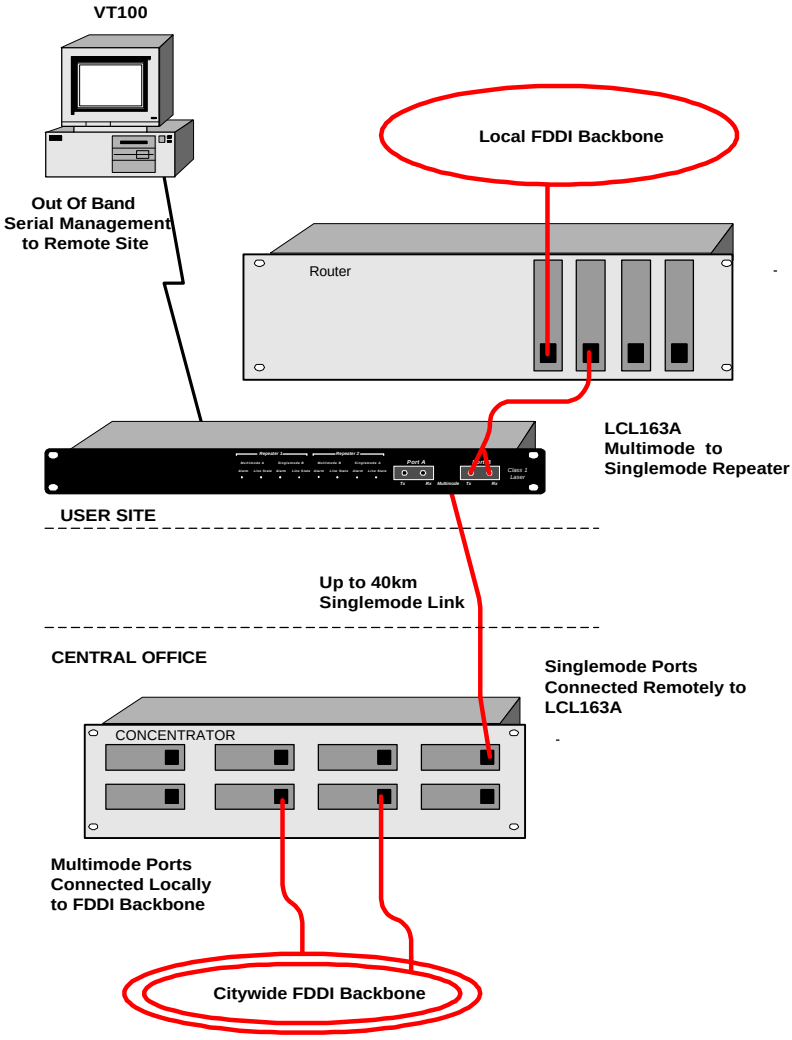

In the above application, several local sites are interconnected using LCL163A/LCL164As. Two of the A and B ports of the multimode local rings are connected to the multimode A and B ports of the LCL163A/LCL164A. This extends the ring via the single-mode fiber to each of the other sites, where they are returned to multimode A and B interfaces for connection to that backbone.

**Figure 3: Linking a Central Office to a Remote Site**




In this application, the single attach ports of the routers are inter-connected using two LCL163A repeaters. The router port is simply connected to either multimode port (i.e. A or B). The corresponding single-mode fiber is taken to either port of the far end LCL163A which in turn is connected to the router via the corresponding multimode ports. For dual homing connections, dual LCL164A repeaters may be used by simply connecting each port of the router to the A and B ports via the single-mode fibers to the far end A and B ports and subsequently to the multimode M-ports of a concentrator.

**Figure 4: M-Port Link from Concentrator to a Single LCL163A**




In this application the Single Attach Station port of the router is connected to the single-mode M-Port of the concentrator via one LCL163A (single version). The multimode Single Attach Station Port of the router connects to the multimode port on the LCL163A. The single-mode port of the LCL163A connects directly to the single-mode M-Port of the concentrator.

# 4. Installation

## 4.1 Operating Modes

For the LCL163A/LCL164A to operate correctly in a ring the Test Switch fitted on the back panel must be set to the Normal position. The LCL163A/LCL164A needs no further configuration to operate simply in a ring. However, for maximum efficiency of alarm reporting over extended distances, four management operating modes are available.

1) Direct Terminal Connection.
2) Remote Terminal Connection (dial in).
3) Remote Terminal Connection (dial out).
4) Remote Controller Device using simple asynchronous commands to gather information from the LCL163A/LCL164A.

In all operating modes, dry contact alarms can be configured to indicate error conditions.

### 4.1.1 Mode 1 - Direct Terminal Connection

This is the factory default configuration.

The RS232 cable supplied with the LCL163A/LCL164A allows connection of a 9 way serial port of a PC or laptop to the LCL163A/LCL164A. The PC should have a VT100 style terminal emulator loaded which requires the following configuration:

9600 baud
8 bits
1 stop bit
No parity
XON/XOFF flow control.

After power on, the terminal displays the self-test sequence followed by the main screen showing status information for the LCL163A/LCL164A.

To connect an unattended Auto Answer Modem to the LCL163A/LCL164A in terminal mode, please NOTE: At start up LCL163A/LCL164A sends the initialization string “ATQ1&D2&S1&C1”.

This sets the modem to Quiet Mode, uses DTR, DSR and DCD. If you require that the modem be capable of being dialed into after a power down of the modem, it is vital that you configure the modem to 9600 Baud, Auto Answer held permanently in its own memory. Check your modem user manual for details of setting the modem into unattended auto answer mode.

When configured to "Terminal" the LCL163A/LCL164A makes no use of DCD or DSR. DTR is always asserted.

To return to this mode from any mode, connect the terminal and press "CTRL_ Z", followed by "CTRL_L".

### 4.1.2 Mode 2 - Remote Terminal Connection (dial in)

Dial in access to the LCL163A/LCL164A is made using modems and a remote VT100 or PC emulating a VT100 terminal. Figure 5 shows a typical link.

To connect the modem to the LCL163A/LCL164A, use a standard 25 way straight through serial cable.

Configure the modem to 9600 Baud, Auto Answer, Enabled DTR. Other control lines are not required. NOTE: The LCL163A/LCL164A sends an initializer string to the modem on power up, as described in Mode 1.

At the remote site the VT100/PC emulator is connected to the remote modem. See the VT100/PC manual for the cable required to connect to that modem.

