FIM-102D MATRIX FIBER INTERFACE

INSTRUCTION MANUAL

FIM-102D Matrix Fiber Interface Instruction Manual

Part Number 810319

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A Vitec Group Company

CONTENTS

1 OPERATION

DESCRIPTION

With a Clear-Com FIM-102D System, you can connect Clear-Com intercom stations or interfaces to the central Matrix using fiber-optic cables at distances of up to 12 miles (20 km).

The system consists of one FIM-102D at the Matrix-frame end and another FIM-102D unit at the Matrix-station end. Connecting the pair of interfaces with fiber rather than with the standard 4-wire twisted copper, gives you advantages such as increased security from electromagnetic and RF interference, flexibility in equipment placement, ease of maintenance and often, reduced cost.

CONNECTING INTERCOM STATIONS TO THE CENTRAL MATRIX

The Clear-Com FIM-102D system transmits audio and data signals from 1 or 2 intercom stations or interfaces to the Matrix frame through the process illustrated in Figure 2.

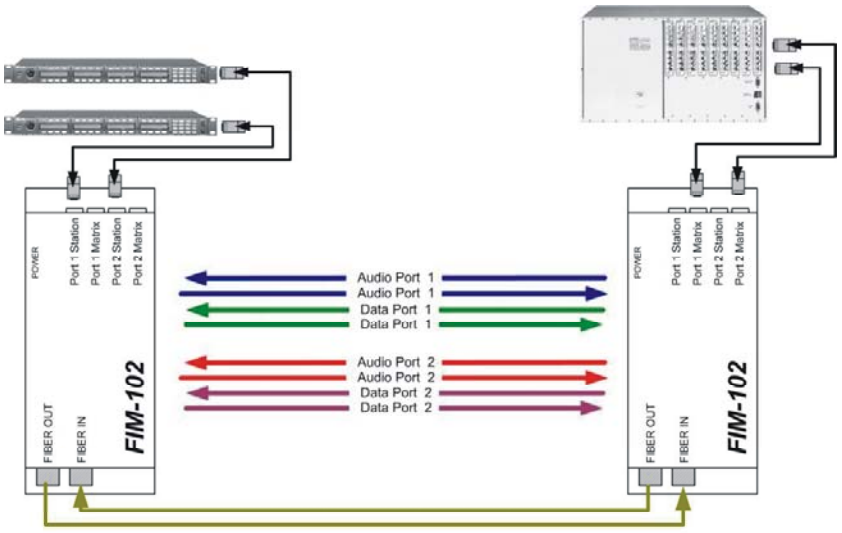


Figure 1: Connecting Intercom Stations to the Central Matrix

1. Matrix Plus intercom stations transmit *analog* audio signals and *digital* data signals to the first FIM-102D unit via copper cable terminated with RJ-45 connectors.

2. The first FIM-102D unit converts the analog audio signals to digital audio signals through an analog-to-digital converter (ADC) located on the FIM-102D unit's main circuit board.

3. The first FIM-102D unit then multiplexes (combines) the digital audio signals with the already digital data signals.

4. The first FIM-102D then converts the multiplexed digital signal into an optical signal.

5. The first FIM-102D then transmits the optical signal over up to 12 miles (20 km) of fiber-optical cable to the second FIM-102D unit, where a similar but reverse process occurs to convert the signal back to its original format.

6. The second FIM-102D unit converts the received optical signal to a digital signal.

7. The second FIM-102D then "demultiplexes" (separates) the digital signal back into it's separate audio and data signals for each intercom unit.

8. The second FIM-102D then converts the *digital* audio signals for each intercom station to *analog* audio signals by sending the signals through a digital-to-analog converter (DAC) located on the FIM-102D unit's main circuit board.

9. The second FIM-102D unit then transmits the analog audio and digital data signals for each intercom station to the central Matrix over copper cable terminated with RJ-45 connectors.

10. The central Matrix receives the intercom stations' audio and data signals in the same format in which they were originally sent by the Matrix Plus 3 intercom stations.

CIRCUIT	DESCRIPTION
Analog-to-Digital Converters	High speed analog-to-digital converters for each audio channel.
Multiplexer	Sequentially presents two RS-422 digital inputs and two digitized audio signals from the A/D converters to the optical output driver.
Demultiplex-er	Takes sequential digital signals from the pin diode and separates them into 4 separate lines: two to the D/A converters and two to the RS-422 transmitters.
Digital-to-Analog Converters	High speed digital-to-analog converters for each audio channel convert the digitized audio signal back to analog audio.

WARNING: *Always use extreme caution with fiber-optic equipment. Never look directly into the light port or into the end of the optical fiber while either FIM-102D unit is operating. Even if you do not see visible light, eye damage is possible.*

CONNECTING INTERFACE MODULES TO THE CENTRAL MATRIX

With a pair of FIM-102D units you can also remotely connect Clear-Com rack-mounted Matrix interface modules to the central Matrix. For example, using a Clear-Com CCI-22 dual party-line interface at one end, you can connect two independent, external 2-wire party line systems to the central Matrix from a distance of up to 12 miles (20 km). Or, with a Clear-Com TEL-14 Telephone Interface Module, you can send telephone audio to the central Matrix over a secured interference-free fiber-optic line. By using a Clear-Com FOR-22 4-wire interface module, you can send 4-wire audio plus transmit keying over a fiber-optic line. You can also use a Clear-Com EF-1M to interface 2-wire Clear-Com or RTS party lines to the central Matrix over a fiber-optic link.

Figure 2 shows a system with connected interface modules.

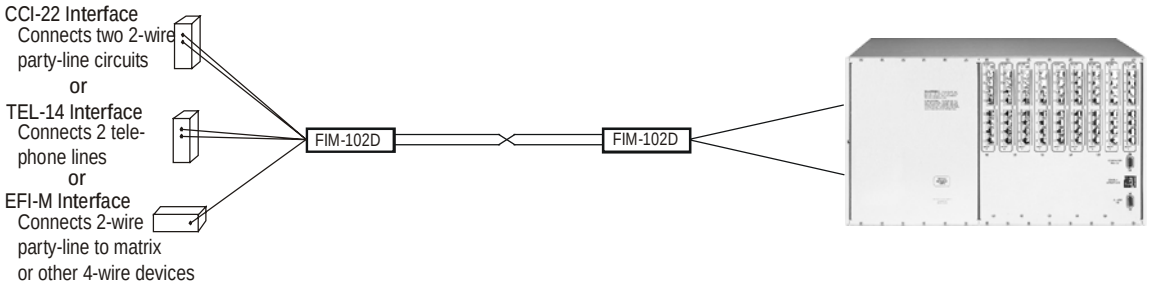


Figure 2: Connecting Interface Modules to the Central Matrix

USING THE FIM-102D IN CONJUNCTION WITH THE EF-1M AS A STAND-ALONE PARTY LINE EXTENDER

Using a Clear-Com EF-1M at each end of a FIM-102D set, you can extend Clear-Com or RTS 2-wire party line intercoms over a fiber-optic link independent of a Matrix intercom system.

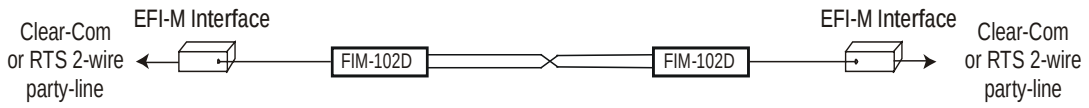


Figure 3: EF-1M and FIM-102D as Party-Line Extender

FIM-102D Two-Fiber Configuration

In a standard two-fiber system, identical FIM-102D units are used at each location. The units both transmit at 300 nm on ST connector "Fiber Out" and receive the 300 nm signal on ST connector "Fiber In". They are connected by the two fibers so that the optical output of each box is connected to the optical input of the other. In both one- and two-fiber systems, the input of channel 1 on one unit becomes the output of channel 1 on the other unit and vice versa.