For dial in access it is suggested that you use a Hayes compatible modem. The "Connected To" management field should be set to "modem" which will send the initializer string to the modem each time a critical event is to be reported as well as on power up. See Section 6.3.11 for details of the "Connected To" field.

Dial in access is commonly used with the dry contact alarms that indicate a condition to a control center which subsequently dials into the unit to ascertain the nature of the alarm. See "Alarm Reporting" in Section 6.5 for details of contact devices.

### 4.1.3 Mode 3 - Remote Terminal Connection (dial out)

For those systems where direct dial out access is required, the unit may be configured to dial a remote location via a Hayes compatible modem whenever a fault condition occurs.

Configure the modem to 9600 Baud, Monitor DTR.

The LCL163A/LCL164A will automatically request use of Data Set Ready and Carrier Detect of the Hayes modem, whenever a critical event is to be reported, by using the "&D2&S1&C1" control string.

Using a directly attached terminal (see Mode 1 above) and referring to Section 6.3, configure the LCL163A/LCL164A "Connected To" field to "Modem" and include the telephone number of the remote site in the "Modem Init String", in the form "D <number to dial>" e.g.: Modem Init String ATD 123 456 789.

Set the events that you require the modem to dial out on. See "Alarm Reporting" in Section 6.5. Save the changes as you leave edit mode.

**NOTE:** Once saved these choices, including phone numbers etc., are held in non-volatile memory within the LCL163A/LCL164A. Consequently problems with borrowed or swapped modems are avoided.

Attach the modem using a 25 way straight through cable.

The LCL163A/LCL164A will dial out whenever one of the "Alarm" conditions occurs. If the far end is busy or unavailable, the LCL163A/LCL164A will retry at minute intervals until the call is answered.

### 4.1.4 Mode 4 - Remote Controller Device

To permit a remote device to interrogate the LCL163A/LCL164A, a simple control interface is included that permits a remote station to be programmed to poll the LCL163A/LCL164A for specific information on a Command/Response basis sent line by line.

To use the command mode, attach a terminal as described in Mode 1 above and edit the Display Mode to be line by line.

In this mode, the LCL163A/LCL164A can be directly attached to the device or a terminal or connected to via a modem for dial in or out access as described in Modes 1, 2 and 3.

## 4.2 Step by Step Installation

1. Decide on the operating mode that best suits the system (see Operating Modes).

2. Attach a PC running a VT100 emulator using the cable supplied. Set the VT100 to 9600 baud, 8 bits, 1 stop bit, no parity, XON/ XOFF flow control.

3. Using the terminal emulator, edit the LCL163A/LCL164A configuration to support:
   a) Chosen operating mode.
   b) Alarm conditions.

   See Section 6, Management Serial Interface for details of how to edit the LCL163A/LCL164A fields.

4. Check the loss budgets for the single-mode and multimode interfaces. Use the table below to check the required maximum and minimum losses for each link versus connector/product type.

| Connector Type | Receiver Saturation | Minimum Loss between LCL163A/LCL164 as (to avoid saturation) | Maximum Loss (Link Budget) |
|---|---|---|---|
| Multimode MIC | -14dBm | 0 | 12dB |
| Multimode SC | -14dBm | 0 | 12.5dB |
| Single-mode FC (Standard Power) | -14dBm | 7db | 19dB |
| Single-mode SC (Standard Power) | -8dBm | 0dB to like device or 8dB to High Power remote device | 19dB |
| Single-mode SC (High Power) | -3dBm | 3dB | 30dB |

If the link loss is less than the minimum required or if the received power from the remote equipment is greater than the receiver saturation figures, then optical attenuators must be used.

5. Fasten the LCL163A/LCL164A into a rack or place on a suitable shelf. Check that the ventilation holes in the sides of the unit and the fan vent on the back of the box are not covered.
   **Do NOT power up the units at this stage.**

6. Connect the single-mode interface ensuring that clean single-mode jumpers are used. Refer to the connection guide below.

7. Connect the multimode interface ensuring that clean multimode jumpers are used. Refer to the connection guide below.

Connect the fiber between adjacent dual repeaters as follows:

| **Single-mode Fiber Link Connections (Dual Repeater)** | |
|---|---|
| **This LCL164A** | **Far End LCL164A** |
| Single-mode Port A Rx | Single-mode Port B Tx |
| Single-mode Port A Tx | Single-mode Port B Rx |
| Single-mode Port B Rx | Single-mode Port A Tx |
| Single-mode Port B Tx | Single-mode Port A Rx |

Connect the fiber between adjacent single repeaters as follows:

| **Single-mode Fiber Link Connections (Single Repeater)** | |
|---|---|
| **This LCL163A** | **Far End LCL163A** |
| Single-mode Port Rx | Single-mode Port Tx |
| Single-mode Port Tx | Single-mode Port Rx |

Connect the fiber on the multimode side between the LCL163A/LCL164A and the DAS as follows:

| Multimode Fiber Link Connections (Dual Repeater) | |
|---|---|
| **This LCL164A** | **DAS** |
| Multimode Port A Rx | Multimode Port B Tx |
| Multimode Port A Tx | Multimode Port B Rx |
| Multimode Port B Rx | Multimode Port A Tx |
| Multimode Port B Tx | Multimode Port A Rx |

Connect the fiber on the multimode side between the LCL163A/LCL164A and the SAS as follows:

| Multimode Fiber Link Connections (Single Repeater) | |
|---|---|
| **This LCL163A** | **SAS** |
| Multimode Port Rx | Multimode Port Tx |
| Multimode Port Tx | Multimode Port Rx |

**NOTE:** When connecting the Dual Repeater, Repeater 1 consists of multimode Port A and single-mode Port B, and Repeater 2 consists of multimode Port B and single-mode Port A.

## 4.3 Installation Testing

While the LCL163A/LCL164A operates in most installations without configuration, we recommend that you carry out the following installation tests.

Testing a ring segment (i.e. two LCL163A/LCL164A repeaters and the single-mode link between them) requires a technician at each end of the link.

### 4.3.1 Transmitter Power Tests

**CAUTION!** Before powering on an LCL163A/LCL164A repeater, please NOTE:

This product contains laser diode emitters operating at a wavelength of 1300nm, Class 1 AEL. Use of optical instruments with this product may increase eye hazard.

CLASS 1 LASER PRODUCT

Furthermore, keep in mind that the units do not have a power switch.
Section 4.3.2 details the actions necessary to perform a link test.
Command string is PMT - Perform Media Test.