The two FIM-102D units in the two-fiber version are identical, so the units are interchangeable.

FIM-102 One-Fiber Configurations

These configurations may be offered at a later date.

FIM-102D FRONT PANEL CONNECTORS AND LIGHTS

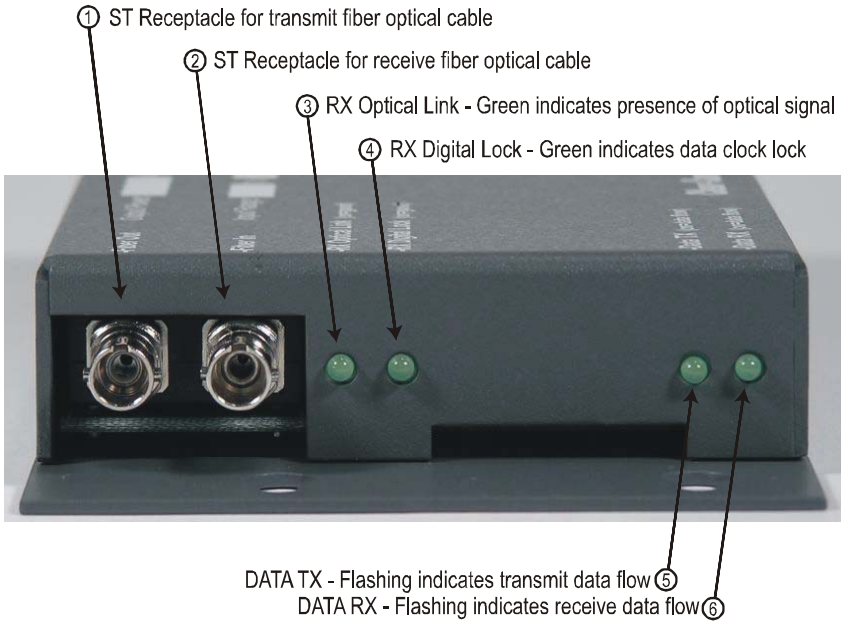


Figure 4: Front Panel of FIM-102D Unit

① **Fiber Out**
Fiber Optic ST type receptacle for connection of transmit Fiber Optic Cable to other FIM-102D unit.

② **Fiber In**
Fiber Optic ST type receptacle for connection of receive Fiber Optic Cable from other FIM-102D unit.

③ **RX Optical Link**
On (green) indicates presence of sufficient optical signal from other FIM-102D unit for communication.

④ **RX Digital Lock**
On (green) indicates presence of digital clock signal from other FIM-102D unit.

⑤ **DATA TX**
Flashing green indicates transmit data is flowing.

⑥ **DATA RX**
Flashing green indicates receive data is flowing.

FIM-102D REAR PANEL CONNECTORS

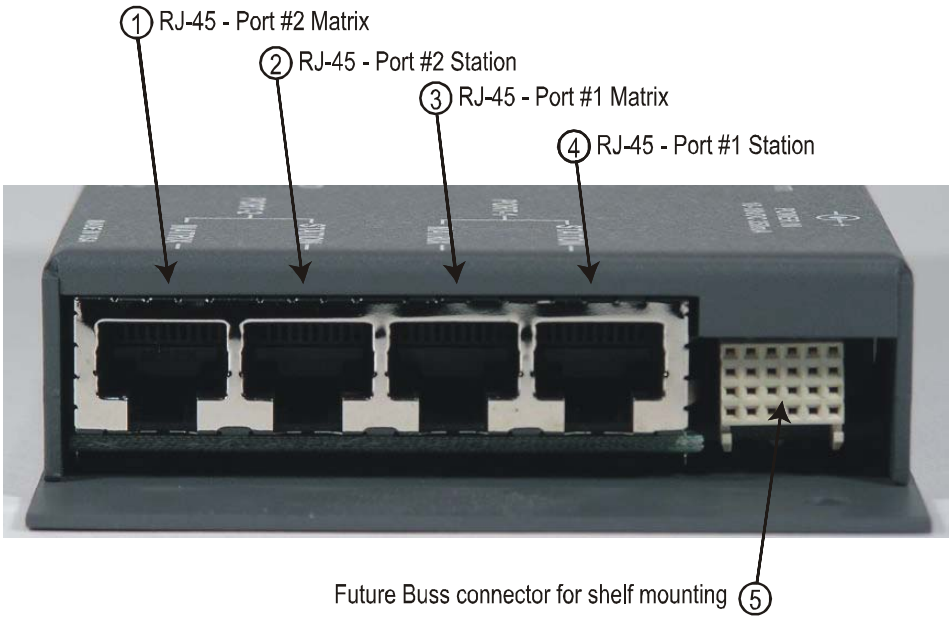


Figure 5: Rear Panel of FIM-102D Unit

① Port #2 Matrix

For Matrix end of FIM-102D link. Connect RJ-45 cord from here to Matrix port.

② Port #2 Station

For Station end of FIM-102D link. Connect RJ-45 cord from here to Station or Interface.

③ Port #1 Matrix

For Matrix end of FIM-102D link. Connect RJ-45 cord from here to Matrix port.

④ Port #1 Station

For Station end of FIM-102D link. Connect RJ-45 cord from here to Station or Interface.

⑤ Future Buss connector

This connector is only used when FIM-102D is mounted in an optional multiple unit equipment shelf. The shelf supplies power to the FIM-102D via this connector.

Figure 6: FIM-102D Shown With Wall Mounted Power Supply

2 INSTALLATION

UNPACKING

When you receive your Clear-Com FIM-102D System, check to make sure you have received all components of the system. The following items make up a Clear-Com FIM-102D:

- FIM-102D multiplexer/demultiplexer unit
- External power supply

You will require two FIM-102D sets to complete a circuit.

Inspect the units for mechanical damage. Inspect all electrical connectors for bent or damaged pins and latches. Report any damage to the carrier and to Clear-Com Intercom Systems.

Leave the protective plastic caps on the optical connectors until it is time to attach the fibers to the units.

INSTALLING AN FIM-102D UNIT IN A RACK

A frame for mounting multiple FIM-102D units is available. Please contact the Clear-Com sales department for information.

SELECTING AND INSTALLING FIBER-OPTIC CABLE

The person installing the FIM-102D units is responsible for providing the fiber optic cable runs. The FIM-102D will operate with either Single-Mode or Multi-Mode Fiber Optic Cable. You will experience the best distance performance when using Single-Mode cable as shown in Table 1.

FIBER CORE DIAMETER	MAXIMUM FIBER LENGTH
50 microns (multimode)	3 miles (5 km)
62.5 microns (multimode)	2 miles (3 km)
8 microns (single mode)	12 miles (20 km)

Table 1: Maximum Fiber Lengths

Mark or tag the optical fibers when they are pulled, carefully avoiding the fiber tip, so that their identity is known at both ends. If there is confusion about the identity of the two fibers, shine a flashlight at one end of the fiber and look for light at the other end.

WARNING*:* Do not use the FIM-102 optical output to identify cables. Never look directly into the end of the optical fiber while either end of the system is operating. Even if you do not see visible light, eye damage is possible.

Inspect the fiber ends and clean them with clean, dry compressed air or with Kim-Wipes that have been saturated with isopropyl alcohol. Fingerprints or other dirt on the optical connector end surfaces will reduce the received optical signal level.