**NOTE:** Status LEDs and Line Status, etc., are not meaningful during the test and are only reinstated once edit mode has been left.

At the first site:
**Via the Management Interface**

1. Connect the serial cable supplied with the unit to a PC/laptop serial port.

2. Connect a 1300nm Power Meter to the interface that you want to test using a clean patch lead.

3. Run a VT100 emulator on the laptop, available in most communications packages or in Windows Terminal Emulation program (from the Accessories Window of Program Manager).

4. Configure the COM port to 9600 baud, 8 bits, 1 stop bit, and no parity, XON/XOFF flow control.

5. Power up the LCL163A/LCL164A and type CTRL_L if it is necessary to redraw the screen. Record the serial number on the test result sheet, and check the self-test result once completed.

6. Enter Edit mode by typing CTRL_E, followed by your password, if already set. (Simply press 'Enter' if no password has been set).

7. Press TAB until the Operating Mode field is highlighted.

8. Press '+' until the Laser Power Test Mode is displayed.
NOTE: This will interfere with the operation of any connected devices.

**Single-mode Interface Light Levels**:

9. Measure the launch power and record the result on the test record sheet.

10. Power down the LCL163A/LCL164A. Connect the link to the remote site, power up the unit and to measure the receive power of the LCL163A/LCL164A at the remote site use a 1300nm power meter at that site. Note: The laser power test needs to be set via the management interface. Check the receive power is acceptable, see receiver figures in Section 4.2.

11. Repeat steps 1 through 8.

12. Record the receive power at the remote site on the test record sheet. With the Test Switch set to Laser Power (Pwr) or with Operating Mode still set to Laser Power Test, measure the launch power from the LCL163A/LCL164A multimode interface. Verify that it is -16.5dBm $\pm$ 2.5dB. Record the results on the test sheet.

**Multimode Interface Light Levels:**

13. Repeat steps 10 through 12 above for the other multimode interface.

14. On the terminal keyboard press '+' to return the Operating Mode back to Normal. Press ESC to exit Edit Mode. Press 'N' so that any changes are not saved.

15. Power down the LCL163A/LCL164A.

This concludes the transmitter power tests.
REMEMBER TO LEAVE EDITMODE BY PRESSING BOTH ESC AND ‘N’.

### 4.3.2 Single-mode Media Test (inter LCL163A/LCL164A units only)

At both ends of the single-mode link:

1. Connect the serial cable supplied with the unit to a PC/laptop serial port.

2. Run a VT100 emulator on the laptop available in most communications packages or Windows Terminal Emulation.

3. Configure the COM port to 9600-baud, 8 bits, 1 stop bit, and no parity, XON/XOFF flow control.

4. Power up the LCL163A/LCL164A and redraw the screen if necessary by typing CTRL_L.

5. Enter Edit Mode by typing CTRL_E followed by your password, if already set.

6. Press TAB until Single-mode Media Test is highlighted, then press 'Y'. Re-enter your password to confirm the test.

7. Set one end of the link to Slave Mode:
   Press 'A' for single-mode Port A.*
   Press 'S' for Slave Mode.

   Set the other end (i.e. at the remote site) of the link to Master Mode:
   Press 'B' for single-mode Port B.*
   Press 'M' for Master.
   Ensure that one end of the link is set to Port A and the other end to Port B.*
   *Not Required on Single Version.

8. At the Master end press 'Y' to start the test.
   The link test takes approximately 30 seconds and no action should be taken until the test result is announced at the master device.
   **NOTE:** The Slave Device will not report a test result.

9. Press 'Q' followed by 'N' followed by 'ESC' to end the test at slave end.

10. Press 'N' followed by 'ESC' to end the test at the master end.

**If the test fails**:

Repeat the transmitter power tests (as outlined in Transmitter Power Tests) and ensure the minimum receive power on the single-mode interface is greater than -31dBm.
If the single-mode receive power is less than -31dBm, power down the unit, clean all the single-mode connectors (and any attenuator plugs) and measure the receive power again.
If the link budget (i.e. difference between LCL163A/LCL164A launch power and far end receive power) is greater than 19dB (30dB for the high power SC option), then either the link is too long or contains too many (bad) splices. An intermediate repeater may be necessary.

If the launch power from the LCL163A/LCL164A on the single-mode interface is less than -4dBm for the high power device or -15dBm for the standard power device then that unit is faulty and needs to be replaced.
If the link loss and receive powers are acceptable, check the inter-connection (A to B, Tx to Rx, etc) and repeat the test. Make sure that one end is configured as Master and the other as Slave. Also, make sure that one end is configured Port A and the other as Port B.
Record the link test result on the test sheet.

**NOTE:** It is not necessary to repeat the link test for the other port as this is done when this test is performed from the far end.

This concludes the Link Confidence Test.

# 5. Diagnostic LEDs

## 5.1 Dual Repeater

| LED | Color | Condition |
|---|---|---|
| Alarm<br>Port A, B<br>Multimode | Red | The fiber link associated with that port is not working. Check the receive fiber and that the connected DAS is powered up and in the ring. |
| Alarm<br>Port A, B<br>Single-mode | Red | The fiber link associated with that port is not working. Check the receive fiber, the connection to the remote unit, and that the remote unit is powered up.<br><br>**NOTE:** A remote multimode alarm is repeated on to a single-mode link. Consequently it is important to check the remote LCL163A/LCL164A's multimode alarm status whenever a single-mode alarm is reported. |
| Line State<br>All Ports | Green | Active Line State. This indicates that a valid data frame sequence is present. This will be seen to flicker during normal use as line states periodically change under normal operation. |
| Line State | Orange | Indicates a Halt, Master or Idle Line State has been detected. As the Idle line state is used during the normal operation of network to separate data frames, this line state indicates physical connection is present, but no network activity.<br>Master and Halt are used during the initialization process, so these should only be seen at power on, or if a link is faulty. |
| | Off | Indicates Quiet Line State. This line state indicates the absence of a physical link. If this condition occurs check the receive fiber path, that the connected DAS is in the ring, and that the remote unit is powered up. |