CONNECTING FIBER-OPTIC CABLE TO THE FIM-102

Figure 1: ST Optical Connections on an FIM-102D Unit's Front Panel

Refer to Figure 1 before connecting the optical fiber to the ST optical connectors on the FIM-102D unit's front panel.

The FIM-102D is compatible with industry standard ST-type connectors. You may use installed backbone cables or dedicated cables with it.

Always follow the connector manufacturer's directions when fastening a connector to the cable.

On a two-fiber system, connect the cables so that:

- transmitter ST **"Fiber Out"** at the near end connects to receiver ST **"Fiber In"** at the far end and
- transmitter ST **"Fiber Out"** at the far end connects to receiver ST **"Fiber In"** at the near end.

Figure 2 illustrates the entire wiring scheme for the FIM-102D system.

CONNECTING AUDIO/DATA CABLES TO THE FIM-102D

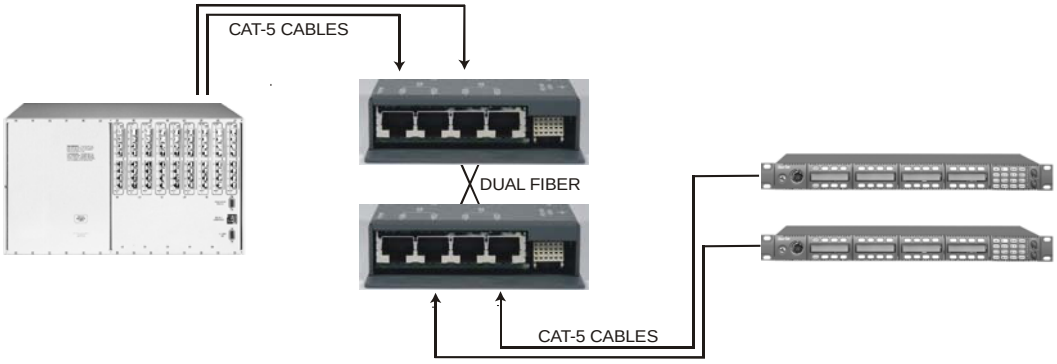
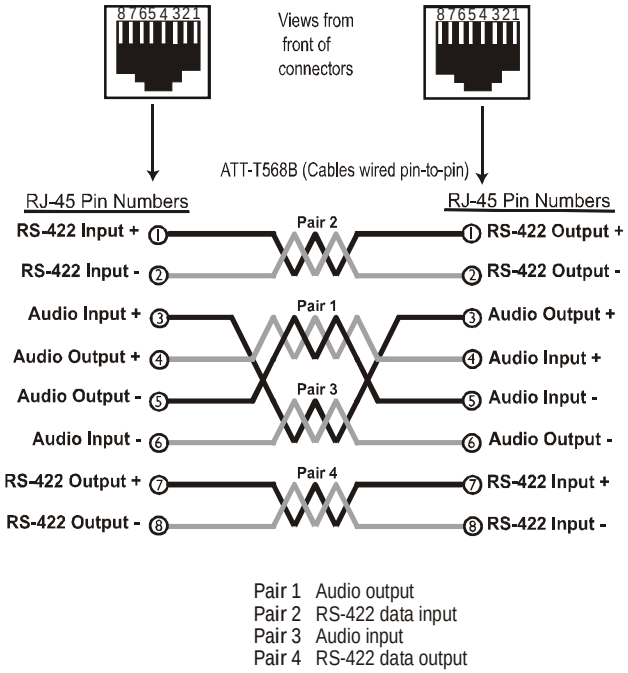


Figure 2: Wiring an FIM-102D to intercom stations or interfaces

RJ-45 connectors on the FIM-102D unit's rear panel connect the unit to audio and data inputs and outputs as shown in Figure 2. Figure 3 illustrates the CAT-5 and above cable pinout configuration. The maximum length for CAT-5 cables is 10,000 feet (3 km).



Pair 1 Audio output
Pair 2 RS-422 data input
Pair 3 Audio input
Pair 4 RS-422 data output

Figure 3: CAT-5 Cable Pinout Diagram

3 MAINTENANCE

TROUBLESHOOTING TIPS

Listed on the next page are some of the more common problems that you may experience, their possible causes and suggested solutions.

SYMPTOM	POSSIBLE CAUSE	
No operation, indicators all off.	No power.	Make sure the external power supplies are plugged in to a 120 VAC outlet and to the power receptacle on the FIM-102
No operation, RX Optical Link and RX Digital Lock leds are not lit.	Optical communications failure.	Check for broken or disconnected fibers. Check to see if the FIM-102 at the other end is operating correctly.
FIM-102 units are operating correctly, but connected stations or interfaces are not.		Check RJ-45 cables or Matrix configuration.

If you are unable to resolve a problem with your FIM-102 unit, call Clear-Com Intercom Systems at (510) 496-6666 and ask for the Service Department. See the Warranty Chapter for more information.

PREVENTIVE MAINTENANCE

Every two years verify the adequacy of optical power at the far end of each optical fiber with an optical power meter.

4 GLOSSARY

fiber-optic cable A fiber-optic cable consists of a glass core covered with a reflective material called "cladding" and several layers of buffer coating to protect the cable from the environment. A laser sends light pulses through the glass core to the other end of the cable.

full duplex Refers to transmission of signals in two directions simultaneously.

interface A piece of electronic hardware designed to convert the 4-wire signals of a central matrix port to some other form of communications, such as 2-wire party line, telephone, etc. The interface is connected to a central matrix port. The external non-4-wire device is then connected to the interface.

mode A term used to describe a light path through a fiber as in multimode or single mode.

multimode fiber-optic cable The glass core of a multimode fiber is larger than the core of a single mode fiber, which causes the transmitted light beam to disperse as it travels through the core. Single mode fiber, with its smaller core, concentrates the light beam so that it carries signals further. Multimode fiber was the first type of fiber offered by manufacturers. Single-mode fiber evolved as production methods improved.

multiplexing The process by which two or more signals are transmitted over a single communications channel. Examples include time division and wavelength division multiplexing.

nanometer (nm) Common unit of measure for wavelength. One billionth of a meter.

optical signal A laser at one end of a fiber-optic cable pulses on or off to send a light signal through the glass core of the cable to the other end of the cable. Because the light signals are binary (on or off), the signal is digital.

port Any of the input/output connections (RJ-45 connectors) on the back panel of the central matrix. These connectors and the attached cables connect the central matrix to remote intercom devices. The term "port" emphasizes that the connection is a "portal" between the central matrix and the remote intercom devices.

remote station Any intelligent intercom device connected to the back-panel ports of the central matrix. This term does not refer to devices connected through interfaces.

single-mode fiber-optic cable The glass core of a single-mode fiber is smaller in diameter than the core of a multimode fiber, so that the light signal transmitted over the core is more concentrated than with multimode fiber, which allows the signal to travel further. Single-mode fiber evolved from multimode fiber as production methods improved.

wavelength-division multiplexing (WDM) A method of multiplexing optical signals developed for use on fiber-optic cable. Each signal is assigned a particular wavelength on the light spectrum and therefore many signals can be transmitted simultaneously without interfering with each other.