## 5.2 Single Repeater

| LED | Color | Condition |
|---|---|---|
| Alarm<br>Multimode Port | Red | The fiber link associated with that port is not working. Check the receive fiber and that the connected SAS is powered up and in the ring. |
| Alarm<br>Single-mode Port | Red | The fiber link associated with that port is not working. Check the receive fiber, the connection to the remote unit, and that the remote unit is powered up.<br><br>**NOTE:** A remote multimode alarm is repeated on to a single-mode link, consequently it is important to check the remote LCL163A/LCL164A's multimode alarm status whenever a single-mode alarm is reported. |
| Line State<br>All Ports | Green | Active Line State. This indicates that a valid data frame sequence is present. This will be seen to flicker during normal use as line states periodically change under normal operation. |
| Line State | Orange | Indicates either a Halt, Master or Idle Line State has been detected. As the Idle line state is used during the normal operation of network to separate data frames, this line state indicates physical connection is present, but no network activity. Master and Halt are used during the initialization process, so these should only be seen at power on, or if a link is faulty. |
| | Off | Indicates Quiet Line State. This line state indicates the absence of a physical link. If this condition occurs check the receive fiber path, that the connected SAS is in the ring, and that the remote unit is powered up. |

# 6. Management Serial Interface

The LCL163A/LCL164A supports a management interface. The features of this interface are:

- Serial port communications at 9600 Baud.
- VT100 Teletype control codes.
- Hayes compatible modem initialization and dial strings.
- Indicators of events and data associated with the FDDI Ring

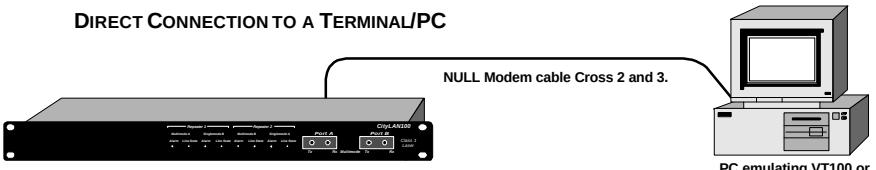
  including:

  - power alarm
  - line state
  - port status
  - power supply failure
  - user definable fields for location, serial number
  - password protection
  - single-mode media test.

Typical hardware configurations for the serial management interface are shown overleaf.

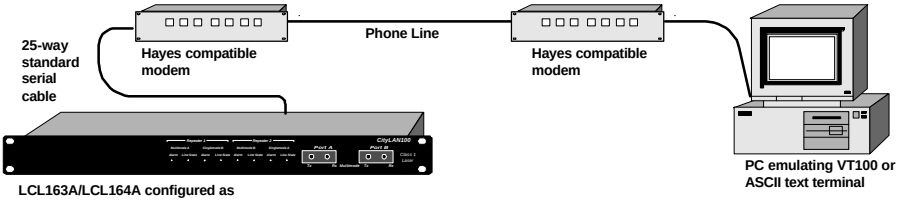
## Figure 5: Management Hardware Configurations

### DIRECT CONNECTION TO A TERMINAL/PC




**When connected to a terminal only pins 2, 3 and 7 are used. Flow control is XON/XOFF. Line speed is 9600. All other signals are ignored.**

### CONNECTION TO A TERMINAL VIA A MODEM LINK




**When connected to a modem the LCL163A/LCL164A uses DTR, DSR and DCD to establish the link. Standard straight through 25-way serial cables must be used between the LCL163A/LCL164As and the modems. The LCL163A/LCL164A assumes a Hayes compatible modem is attached. See Appendix 1 for details of cable assemblies.**

## 6.1 Hardware Configuration

The serial port uses TXD, RXD, SIG_GND, DTR, DSR and DCD.
See Section 6.4 for RS232 pinouts.
The 25 way D-Type is located on the rear of the unit.

**NOTE:** Signals DSR, DTR and DCD are only meaningful when the LCL163A/LCL164A is connected to a modem (see software configuration).

| | Directly Attached Device | | |
|---|---|---|---|
| **25 Way Cable Choice** | **VT100** | **Hayes Compatible Modem** | **PC Serial Port** |
| Null Modem (crosses Tx and Rx) | ✓ | x | ✓ |
| Straight through 25 way serial cable | x | ✓ | x |

**NOTE:** The device connected to the far end modem uses a straight through cable as standard.

## 6.2 Software Configuration

The LCL163A/LCL164A management has two operating modes.

1) A full screen mode utilizing ANSI (VT100 style) control codes. All the information is displayed on the screen and automatically updated as events occur.

   User editable fields are changed on screen in an edit mode. For example, to edit the serial number, press “CTRL_E”, enter the password, press Tab to access the serial number, enter the new serial number. Press “ESC” to exit edit mode.

2) A command line mode where the user is presented with a prompt. Three character control codes allow the user or controlling program to display information. This mode makes no use of display control codes, other than carriage return and line field, and is intended as a simple machine interface rather than user interface.

The information obtainable and editable is the same in either operating mode.

### 6.2.1 Whole Screen Mode

In this mode, VT100 style escape sequences are used to display all of the information on the screen as shown later in this section. This mode permits a simple, at-a-glance view of the operation of the repeater.

Users can edit some fields using the following commands:

| | | |
|---|---|---|
| CTRL_E | - | Enter edit mode |
| TAB | - | Next editable field |
| ESC | - | Leave edit mode |
| CTRL_L | - | Redraw screen |
| CTRL_C | - | Hang up (when connected to modem only) |
| CTRL_Z | - | Return to terminal mode (when connected to modem only) |

The LCL163A/LCL164A must be removed from edit mode to operate correctly in the ring. For example:
To change the serial number field:

Press “CTRL_E” - enter Edit Mode
Type in your password or press CR if NULL
Press Tab - the Serial Number will be highlighted
Type in new Serial Number
Press “ESC”
Press “Y” to save the changes.

The serial number field is now changed, and will remain so even after the unit is powered off and on again.

**NOTE**: When in Edit Mode, Status LEDs and Line States are not updated.

Text fields such as the serial number, location, etc, may contain normal ASCII characters and spaces.

To edit more than one field, press *Tab* and the next editable field is highlighted.

To end Edit Mode, *ESC* can be pressed at any time. The user will be prompted to confirm the changes, which will be stored in non-volatile memory. Whilst the values are written to memory, power must not be removed from the unit.

**NOTE: IF FOR ANY REASON THE TERMINAL APPEARS TO BE LOCKED UP (PARTICULARLY WHEN ADDING A TERMINAL TO THE EQUIPMENT) IT IS USUALLY BECAUSE THE LCL163A/LCL164A HAS BEEN LEFT IN AN UNKNOWN STATE:**
**TO CORRECT THIS PRESS CNTRL_Q (XON) FOLLOWED BY ESC TWICE. THIS WILL BACK THE LCL163A/LCL164A OUT OF ALL "LOCKUP" CONDITIONS.**

The screen displays for the repeaters are as follows.