5 SPECIFICATIONS

Audio

Transmission Method	Digital, TDM, 24-bit, 48k samples/sec
Input Impedance	600 Ohms balanced
Output Impedance	30 Ohms balanced
Maximum Input Level (600 Ohms)	+17 dBm (peak)
Maximum Output Level (from 30 Ohms balanced)	+17 dBm into 600 Ohms
Frequency Response (@8 dBm)	

from 20 Hz to 20 kHz	±0.2 dB
Total Harmonic Distortion + Noise	
from 20 Hz to 20 kHz (@ +8 dBm)	<0.05%
at 1 kHz (@ +18 dBm)	<0.0085%
Intermodulation Distortion (SMPTE)	
60 Hz + 3 kHz mixed 4:1 @ +8 dBm	<0.04%
Signal to Noise Ratio, unweighted,	
20 Hz - 20 kHz, ref. to +18 dBm clip level	>80 dB
Aggregate Digital Data Rate	43 Mbaud

Mechanical/Electrical/Environmental

Connectors	RJ-45; coaxial
Optical Connectors	ST-type
Power Connector	2.5mm Circular
Input Voltage Range	9-18 Vdc
Power Consumption	
(@13.8V per end, all channels at full level)	<5 watts
Temperature Range	–40° to 65° C
Humidity Range	0 to 95% non-condensing
A/C Adapters	supplied

Electro-Optical System Margin Data

Operating Wavelength	1300 nm
TX output into cable	-10 to -15 dBm
RX sensitivity	≤ 34 dBm
OP Margin Single Mode	19 dBm
OP Margin Multi Mode	12 dBm

Matrix Data Communications (Frame-to-Station Digital Data)

Transmission Rate	RS-422, Balanced TTL Levels, 0 to 150 kBits/sec
Jitter	1.12 msec*

*Higher rates possible dependent upon user system jitter tolerance.

Power Requirements

Voltage	9-18 VDC

Caution: Absolute maximum voltage is 18 VDC. Equipment damage may occur at higher voltages.

Notice about Specifications

While Clear-Com makes every attempt to maintain the accuracy of the information contained in its product manuals, that information is subject to change without notice. Performance specifications included in this manual are design-center specifications and are included for customer guidance and to facilitate system installation. Actual operating performance may vary.

6 VITEC GROUP COMMUNICATIONS LIMITED WARRANTY

This product is guaranteed by Vitec Group Communications to be free of manufacturing defects in material and workmanship under normal use for one year from the date of purchase.

The Vitec Group Communications warranty does not cover any defect, malfunction or failure caused beyond the control of the Group, including unreasonable or negligent operation, abuse, accident, failure to follow instructions in the manual, defective or improperly associated equipment, attempts at modification and repair not authorized by VGC, and shipping damage. Products with their serial numbers removed or defaced are not covered by this warranty.

This warranty is the sole and exclusive express warranty given with respect to Clear-Com products. It is the responsibility of the user to determine before purchase that this product is suitable for the user's intended purpose.

Any and all implied warranties, including the implied warranty of merchantability, are limited to the duration of this express limited warranty. Neither Vitec Group Communications nor the dealer who sells its products is liable for incidental or consequential damages of any kind.

For your own records fill in the information below:

Model No._____Serial No._____
Date Purchased_____
Purchased from (dealer)_____
Address_____
City_____State____ ZIP_____

FACTORY SERVICE

All equipment returned for repair must be accompanied by documentation stating the return address, telephone number, date of purchase and a description of the problem.

Before returning equipment for repair, you must obtain a return authorization number. To obtain a return authorization number, call our customer service department at the number listed below. By talking with our representatives, many problems can be resolved over the phone. You can also send a fax to our customer service department or send an email to support@clearcom.com.

After obtaining a return authorization number, send equipment to be repaired to:

Customer Service Department
Vitec Group Communications, Inc.
4065 Hollis Street
Emeryville, CA 94608-3505
Telephone: (510) 496-6666
Fax: (510)496-6610
Web site: www.vitecgroupcomms.com

WARRANTY REPAIR

If in warranty, no charge will be made for the repairs. Equipment returned for warranty repair must be sent prepaid and will be returned prepaid.

NON-WARRANTY REPAIR

Equipment that is not under warranty must be sent prepaid to Vitec Group Communications, Inc. If requested, an estimate of repair costs will be issued prior to service. Once repair is approved and repair of equipment is completed, the equipment will be shipped freight collect from the factory.