**DUAL REPEATER**
**LCL163A/LCL164A Single-mode Dual Fiber Repeater**

**Password**: ********
**Location**: 20 character location
**Redundant PSU**: Not Fitted
**Serial Number**: 12345678
**Display Mode**: Whole Screen
**Self Test**: Passed

| **Port Status** | **Line State** | **Receive** | **Power** |
|---|---|---|---|
| **Multimode Port A** | Normal | Active | Good |
| **Single-mode Port B** | Normal (A) | Idle | Good (A) |
| **Multimode Port B** | Normal | Idle | Good |
| **Single-mode Port A** | Normal (A) | Active | Good (A) |

**Single-mode Media Test**
**Connected to**: Terminal **Operating Mode**: Normal
**Hayes Modem Init String**: AT
**Commands are: Crtl E, Start Editmode; Tab, Next Field; ESC, End Editmode**

**SINGLE REPEATER**
**LCL163A/LCL164A Single-mode Fiber Repeater**

**Password**: ********
**Location**: 20 character location
**Redundant PSU**: Not Fitted
**Serial Number**: 12345678
**Display Mode**: Whole Screen
**Self Test**: Passed

| **Port Status** | **Line State** | **Receive** | **Power** |
|---|---|---|---|
| **Multimode Port** | Normal | Active | Good |
| **Single-mode Port** | Normal (A) | Active | Good (A) |

**Single-mode Media Test**
**Connected to**: Terminal **Operating Mode**: Normal
**Hayes Modem Init String**: AT
**Commands are: Crtl E, Start Editmode; Tab, Next Field; ESC, End Editmode**

### 6.2.2 Command Mode

In command mode, a prompt is presented to the user. Separate command codes are entered for each field to be displayed or edited. VT100 control codes are not used. The mode permits simple interface to a controlling program that needs to poll the LCL163A/LCL164A repeater for information.
Commands are as shown below:

**DUAL REPEATER**

User Commands Are:-

| | | | |
|---|---|---|---|
| DSN- | Display Serial Number | ESN- | Edit Serial Number |
| DLO- | Display Location | ELO- | Edit Location |
| DPS- | Display Power Supply Status | PMT- | Perform Media Test |
| DOM- | Display Operating Mode | DMI- | Display Modem Init String |
| EMI- | Edit Modem Init String | DMC- | Display Connected Device Type |
| MOD- | Repeater Connected to Modem | TER- | Repeater Connected to Terminal |
| LMA- | Line State - MMode Port A | LSA- | Line State - SMode Port A |
| LMB- | Line State - MMode Port B | LSB- | Line State - SMode Port B |
| DMA- | Multimode Port A Status | DSA- | Single-mode Port A Status |
| DMB- | Multimode Port B Status | DSB- | Single-mode Port B Status |
| PMA- | Receive Power - MMode Port A | PSA- | Receive Power - SMode Port A |
| PMB- | Receive Power - MMode Port B | PSB- | Receive Power - Smode Port B |
| RPA- | Change Redundant PSU Status Alarm | EPW- | Edit Password |
| MPA- | Change MM A Port Status Alarm | SPA- | Change SM A Port Status Alarm |
| MPB- | Change MM B Port Status Alarm | SPB- | Change SM B Port Status Alarm |
| MAA- | Change MM A Power Alarm | SAA- | Change SM A Power Alarm |
| MAB- | Change MM B Power Alarm | SAB- | Change SM B Power Alarm |
| STR- | Display Self Test Result | WSM- | Display In Whole Screen Mode |

**SINGLE REPEATER**

User Commands Are:-

| | | | |
|---|---|---|---|
| DSN- | Display Serial Number | ESN- | Edit Serial Number |
| DLO- | Display Location | ELO- | Edit Location |
| DPS- | Display Power Supply Status | PMT- | Perform Media Test |
| DOM- | Display Operating Mode | DMI- | Display Modem Init String |
| EMI- | Edit Modem Init String | DMC- | Display Connected Device Type |
| MOD- | Repeater Connected to Modem | TER- | Repeater Connected to Terminal |
| RPA- | Change Redundant PSU Status Alarm | EPW- | Edit Password |
| LMA- | Line State - MMode Port A | | |
| LMB- | Line State - MMode Port B | | |

DMA- Multimode Port Status
DSB- Single-mode Port Status
PMA- Receive Power - MMode Port
PSB- Receive Power - SMode Port
MPA- Change MM Port Status Alarm
SPB- Change SM Port Status Alarm
MAA- Change MM Power Alarm
SAB- Change SM Power Alarm
STR- Display Self Test Result
WSM- Display In Whole Screen Mode

## 6.3 Field Definitions and Use

All of the fields can be displayed and changed (if editable) in either screen mode. The fields are as follows:

### 6.3.1 Password (editable)

A user defined password field to prevent unauthorized access to repeater variables. The value is held in non-volatile memory and remains resident when the unit is powered off.
The user is prompted for a password (if present) once field editing is attempted in either mode.
Command mode uses EPW - Edit Password.
A null password is set as a factory default.

**NOTE:** When in Edit Mode, Status LEDs and Line States are not updated.

### 6.3.2 Serial Number (editable)

A user defined 8-character serial number, stored in non-volatile memory. This is set to the unit serial number on shipping but may be edited by the user to uniquely identify the unit.

The command mode strings are DSN - Display Serial Number, ESN - Edit Serial Number.

### 6.3.3 Location (editable)

A user defined 20-character string. Usually used to store location of this repeater. Editable by the user.

Command mode strings are DLO - Display Location, ELO - Edit Location.

### 6.3.4 Self Test

The power on self-test result is displayed in this field (either Passed or Failed). If either repeater has failed, the self-test result is failed. Powering off/on the LCL163A/LCL164A will re-run self test and the faulty repeater can be identified during the test. If self-test has failed, the dry contacts will always be activated.

### 6.3.5 Display Modes (editable)

Allows the user to change from whole screen mode to command mode. Changing this field blanks the screen and enters command mode. A command from command mode returns the user to whole screen mode. This field is stored in non-volatile memory.

Command mode string is WSM - Whole Screen Mode.

### 6.3.6 Redundant PSU

This indicates the state of the redundant PSU. Possible messages are:

| | | |
|---|---|---|
| Not fitted | - | No redundant PSU is fitted. |
| Primary PSU failed | - | Main PSU has failed. |
| Secondary PSU failed | - | Secondary PSU has failed. |
| Monitor Error | - | The PSU Monitor Circuit has failed. |

Command mode string is DPS - Display Power Supply Status.

**NOTE:** Redundant PSU is an order time option.

### 6.3.7 Port Status

This field indicates the status of the corresponding port, i.e. Multimode Ports A and B and Single-mode Ports A and B (Dual Version)/Multimode Port and Single-mode Port (Single Version).

Messages are:
**Normal:** Port is operating normally.
**Fault:** A fault exists on that port. Check all fiber links to upstream station (including remote multimode connections).
**Wrapped**: The associated far end MAC is wrapped. This may be due to a fault on the other path or may have been forced by management.

Each port field can individually report an alarm condition. To edit the field enter edit mode (CTRL_E followed by any password) and highlight the appropriate field by pressing TAB.

Subsequently press 'A' to enable/disable the alarm condition. An (A) indicates that alarm reporting is enabled for that field.

Port Status Alarms do not take effect for one second. This allows minor disruption to the network to be ignored. Compare with Power Alarm State in Section 6.3.9.

**DUAL REPEATER**

Command mode strings are:
DMA - Display Multimode Port A Status
DSA - Display Single-mode Port A Status
DMB - Display Multimode Port B Status
DSB - Display Single-mode Port B Status
MPA - Enable/Disable Multimode Port A Status Alarm
SPA - Enable/Disable Single-mode Port A Status Alarm
MPB - Enable/Disable Multimode Port B Status Alarm
SPB - Enable/Disable Single-mode Port B Status Alarm

**SINGLE REPEATER**

Command mode strings are:
DMA - Display Multimode Port Status
DSB - Display Single-mode Port Status
MPA - Enable/Disable Multimode Port Status Alarm
SPB - Enable/Disable Single-mode Port Status Alarm

### 6.3.8 Line State

This field indicates the line state being received at a port, i.e. Multimode Ports A and B, Single-mode Ports A and B. (Dual repeater), Multimode Port and Single-mode Port (Single repeater).

Active Line State - indicates that the ring is active, i.e. a valid data frame sequence is present.
Idle Line State - indicates physical connection is present, but no network activity.
Halt Line State, Master Line State - used during the link initialization process.
Quiet Line State - indicates the absence of a physical link, or indicates that the ring is in the initialization process.

**DUAL REPEATER**
Command mode strings are:
LMA - Display Line State Multimode Port A
LSA - Display Line State Single-mode Port A
LMB - Display Line State Multimode Port B
LSB - Display Line State Single-mode Port B

**SINGLE REPEATER**
Command mode strings are:
LMA - Display Line State Multimode Port
LSB - Display Line State Single-mode Port

### 6.3.9 Power Alarm State

This field indicates the state of the physical link between devices. The field is non-editable.

Each port's power alarm can individually be set to report an alarm condition. To edit the field enter edit mode (CTRL_E followed by any password) and highlight the appropriate field by pressing TAB. Subsequently press 'A' to enable/disable the alarm condition. An (A) indicates that an Alarm is set for that field. Power Alarms are effective immediately, any length break will cause an Alarm. Compare with Port Status.

**DUAL REPEATER**
Command strings are:
PMA - Display Receive Power - Multimode Port A
PSA - Display Receive Power - Single-mode Port A
PMB - Display Receive Power - Multimode Port B
PSB - Display Receive Power - Single-mode Port B
MAA - Enable/Disable Multimode Port A Power Alarm
MAB - Enable/Disable Multimode Port B Power Alarm
SAA - Enable/Disable Single-mode Port A Power Alarm
SAB - Enable/Disable Single-mode Port B Power Alarm

**SINGLE REPEATER**
Command strings are:
PMA - Display Receive Power - Multimode Port
PSB - Display Receive Power - Single-mode Port
MAA - Enable/Disable Multimode Port Power Alarm
SAB - Enable/Disable Single-mode Port Power Alarm

### 6.3.10 Single-mode Media Test

This field allows the user to perform a link test on the single-mode path. Section 4.3.2 details the actions necessary to perform a link test.

Command mode string is PMT - Perform Media Test.

Note: Status LEDs and Line Status etc are not meaningful during the test and are only re-instated once editmode has been left.

### 6.3.11 Connected to: (editable)

Shows the connected device types on the command port. Possibilities are:

Terminal:
In this mode, the states of DSR, DCD, CTS and RTS are ignored. XON/XOFF flow control is used.
In this mode the LCL163A/LCL164A operates the contact alarms but makes no attempt to dial out via the modem. This mode is used for direct terminal connection and dial in access for permanently configured unattended answer mode modems.
DTR is held high by the device in this mode.

Modem:
As events occur the LCL163A/LCL164A will initialize the modem using the Hayes Modem string held in memory. If the Modem Init String holds a phone number preceded by 'D' Dial Modifier the modem will dial out. The repeater uses Hayes Modem codes to confirm and clear the connection. To connect the LCL163A/LCL164A to a modem, a straight through 25 way serial cable must be used. A standard 25 way PC serial port to modem cable is ideal. The LCL163A/LCL164A uses DTR, DSR and DCD to ensure the link is good.

When connected to a modem, events are indicated to the remote station by sending the user defined modem dial string and raising DTR. The modem then waits for the far end to answer before sending the data. The events that cause dialing can be tailored by setting the Report Alarm (A) flag next to the field.

The LCL163A/LCL164A will respond to dial in, however, it may be necessary to redraw the screen by typing “CTRL_L” after communication is established.

To avoid holding open phone lines indefinitely, the LCL163A/LCL164A repeater will hang up 30 minutes after the last change in notifiable state is recorded. A subsequent event will cause the LCL163A/LCL164A to re-dial the remote site.

Command strings are:-
DMC - Display Modem Connect
TER - Connect to Terminal
MOD - Connect to Modem

Keyboard Commands are:
CTRL_C or CTRL_H - Hang Up
CTRL-Z - Revert to Terminal Connection; i.e., Suppress dial features.

**NOTE:** Certain communications packages do not pass control codes to the remote device.
For example: "CTRL_C" in Windows applications.

### 6.3.12 Operating Mode

To facilitate simple installation testing the LCL163A/LCL164A supports three operating modes:
Normal - LCL163A/LCL164A connects normally to the ring.
Loopback - All ports are looped back enabling remote link testing with some FDDI test units.
Laser Power Test - Idles are streamed from all transmitters allowing link tests and transmitter validity tests.

**NOTE:** For the LCL163A/LCL164A to be connected to other network devices, the operating mode MUST be set to NORMAL.

### 6.3.13 Hayes Modem Init. String (editable)

This is a 30-character initialization string for a Hayes compatible Modem. Users can include a phone number and other Hayes control codes that the repeater will send to the modem every time it reports an alarm state. See your modem manual for permissible user codes. This value is user editable and held in non-volatile memory.

Command mode strings are: -
DMI - Display Modem Init String, EMI - Edit Modem Init String

When configured or connected to a modem, the LCL163A/LCL164A always sends an initialization string consisting of:

ATQ1&D2&S1&C1

Section 6.2 and 6.3 gives details of the configuration and edit mechanisms. This command indicates to the modem as follows:

Q1 -Quiet mode, do not return text indicators to the LCL163A/LCL164A.
&D2 -Hang up if LCL163A/LCL164A drops DTR.
&S1 -Send DSR to CityLAN100 when ready.
&C1 -Indicate DCD (i.e. carrier present) to the modem.

Whilst these default commands can be overridden by placing a later command set into the initialization string, it is not recommended that you do so. The rest of the initialization string is intended for additional, complementary commands, e.g. phone number to dial (add "D phone number" to the Init. string).

## 6.4 Serial Port

The serial port is configured to operate at 9600 Baud.
A standard 25 way D-Type is located on the rear of the unit and has the following pinouts:

| | | | | |
|---|---|---|---|---|
| 2 | - | TXD | Transmit Data | Output |
| 3 | - | RXD | Receive Data | Input |
| 7 | - | GND | Signal Ground | Gnd |
| 20 | - | DTR | Data Terminal Ready | Output |
| 6 | - | DSR | Data Set Ready | Input |
| 8 | - | DCD | Data Carry Detect | Input |

All other signals are ignored by the LCL163A/LCL164A repeater, only 2, 3 and 7 are required when connected to a terminal, see "Connected to" in Section 6.3.11.
Flow control is performed using XON/XOFF (CTRL_Q/CTRL_S) control codes.

## 6.5 Alarm Reporting

Both the dry contact closures and the modem dial out facility are enabled based on user configurable events. On the Dual Repeater the dry contact closures operate whenever:

Power is lost

or self-test failed
or single-mode Port A power alarm and report alarm set
or single-mode Port B power alarm and report alarm set
or multimode Port A power alarm and report alarm set
or multimode Port B power alarm and report alarm set
or single-mode Port A is not in state normal and report alarm set
or single-mode Port B is not in state normal and report alarm set
or multimode Port A is not in state normal and report alarm set
or multimode Port B is not in state normal and report alarm set
or redundant PSU is fitted and has failed.

On the Single Repeater the dry contact closures operate whenever:
Power is lost
or self-test failed
or single-mode Port power alarm and report alarm set
or multimode Port power alarm and report alarm set
or single-mode Port is not in state normal and report alarm set
or multimode Port is not in state normal and report alarm set
or redundant PSU is fitted and has failed.

**NOTE:** During an alarm, the Normally Open contacts close and the Normally Closed contacts open.

The modem will dial for all events other than power fail and self test fail. To set any of these events as an alarm condition:

1. Connect a terminal.
2. Enter edit mode.
3. Enter the password.
4. TAB to the field you want to report the alarm.
5. Press 'A'.
6. An (A) will appear next to the field when alarm reporting is set.
7. Repeat 4, 5 and 6 for each field you require to report alarms.
8. Press ESC followed by 'Y' to save the changes.

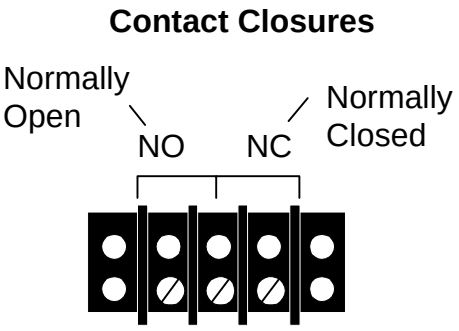
The factory defaults are shown on Section 6.2.1. Remember status LEDs and Line States are not updated during edit mode.

## 6.6 Contact Alarms

The LCL163A/LCL164A units are fitted with dry contact alarms to indicate fault conditions to an external monitor. The events that cause the contact alarms to operate are user configurable. Each power alarm, port status, redundant power supply and self-test failure can all generate a contact alarm. See sections 6.3.7 and 6.3.9 for details of configuration.

The contact closures are located on the rear of the unit and have 3 terminals which operate as shown in Figure 6.

**Figure 6: Contact Closure Pins**




"Normally" is the state without an alarm condition

# 7. Power and Fuses

Four power options are available as order time choices. These are:

90-264V AC Power Supply.
90-264V AC Redundant Power Supply.
48V-DC Power Supply.
48V-DC Dual Redundant Power Supply.

(See Section 6.3.6 for details of management reporting for redundant power supplies).

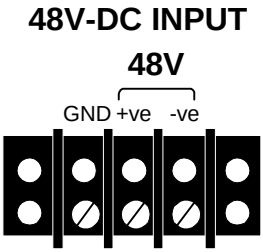
Both AC options receive power from a single IEC 320 power socket. The DC power supply options have three terminals marked chassis ground, - and +. It is vital to connect the negative power input to the terminal marked '-' and the positive power input connected to the terminal marked '+' as shown in Figure 7. If, when using DC power supplies, the local power source is marked 0V and +48V, the 0V line is connected to negative, and +48V to the positive. Conversely, if the power source is marked 0V and -48V, connect 0V to positive and -48V to negative. In the event that the power is connected the wrong way round, the LCL163A/LCL164A simply will not power up: reverse the polarity of the connection.

When unpowered the connecting DAS will automatically wrap. The LCL163A/LCL164A unit at the far end will not wrap, the associated Receive Power Alarm LEDs will be lit, the associated Line State LED will be off (i.e. Quiet State) and the terminal will report a fault.

If the “Line Status” LEDs do not alternately light for about ten seconds when the unit is switched on and power is correctly supplied to the unit then that unit is faulty. The safety fuse is located internally and no attempt to change this fuse should be made by unqualified personnel. The failure of this fuse probably indicates a more serious problem; return the unit to your supplier.

**NOTE:** Before calling the supplier, always check the power cable and socket to which it is connected. Most “power fail” faults are attributable to simple operator errors during commissioning.

**Figure 7: DC Power Input**



# 8. Troubleshooting

| Condition | Possible Cause |
|---|---|
| No LEDs lit | Check power is correctly supplied to the device. Acceptable voltage range is 90-264V, 47-63Hz. |
| Line State permanently idle | This is probably because that port is on the secondary path, which is not currently carrying data. This is not a fault condition but indicates that no data is being transmitted on that path. |
| Alarm LED permanently lit | A quiet line state has been detected. This usually indicates a fault in the segment of the ring between and including the attached devices. Carefully check the fiber path associated with the alarm.<br><br>**NOTE:** As the LCL163A/LCL164A repeaters pass through all data conditions it is important to check the far end device's multimode port status whenever an alarm is seen on a single-mode interface. To test the single-mode link run the media link test as described in Section 4.3.2. |
| Alarm LED flashes regularly | The attached station is receiving a break condition and trying to re-establish a link. Part of the state machine forces breaks when it tries to re-establish the link. Check that no Alarm LEDs in this segment are permanently lit -- see above. Otherwise, the fault probably lies in the multimode receive path of that station. |
| Line State repeatedly alternates from Active or Idle to Halt, Quiet or Master. | The attached device is failing to establish a link with the far end device. Check the Receive Alarm LEDs and fiber links. |
| Dial In fails | Modem not set to Unattended Answer Mode correctly. LCL163A/LCL164A needs to be configured “User Connected To: modem” option. Cable type incorrect -- See Appendix I. |

| | |
|---|---|
| Dial Out fails | Modem not Hayes compatible or not connected to phone line.<br>Dial string not included in Modem Initialization String. "Connected To" field not set to "modem". Alarm events are not configured correctly. |
| Terminal is locked up | Terminal has been left in an unknown condition. Press control Q (XON) followed by ESC twice. To back the terminal out of every test or edit condition it may be necessary to press ESC up to 4 times. If this fails check the cable connections and that power is correctly supplied to the device. |
| Contact alarm does not operate | Alarm condition not configured correctly.<br>Monitor equipment connected to wrong contacts (Normally Open versus Normally Closed). See Section 6.6. |

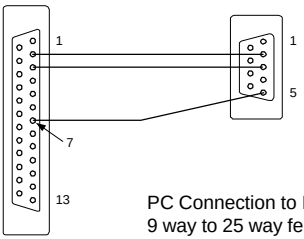
If, after going through this troubleshooting section, you fail to resolve your problem and require more help, please call Black Box Technical Support at 724-746-5500. When calling Technical Support please have the following information ready:

1. Unit type
2. Serial number.
3. Environment layout. Include hubs, bridges and routers (with model numbers), estimated cable lengths (between equipment) and type of cable.
4. A description of the problem you are experiencing.
5. List of tests performed.

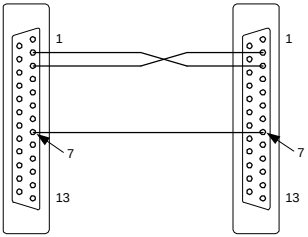
# 9. Appendix I: Management Cable Pinouts

### Figure 8: Management Cable Pinouts

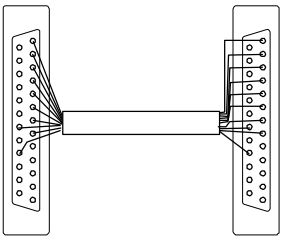
All views are rear view of connector, solder bucket side.




PC Connection to LCL16Xproducts,
9 way to 25 way female connections.




PC or VT100 Connection to LCL16X products,
25 way to 25 way female connections.



Join pins 1, 2, 3, 4, 5,
6, 7, 8, 20, 22
between connectors.

Modem connection to LCL16X products,
25 way female to 25 way male connections.

# 10. Appendix II: Example Test Result Sheet – Dual Repeater

| **LCL164A Serial Number:** | | |
|---|---|---|
| **Location:** | | |
| | **Port A** | **Port B** |
| Single-mode Interface<br>Launch Power dBm<br><br>Receive Power (far end of link) dBm<br><br>Attenuator Required? dB (See page 8)<br><br>Link Loss Budget (launch-receive) dB<br><br>Single-mode Media Test | | |
| Multimode Interface<br>Launch Power dBm<br><br>Receive Power (far end of link) dBm<br><br>Link Loss Budget (launch-receive) dB<br><br>Maximum Rx Power from Customer Unit dB<br><br>Attenuator Required? dB | | |

# 11. Appendix III: Example Test Result Sheet – Single Repeater

| **LCL163A Serial Number** | |
|---|---|
| **Location** | |
| | **Port** |
| Single-mode Interface<br>Launch Power dBm<br><br>Receive Power (far end of link) dBm<br><br>Attenuator Required? dB<br><br>Link Loss Budget (launch-receive) dB<br><br>Single-mode Media Test | |
| Multimode Interface<br>Launch Power dBm<br><br>Receive Power (far end of link) dBm<br><br>Link Loss Budget (launch-receive) dB<br><br>Maximum Rx Power from Customer Unit dB<br><br>Attenuator Required? dB | |

# 12. Glossary of Terms

ANSI .. American National Standards Institute
CDDI .. Copper Distributed Data Interface
CTS .. Clear To Send
DAS .. Dual Attach Station
dB .. Relative Measurement of Light Power or Light Loss in Decibels
dBm .. Measurement of Light Power Relative to One Milliwatt of Light Power
DCD .. Data Carrier Detect
DSR .. Data Set Ready
DTR .. Data Terminal Ready
ESC .. Escape Key Code
FC .. Keyed Screw Fit Style of Optical Connector
FDDI .. Fiber Distributed Data Interface
MAC .. Media Access Control
MIC .. Media Interface Connector
PC .. Personal Computer
PHY .. Physical Layer of FDDI Protocol
RS232 .. Serial Communications Link
RTS .. Request To Send
RXD .. Receive Data
SC .. Square Bayonet Style of Optical Connector
SIG_GND Signal Ground
TXD .. Transmit Data
VT100 .. Type of Terminal Created by Digital Equipment Corporation
XON .. “Transmit On” Command for Flow Control
XOFF .. “Transmit Off” Command for Flow Control
X3T9.5/X3T12.. FDDI Working Committee

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